



THÈSE

En vue de l'obtention du **DOCTORAT DE L'UNIVERSITÉ DE TOULOUSE**

Délivré par l'Université Toulouse 2 - Jean Jaurès

Présentée et soutenue par
Clotilde LASSON

Le 6 décembre 2023

**Vers une meilleure compréhension et évaluation des
comportements orthorexiques chez l'adulte**

Ecole doctorale : **CLESCO - Comportement, Langage, Education, Socialisation,
Cognition**

Spécialité : **Psychopathologie**

Unité de recherche :
**CERPPS -Centre d'Etudes et de Recherches en Psychopathologie et
Psychologie de la Santé**

Thèse dirigée par
Amélie ROUSSEAU et Stacey CALLAHAN

Jury

M. Alain GUERRIEN, Rapporteur

M. Arnaud CARRE, Rapporteur

Mme Nelly GOUTAUDIER, Examinatrice

Mme Natalène SEJOURNE, Examinatrice

Mme Amélie ROUSSEAU, Directrice de thèse

Mme Stacey CALLAHAN, Co-directrice de thèse

“Cooking is all about people. Food is maybe the only universal thing that really has the power to bring everyone together. No matter what culture, everywhere around the world, people eat together.”

Guy Fieri

REMERCIEMENTS

Tout d'abord, je tiens à exprimer ma profonde reconnaissance et gratitude envers ma directrice de thèse, **Pr. Amélie Rousseau**, pour la confiance qu'elle m'a témoigné en acceptant de diriger cette thèse de doctorat. Merci pour ses nombreux et riches enseignements, et ce depuis le début de mon cursus à l'Université de Lille, qui, en plus de m'avoir permis d'enrichir mes connaissances et d'approfondir mes réflexions, m'ont donné l'envie de faire de la recherche. Merci également pour ses relectures, corrections et précieux conseils qui ont participé à faire aboutir cette thèse de doctorat. Et enfin un tout grand merci pour son infinie bienveillance ainsi que sa disponibilité durant ces 9 dernières années.

Je tiens également à exprimer ma profonde reconnaissance et gratitude envers ma co-directrice de thèse, **Pr. Stacey Callahan**, d'avoir accepté de reprendre la co-direction de cette thèse de doctorat. Merci pour ses relectures ainsi que pour la confiance accordée en me confiant des TDs de psychopathologie.

Je tiens à exprimer ma sincère gratitude envers l'ensemble des membres invités de mon Jury, **Pr. Alain Guerrien**, **Dr. Arnaud Carre**, **Dr. Natalène Séjourné**, et **Pr. Nelly Goutaudier**, pour l'honneur qu'ils et elles me font de siéger à mon jury de thèse, et ainsi d'avoir accepté de consacrer une partie de leur temps à lire et évaluer mon travail.

J'aimerais ensuite adresser ma profonde reconnaissance à **Pr. Nelly Goutaudier**, **Dr. Siobhan Vicente**, **Pr. Lucia Romo**, **Dr. Friederike Barthels**, **Dr. Juan Ramón Barrada**, et **Pr. María Roncero**, avec qui j'ai eu la chance de collaborer et qui ont participé à enrichir ce travail de doctorat. Je les remercie pour leurs réponses à mes interrogations et leurs judicieux conseils concernant nos projets de recherche.

J'aimerais également adresser ma profonde reconnaissance au **Dr. Damien Fouques** et au **Pr. Valérie Le Floch**, membres de mon comité de suivi de thèse, pour les échanges passionnants que nous avons eu, ainsi que pour les pistes de réflexion qui ont émergé de ces échanges.

Merci à **mes parents** et à leurs amis **Frédérique** et **Pierre** pour leur soutien durant cette thèse de doctorat, et ce malgré la distance.

Merci à toutes les personnes qui ont pris le temps de répondre à nos questionnaires nous fournissant des données nous permettant de mener à bien nos recherches.

Merci à mes ami.e.s, **Jean, Deniz, Ecem, Donia, Mathilde, Capucine, Arthur, Océane, Anne-Sophie, Joannot, et Julien.** Merci pour tous ces beaux moments de partage, votre bonne humeur, votre écoute, vos conseils et votre soutien à toute épreuve. Je me sens incroyablement chanceuse de vous avoir toutes et tous rencontré.e.s. Ces 4 années et demie de doctorat n'auraient sans aucun doute pas eu la même saveur sans vous. Merci d'être vous tout simplement !

Ecem, ou devrais-je dire Dr. Yakın, partenaire de début de doctorat, co-bureau et très bonne amie, ton départ au cours de cette première année a été inattendu et soudain. Je te remercie infiniment pour ton soutien indéfectible, tes conseils avisés, tes relectures attentives, et je chéris nos moments de partage au laboratoire ou en dehors ainsi que nos afterworks et soirées.

Jean, merci pour ta présence, ton soutien, et tes conseils précieux au cours de ce long périple qu'a été notre doctorat. Nous arrivons tous les deux respectivement au terme de nos objectifs, sache que ton support moral et intellectuel tout au long de ces années m'a grandement aidée.

Mathilde, d'abord co-bureau, devenue rapidement une très bonne amie, merci pour ces moments studieux et productifs ponctués de quelques rares pauses nécessaires, merci de m'avoir apporté la motivation et la rigueur dont j'ai parfois pu manquer, merci pour ton aide, ton écoute, ton soutien, tes conseils et relectures. Promis je continuerai encore longtemps à te faire ces pancakes que tu aimes tant.

Lionel, et Dylan, co-bureaux hors pairs, merci pour ces moments et conversations intéressantes qui m'ont permis de procrastiner agréablement et artistiquement.

Donia, et Capucine, merci pour ces heures passées à discuter de façon animée de sujets passionnants en salle de pause, dans les bureaux, ou sur le roof top de la maison de la recherche.

Et enfin, petit clin d'œil à cet été 2023 durant lequel une grosse partie de ce manuscrit de thèse a été rédigé. Un merci tout particulier à **Mathilde, Anne-Sophie, Océane, Joannot, Julien, et Sarah**, pour cet été passé ensemble, qui, je pense, a été jusqu'ici le plus beau de mes 27 années de vie. Cet été s'annonçait comme une période de rédaction intensive, stressante,

tendue, et a finalement été bien différent de ce à quoi je m'attendais. Il m'a permis de prendre réellement conscience de la nécessité de décrocher totalement pour prendre du recul, revenir plus efficacement, plus reposée, et plus apte au travail. Cet été, passé à vos côtés, a été incroyablement riche, épanouissant et incroyable. Et pour ça, merci, vraiment !

TABLE DES MATIÈRES

REMERCIEMENTS.....	ii
LISTE DES TABLEAUX	6
LISTE DES FIGURES.....	7
LISTE DES ABRÉVIATIONS, SIGLES, ET ACRONYMES	8
RÉSUMÉ.....	10
SUMMARY.....	13
INTRODUCTION.....	15
PARTIE THÉORIQUE	18
Chapitre 1 : Orthorexie : Évolution d’un concept de 1997 à aujourd’hui.....	18
1. Conception initiale de l’orthorexie nerveuse (Bratman, 1997)	18
2. L’orthorexie nerveuse, un concept à l’origine de débats	19
3. Orthorexie : une conception bidimensionnelle (Barrada & Roncero, 2018)	22
4. Vers une perspective consensuelle de l’orthorexie (Donini et al., 2022)	24
Chapitre 2 : Évaluation et prévalence de l’orthorexie	28
1. Outils de mesure	28
1.1. Bratman’s Orthorexia Test (BOT ; Bratman & Knight, 2001)	28
1.2. ORTO-15 (Donini et al., 2004, 2005)	29
1.3. Eating Habits Questionnaire (EHQ ; Gleaves et al., 2013)	31
1.4. Düsseldorf Orthorexia Skala (DOS ; Barthels et al., 2015a)	32
1.5. Teruel Orthorexia Scale (TOS ; Barrada & Roncero, 2018)	33
2. Prévalence	33
Chapitre 3 : Facteurs de risque et conséquences de l’orthorexie nerveuse.....	35
1. Facteurs de risque de l’orthorexie.....	35
2. Motivations sous-jacentes et conséquences.....	37

Chapitre 4 : Orthorexie et personnalité	39
1. Théories psychologiques de la personnalité	39
1.1. Modèle dimensionnel du Big-Five.....	39
1.2. Modèle du tempérament et du caractère de Cloninger	39
1.3. Modèle dimensionnel des troubles de la personnalité du DSM-5	40
1.4. Modèle catégoriel des troubles de la personnalité du DSM-5	42
2. État des lieux.....	43
Chapitre 5 : Approche processuelle transdiagnostique de l'orthorexie	46
1. Modèle théorique	46
2. Processus transdiagnostiques.....	47
2.1. Perfectionnisme.....	47
2.2. Intolérance à l'incertitude	48
2.3. Ruminations mentales	49
PROBLEMATIQUE ET OBJECTIFS DE RECHERCHE	51
PARTIE EMPIRIQUE	55
Étude 1 : Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students (Lasson et al., 2021)	55
Abstract.....	55
1. Introduction.....	56
2. Methods	58
2.1. Participants and procedure	58
2.2. Measures	59
2.2.1. The Düsseldorf Orthorexia Skala (DOS)	59
2.2.2. The Eating Habits Questionnaire (EHQ)	59
2.2.3. The Eating Attitudes Test-26 (EAT-26)	60
2.2.4. Psychopathology measures	60
3. Data analysis.....	60
4. Results.....	61
4.1. Confirmatory factor analysis (CFA)	61
4.2. Validity and reliability of F-DOS	61
4.3. Prevalence and psychopathology of ON.....	61
5. Discussion.....	63

Étude 2 : Personality profiles in young adults with orthorexic eating behaviors (Lasson & Raynal, 2021)	70
Abstract.....	70
1. Introduction.....	71
2. Method.....	73
2.1. Participants and procedure	73
2.2. Measures	74
2.2.1. Personal information	74
2.2.2. Orthorexia nervosa	74
2.2.3. Eating behavior	74
2.2.4. Personality disorder traits.....	75
2.2.4.1. Schizotypal personality traits	75
2.2.4.2. Obsessive-compulsive personality traits	75
2.2.4.3. Borderline personality traits	75
2.2.4.4. Paranoid personality traits.....	75
2.2.4.5. Narcissistic personality traits	76
2.2.5. Psychopathological symptoms	76
2.2.5.1. Somatization and hypochondriasis symptoms	76
2.2.5.2. Depressive symptoms.....	76
2.2.5.3. Anxious symptoms	76
2.2.5.4. Social phobia symptoms.....	77
2.2.5.5. Obsessive-compulsive symptoms	77
2.2.6. Other psychological measures.....	77
2.2.6.1. Self-esteem	77
3. Data analysis.....	78
4. Results.....	78
4.1. Descriptive statistics	78
4.2. Cluster analysis	78
5. Discussion.....	79
6. Conclusion	82
Étude 3 : Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS) (Lasson et al., 2023)	86
Abstract.....	86
Plain English summary	87
1. Background.....	88
2. Materials and Methods	94

2.1. Participants and procedure	94
2.2. Measures	94
2.2.1. Socio-demographic data.....	94
2.2.2. Teruel Orthorexia Scale (TOS; Barrada & Roncero, 2018).....	94
2.2.3. Düsseldorf Orthorexia Skala (DOS; Barthels et al., 2015a).	95
2.2.4. Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994).	95
2.2.5. Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002).....	95
3. Data analysis	95
4. Results.....	97
4.1.1. Internal structure and reliability	97
4.1.2. Descriptives and associations with other variables.....	98
5. Discussion.....	99
6. Conclusions.....	103
Étude 4 : Identifying psychological processes involved in orthorexia nervosa: a processual transdiagnostic approach.....	109
Abstract.....	109
1. Introduction.....	110
2. Materials and methods	113
2.1. Participants and procedure	113
2.2. Measures	113
2.2.1. Socio-demographic data.....	113
2.2.2. Teruel Orthorexia Scale (TOS; Barrada & Roncero, 2018).....	113
2.2.3. Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011).	113
2.2.4. Frost Multidimensionnal Perfectionism Scale (FMPS; Frost et al., 1990)	114
2.2.5. Intolerance of Uncertainty Scale (IUS; Freeston et al., 1994).....	114
3. Data analysis.....	114
4. Results.....	115
5. Discussion.....	116
6. Conclusion	117
DISCUSSION GÉNÉRALE	123
BIBLIOGRAPHIE	130

ANNEXES.....	155
---------------------	------------

Index des annexes.....	155
------------------------	-----

LISTE DES TABLEAUX

PARTIE THÉORIQUE

CHAPITRE 1

Tableau 1 : Critères diagnostiques de l'ON proposés par plusieurs auteurs, traduction libre tirée de Dajon et al. (2020)..... 19

Tableau 2 : Critères diagnostiques de l'ON résultant du consensus d'un panel d'experts, traduction libre de Donini et al. (2022) 24

PARTIE EMPIRIQUE

Étude 1

Tableau 1 : Participants' demographics and dietary style characteristics ($N = 3235$)..... 67

Tableau 2 : Mean, SD and item selectivity. 68

Étude 2

Tableau 1 : Descriptive statistics and typology of individuals with ON on five traits of personality disorders. 85

Étude 3

Tableau 1 : Goodness of fit indices for the different models. 106

Tableau 2 : Item loadings of the initial and final version of the Teruel Orthorexia Scale-French version. 107

Tableau 3 : Descriptive statistics and correlations. 108

Étude 4

Tableau 1 : Participants' demographics and dietary style characteristics ($N = 511$)..... 120

Tableau 2 : Descriptive statistics and correlations. 121

Tableau 3 : Final model of the backward stepwise regression analysis..... 122

LISTE DES FIGURES

PARTIE THÉORIQUE

CHAPITRE 3

Figure 1 : Modèle psychosocial de l'ON, traduit librement de McComb et Mills (2019). 35

CHAPITRE 4

Figure 2 : Modèle de la détermination des troubles psychopathologiques de Kinderman et Tai (2007) 46

PARTIE EMPIRIQUE

Étude 1

Figure 1 : Path diagram of the tested F-DOS with standardized factor loadings..... 69

Étude 2

Figure 1 : Hierarchical clustering dendrogram 84

Figure 2 : Four-cluster solution based on the 5 personality disorder traits indicated on the x-axis. 84

Étude 4

Figure 1 : The mediating psychological processes model from Kinderman and Tai (2007). 119

LISTE DES ABRÉVIATIONS, SIGLES, ET ACRONYMES

ABOST	Authorized Bratman Orthorexia Self-Test
AN	Anorexie Nerveuse
BMI	Body Mass Index
BOT	Bratman's Orthorexia Test
BN	Boulimie Nerveuse
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CIM	Classification Internationale des Maladies
DOS	Düsseldorfer Orthorexia Skala
DSM	Diagnostic and Statistical Manual of Mental Disorders (Manuel diagnostique et statistique des troubles mentaux)
EAT-26	Eating Attitudes Test-26
ED/EDs	Eating Disorder/Eating Disorders
EDE-Q	Eating Disorder Examination-Questionnaire
EHQ	Eating Habits Questionnaire
ESEM	Exploratory Structural Equation Modeling
F-DOS	Version française de la Düsseldorfer Orthorexia Skala
FMPS	Frost Multidimensionnal Perfectionism Scale
GAD-7	General Anxiety Disorder-7
HeOr	Healthy Orthorexia (orthorexie saine)
IMC	Indice de Masse Corporelle
IUS	Intolerance of Uncertainty Scale
Mini-SPIN	Mini-Social Phobia Inventory
NPI-16	Narcissistic Personality Inventory-16
OCD	Obsessive-Compulsive Disorders
OCI-R	Obsessive Compulsive Inventory-Revised
ON/OrNe	Orthorexia Nerveuse
PDQ-4	Personality Diagnostic Questionnaire-4
PHQ-9	Patient Health Questionnaire-9
RMSEA	Root Mean Square Error of Approximation
RMSR	Root Mean Square Residual

RRS Ruminative Response Scale

RRS-ED Ruminative Response Scale for Eating Disorders

SCL-90R Symptoms Check List-90R

SPQ-B Schizotypal Personality Questionnaire-Brief

TCA Troubles du Comportement Alimentaire

TLI Tucker Lewis Index

TOC Troubles Obsessionnels-Compulsifs

TOS Teruel Orthorexia Scale

WLSMV Weighted Least Squares with Mean and Variance

RÉSUMÉ

L'orthorexie nerveuse (ON), préoccupation excessive pour l'alimentation saine, a suscité un intérêt de plus en plus grand dans la littérature ces dernières années. Cependant, les connaissances accumulées sont à considérer avec prudence en raison notamment de problèmes méthodologiques et conceptuels importants. Ce travail de thèse a pour objectifs d'améliorer la compréhension et l'évaluation de l'orthorexie afin de proposer des prises en charge adaptées à plus long terme.

Étude 1 — Objectifs : Valider une version française de la *Düsseldorf Orthorexia Skala (F-DOS)*, évaluer ses propriétés psychométriques, et évaluer la prévalence des comportements alimentaires orthorexiques dans un échantillon d'étudiants universitaires français. Un échantillon de 3235 étudiants universitaires (89,67% de femmes) avec un âge moyen de 21,13 ans ($SD = 2,23$) a complété la F-DOS, l'*Eating Habits Questionnaire* et l'*Eating Attitudes Test*. Les résultats indiquent une très bonne cohérence interne de l'échelle, une très bonne validité de construit ainsi qu'un modèle à un facteur bien ajusté. Conformément aux scores seuils de l'échelle, 3,28 % des participants peuvent être considérés comme souffrant d'ON, tandis que 11,31% seraient à risque de développer de l'ON. Disposer de la version française d'un outil de mesure comme la DOS, possédant de bonnes qualités psychométriques, présente un intérêt pour le dépistage de l'orthorexie pathologique en population française.

Étude 2 — Objectifs : Établir une typologie de jeunes adultes présentant des comportements alimentaires orthorexiques sur base de leurs traits de personnalité pathologiques (i.e., schizotypique, borderline, paranoïaque, obsessionnelle-compulsive, narcissique). Évaluer le fonctionnement global (i.e., anxiété généralisée, anxiété sociale, troubles obsessionnels-compulsifs, dépression, et estime de soi) de chaque cluster. Le même échantillon de 3235 étudiants universitaires de l'étude 1 a complété des questionnaires évaluant l'ON, les symptômes psychopathologiques, et les traits de personnalité pathologiques. Un sous-échantillon de 106 participants (91,51% de femmes) a été identifié comme ayant des scores d'orthorexie considérés comme pathologiques. Une analyse de cluster hiérarchique dans ce sous-échantillon a permis d'identifier quatre clusters : 1—un cluster avec des niveaux faibles de traits de personnalité pathologique (L); 2— un cluster avec des traits modérés de traits de personnalité pathologique et un niveau faible de traits narcissiques (MD); 3— un cluster avec des niveaux faibles de traits de personnalité pathologique et un niveau modéré de traits

narcissiques (MN); 4— un cluster avec des niveaux élevés de traits paranoïaques et narcissiques (PN) et des niveaux modérés de traits schizotypiques et borderlines. Les clusters PN et MD présentaient des niveaux plus importants d'anxiété, de TOC, et de dépression que les clusters L et MN. Les niveaux de phobie sociale étaient plus élevés et les niveaux d'estime de soi plus faibles dans le cluster MD, et les niveaux d'hypochondrie étaient plus élevés dans les clusters PN et MN. Cette étude suggère que l'ON peut être associée à différents profils de personnalité, certains d'entre eux présentant des niveaux psychopathologiques significatifs. Une attention particulière à certains traits de personnalité pathologique devra être portée par les professionnels de santé afin d'adapter les traitements thérapeutiques proposés aux individus souffrant de comportements alimentaires orthorexiques pathologiques.

Étude 3 — Objectifs : Valider une version française de la *Teruel Orthorexia Scale* (TOS), différenciant l'orthorexie saine (HeOr) de l'orthorexie pathologique (ON), et évaluer ses propriétés psychométriques ainsi que ses relations avec la symptomatologie des troubles du comportement alimentaire et des troubles obsessionnel-compulsifs. Un échantillon de 799 participants (82,9% de femmes) avec un âge moyen de 28,5 ans ($SD = 12,1$) a complété la TOS, la F-DOS, l'*Eating Disorders Examination Questionnaire*, et l'*Obsessive Compulsive Inventory-Revised*. Une modélisation par équations structurelles exploratoire après exclusion des items 9 et 15 indique un ajustement satisfaisant et une consistance interne adéquate. Les corrélations partielles ont montré que la symptomatologie des troubles du comportement alimentaire et la symptomatologie obsessionnelle-compulsive étaient positivement liées à l'ON et non liées ou négativement liées à l'HeOr. Les implications de la TOS paraissent intéressantes pour commencer à étudier l'orthorexie saine et pathologique dans la population française, sans considérer toutes les préoccupations autour de l'alimentation saine comme pathologiques.

Étude 4 — Objectifs : Identifier les processus psychopathologiques transdiagnostiques (i.e., perfectionnisme, intolérance à l'incertitude, et ruminations mentales) qui peuvent expliquer les manifestations de l'orthorexie pathologique. Un échantillon de 511 participants (81,8% de femmes) avec un âge moyen de 37,56 ans ($SD = 15,15$) a complété la TOS, la *Ruminative Response Scale for Eating Disorders*, l'*Intolerance of Uncertainty Scale*, et le *Multidimensional Perfectionism Scale*. Les processus psychopathologiques étaient plus fortement corrélés à l'ON qu'à l'HeOr. Une analyse de régression pas à pas a révélé que les ruminations mentales concernant l'alimentation, le poids corporel et l'apparence physique, ainsi que les standards personnels étaient prédicteurs de l'ON. Cette étude suggère qu'il serait intéressant d'inclure, dans la prise en charge de l'ON, un travail psychothérapeutique spécifique

sur les standards personnels trop élevés et donc inatteignables, ainsi que sur les ruminations mentales liées à l'alimentation, au poids corporel, et à l'apparence physique.

Mots clés : Orthorexie pathologique, Orthorexie saine, Troubles du comportement alimentaire, Alimentation saine, Validation d'outils de mesure, Personnalité, Processus transdiagnostiques.

SUMMARY

Orthorexia nervosa (ON), an excessive preoccupation with healthy eating, has gained increasing interest in the literature these past few years. However, because of major methodological and conceptual problems, current knowledge is to be taken with caution. The aim of this thesis work is to improve our understanding and assessment of orthorexia, in order to propose appropriate long-term treatments.

Study 1 — Aims : To validate a French version of the *Düsseldorf Orthorexia Skala (F-DOS)*, assess its psychometric properties, and evaluate the prevalence of orthorexic eating behaviors in a sample of French university students. A sample of 3235 university students (89.67% female) with a mean age of 21.13 years old ($SD = 2.23$) completed the F-DOS, the *Eating Habits Questionnaire* and the *Eating Attitudes Test*. Results indicate very good internal consistency, construct validity and a well-fitting one-factor model. According to DOS cut-off score, 3.28% of participants could be considered as having ON, while an additional 11.31% could be at risk of developing ON. Having a French version of a measurement tool like the DOS, with good psychometric qualities, is of interest for screening for pathological orthorexia in the French population.

Study 2 — Aims : To establish a typology of young adults with orthorexic eating behaviors based on their pathological personality traits (i.e., schizotypal, borderline, paranoid, obsessive-compulsive, narcissistic). Assess the global functioning (i.e., generalized anxiety, social anxiety, obsessive-compulsive disorder, depression, and self-esteem) of each cluster. The same sample of 3235 university students from study 1 completed questionnaires assessing ON, psychopathological symptoms, and pathological personality traits. A subsample of 106 participants (91.51% female) was identified as having ON scores considered as pathological. Hierarchical cluster analysis in this subsample identified four clusters : 1- a cluster with a low level of pathological personality traits (L); 2- a cluster with moderate pathological personality traits and low narcissistic traits (MD); 3- a cluster with a low level of pathological personality traits and moderate narcissistic traits (MN); 4- a cluster with high paranoid and narcissistic traits (PN) and a moderate level of schizotypal and borderline traits. Levels of anxiety, obsessional-compulsive and depressive symptoms were higher in the PN and MD clusters than in the L and MN clusters. Social phobia was higher and self-esteem lower in the MD cluster and hypochondriasis was higher in the PN and MN clusters. This study suggests that ON can be

associated with different personality profiles, some of them displaying significant psychopathological levels. It also emphasizes the importance of taking into account personality disorder traits of young adults with orthorexic eating behaviors. Healthcare professionals will need to pay particular attention to certain pathological personality traits, in order to adapt the therapeutic treatments offered to individuals suffering from pathological orthorexic eating behaviors.

Study 3 — Aims : To validate a French version of the *Teruel Orthorexia Scale (TOS)*, differentiating healthy orthorexia (HeOr) from pathological orthorexia (ON), and to evaluate its psychometric properties and its relationship with eating disorder and obsessive-compulsive disorder symptomatology. A sample of 799 participants (82.9% women) with a mean age of 28.5 years old ($SD = 12.1$) completed the TOS, the F-DOS, the *Eating Disorders Examination Questionnaire*, and the *Obsessive Compulsive Inventory-Revised*. Exploratory structural equation modeling after exclusion of items 9 and 15 indicated satisfactory fit and adequate internal consistency. Partial correlations showed that eating disorder and obsessive-compulsive symptomatology were positively related to ON and unrelated or negatively related to HeOr. The implications of the TOS seem interesting to start studying healthy and pathological orthorexia in the French population, without considering all preoccupations around healthy eating as pathological.

Study 4 — Aims: To identify transdiagnostic psychopathological processes (i.e., perfectionism, intolerance of uncertainty, and mental ruminations) that can contribute to explaining the manifestations of ON. A sample of 511 participants (81.8% female) with a mean age of 37.56 years old ($SD = 15.15$) completed the TOS, the *Ruminative Response Scale for Eating Disorders*, the *Intolerance of Uncertainty Scale*, and the *Multidimensional Perfectionism Scale*. Psychological processes were more strongly correlated with ON than with HeOr. Stepwise regression analysis revealed that mental ruminations about food, body weight and physical appearance as well as personal standards predicted ON. This study suggests that the treatment of orthorexia nervosa should include specific psychotherapeutic work on unattainably high personal standards, as well as on mental ruminations about food, body weight, and physical appearance.

Key words : Orthorexia nervosa, Healthy orthorexia, Eating disorders, Healthy eating, Validation of measurement tools, Personality, Transdiagnostic processes.

INTRODUCTION

Au cours de ces deux dernières décennies, dans notre société occidentale, un intérêt particulier pour la santé, l'alimentation saine et le bien-être a pris place aux côtés des préoccupations ouvertement dirigées vers la recherche de minceur corporelle et de l'intérêt que portent les individus à leur poids corporel et à leur silhouette. De nombreux éléments peuvent jouer un rôle dans cet intérêt grandissant.

Nous pouvons tout d'abord énoncer le constat de l'inefficacité et de la dangerosité des régimes amaigrissants ayant été mis en avant par le rapport de l'ANSES de 2010. Les marques de régimes amaigrissants ont alors revu leurs stratégies de communication en jouant entre autres sur l'amalgame existant entre le poids et la santé afin de continuer à vendre leurs produits. On leur doit notamment des slogans comme « prendre soin de sa santé c'est évidemment surveiller son poids, et pour surveiller son poids c'est très simple [...] » (spot publicitaire *Comme j'aime* de janvier 2021).

L'exposition et l'accès plus facile à certaines informations sur l'impact que peuvent avoir nos manières de consommer sur l'environnement et les êtres vivants (e.g., exploitation humaine, conditions de travail, bien-être animal, conditions d'élevage et d'abattage des animaux) peuvent également être à l'origine de prises de conscience chez les individus pouvant pousser certains d'entre eux à repenser leur manière de consommer, et ce, notamment au niveau alimentaire.

Les scandales et crises sanitaires (e.g., fraude à la viande de cheval, crise de la vache folle, grippe aviaire, pandémie de Covid-19 etc.) peuvent également être à l'origine d'un sentiment de peur et/ou d'une certaine méfiance d'une partie de la population envers les instances de santé. Cela apparaît d'autant plus probable dans un contexte où la population est très régulièrement exposée à un grand nombre d'informations de santé émanant de diverses sources plus ou moins fiables qui se contredisent pouvant alors créer de la confusion dans l'esprit des individus, une certaine « cacophonie », et une certaine méfiance. Certains individus se tournent alors vers des pratiques de soins non conventionnelles qui peuvent s'avérer dangereuses car pouvant engendrer un retard ou une absence de diagnostic et de prise en charge médicale, ou encore faire la promotion de comportements dangereux pour la santé. La mission interministérielle de vigilance et de lutte contre les dérives sectaires (Miviludes) fait état de 2500 signalements par an dont la majorité dans le domaine de la santé et du bien-être pour ce type de pratiques. Parmi ces signalements nous pouvons citer, par exemple, le cas du

mouvement du respirianisme, fondé sur la croyance qu'un individu pourrait vivre en se nourrissant exclusivement d'air et de lumière, et ayant provoqué le décès de plusieurs de ses adeptes. Ou encore le cas de Thierry Casasnovas, personnalité bien connue et largement suivie sur les médias sociaux, faisant la promotion du crudivorisme, de la consommation de jus de légumes et de comportements dangereux (e.g., lavements) dans l'objectif de guérir des maladies somatiques et psychologiques tout en remettant en question la véracité de la réalité scientifique et médicale en proposant des interprétations fallacieuses des phénomènes somatiques et psychologiques.

Les avantages pour la santé d'un mode de vie sain, comprenant une alimentation saine et une activité physique, ont largement été rapportés au fil des années (e.g., World Health Organization, 2016). De l'intérêt pour la santé peut cependant découler une pathologie : « l'orthorexie nerveuse », terme et concept relativement récent, apparu et décrit en 1997 avec un article publié dans « *Yoga Journal* » et le livre « *Health Food Junkies* » de Steven Bratman, praticien en médecine naturelle. Dans son livre, il décrit les demandes de patients arrivant dans son cabinet avec des demandes de régimes d'éviction toujours plus restrictifs dans une quête de pureté sanitaire ainsi que les conséquences délétères de ces demandes. L'orthorexie est, depuis, à l'origine de nombreuses recherches scientifiques. Cependant, elle n'est pas encore répertoriée dans les classifications des troubles mentaux (i.e., DSM, CIM), aucune estimation fiable de sa prévalence dans la population n'existe, et les résultats concernant les facteurs de risque et conséquences de l'orthorexie ne font pas consensus, et ce notamment en raison de gros problèmes méthodologiques dont fait l'objet le champ de recherche de l'orthorexie. De plus, au début de cette thèse, aucune étude scientifique n'avait été menée sur les comportements orthorexiques en population française. Partant de ces constats, nous avons souhaité explorer, dans cette thèse de doctorat, les comportements orthorexiques chez l'adulte en population française. Pour cela, nous avons souhaité valider en langue française des outils de mesure d'orthorexie possédant de bonnes qualités psychométriques, identifier des profils de personnalité pathologiques liés aux comportements alimentaires orthorexiques, et enfin identifier les processus psychologiques transdiagnostiques liés à l'orthorexie. Cela permettra de mieux comprendre, étudier, évaluer, et prendre en charge les comportements orthorexiques de l'adulte.

Dans un premier temps, le **cadre théorique** nous permettra d'introduire, définir et faire un état des lieux des connaissances actuelles sur l'orthorexie. Il nous permettra également de

présenter les différentes théories psychologiques de la personnalité et de dresser un état des lieux de la littérature sur la personnalité dans l'orthorexie. Enfin, il nous permettra de présenter et définir l'approche processuelle transdiagnostique ainsi que des processus psychologiques qui ont été observés dans des troubles partageant des similarités avec l'orthorexie (i.e., troubles du comportement alimentaire et troubles obsessionnel-compulsifs) et qui pourraient être impliqués dans cette dernière.

Dans un second temps, la **problématique** ainsi que les différents **objectifs de recherche** de cette thèse seront présentées.

Dans un troisième temps, la **partie empirique** exposera les quatre études menées au cours de ce travail de thèse. La première et la troisième étude présenteront la validation française de deux outils de mesure de l'orthorexie, à savoir : la Düsseldorf Orthorexia Skala, et la Teruel Orthorexia Scale. La seconde étude sera consacrée à l'identification de profils de personnalité pathologique chez les jeunes adultes ayant des comportements alimentaires orthorexiques. Enfin, une quatrième étude portera sur les processus psychologiques transdiagnostiques impliqués dans l'orthorexie.

Pour terminer, une **discussion générale** nous permettra de synthétiser les résultats des travaux menés lors de cette thèse de doctorat et de discuter d'éventuelles pistes psychothérapeutiques et d'une ouverture vers de futurs travaux de recherche.

PARTIE THÉORIQUE

Chapitre 1 : Orthorexie : Évolution d'un concept de 1997 à aujourd'hui

1. Conception initiale de l'orthorexie nerveuse (Bratman, 1997)

Le terme orthorexie nerveuse (ON ; du grec « *ortho* » = propre, correct, droit et « *-rexia* » = appétit) a été inventé et décrit pour la première fois par Bratman en 1997 dans le but de décrire un nouveau TCA qui se différencierait de l'anorexie nerveuse (AN) et de la boulimie nerveuse (BN) par le fait que l'accent serait mis sur l'aspect qualitatif de l'alimentation plutôt que sur l'aspect quantitatif de celle-ci. Dans son livre « *Health Food Junkies* » (Bratman & Knight, 2001), Bratman mentionne qu'il recevait dans son cabinet médical un grand nombre de patients en demande de régimes d'éviction toujours de plus en plus restrictifs dans le but d'améliorer leur état de santé ou de guérir une maladie. Il invente alors le terme d'ON pour parler de ce concept avec ses patients, et le définit comme une obsession envers l'alimentation saine notamment caractérisée par une adhésion à des règles alimentaires strictes. Les écarts à ces règles alimentaires seraient punis et compensés par des règles alimentaires encore plus strictes et/ou des périodes de jeûne. Cette obsession serait également accompagnée d'un sentiment de supériorité à l'égard des personnes ayant un régime alimentaire différent du leur. Une part importante de la vie des personnes orthorexiques serait consacrée à la planification, l'achat, la préparation, et à la consommation de nourriture.

Selon Bratman (2017), l'orthorexie aurait deux stades : (1) l'adoption d'une alimentation saine, (2) l'intensification de la poursuite de cette alimentation saine en une obsession malsaine. L'étiquette de trouble alimentaire serait parfois appliquée prématurément, à tort, dès le premier stade, lorsqu'un individu adopte un régime alimentaire d'apparence irrationnelle, non scientifique ou bizarre. Bratman (2017) considère avoir contribué à cette erreur via son livre dans lequel il consacre une section à la présentation des différentes théories alimentaires (e.g., crudivorisme, régime macrobiotique, régime groupes sanguins). Selon lui, l'intérêt pour l'alimentation saine devient pathologique lorsque des pensées obsessionnelles, des comportements compulsifs, de l'autopunition, un renforcement des restrictions alimentaires et d'autres comportements typiques des TCA commencent à s'installer.

Bratman (2017) pose tout de même la question de la pertinence sur le plan clinique de définir l'orthorexie comme un nouveau TCA distinct de ceux déjà répertoriés dans les

classifications nosographiques. En effet, la définition des critères diagnostiques des TCA décrits à ce jour dans les classifications nosographiques évolue au fil du temps (e.g., abandon de la spécification du poids minimum pour établir un diagnostic d'anorexie mentale lors du passage du DSM-IV-TR au DSM-5). De même, un amalgame s'est créé entre différents concepts distincts, à savoir : l'amélioration de la santé, l'amélioration de l'apparence physique, et la perte de poids ; les aliments sains et les aliments hypocaloriques.

2. L'orthorexie nerveuse, un concept à l'origine de débats

Depuis une dizaine d'années, l'intérêt pour l'ON a conduit à un nombre croissant de publications scientifiques. Dans une étude interrogeant des professionnels de santé (Vandereycken, 2011), 66,7% des participants ont rapporté avoir observé ce trouble dans leur pratique, et 68,5% ont exprimé que son diagnostic mériterait plus d'attention. A ce jour, bien que des tentatives de formulation de ses critères diagnostiques aient été proposées par de nombreux auteurs (Barthels et al., 2015b; Cena et al., 2018; Dunn & Bratman, 2016; Moroze et al., 2015), l'ON n'est pas encore répertoriée dans les classifications nosographiques. Ces critères diagnostiques sont présentés dans le Tableau 1.

Tableau 1

Critères diagnostiques de l'ON proposés par plusieurs auteurs, traduction libre tirée de Dajon et al. (2020)

Auteurs, année	Critères de classification (traduction libre)
Barthels et al. (2015)	<i>Critère A</i> : préoccupation persistante et intensive pour l'alimentation saine et la nutrition. <i>Critère B</i> : anxiété prononcée et évitement important des aliments considérés comme malsains selon des croyances subjectives. <i>Critère C</i> : C1. Au moins deux pensées erronées concernant l'efficacité et les avantages potentiels pour la santé des aliments sains et/ou, C2. Préoccupation ritualisée d'acheter, de préparer et de consommer des aliments, qui n'est pas due à des raisons culinaires mais découle de pensées erronées. L'impossibilité d'adhérer aux règles nutritionnelles provoque des peurs intenses, qui peuvent être évitées par un strict respect des règles <i>Critère D</i> : D1. La fixation sur une alimentation saine provoque des souffrances ou des altérations cliniques importantes dans les domaines sociaux,

professionnel ou d'autres domaines importants de la vie et/ou affecte négativement les enfants (par exemple, nourrir les enfants d'une manière inappropriée pour l'âge) et/ou,

D2. Syndrome de carence dû à des carences alimentaires inappropriées. Dans certains cas, le manque de conscience (insight) est un indicateur de la gravité du trouble

Critère E : une perte de poids et une insuffisance pondérale peuvent être présentes, mais les inquiétudes concernant le poids et l'apparence corporelle ne doivent pas dominer le syndrome

Pour diagnostiquer l'orthorexie, les critères A, B, C et E doivent être clairement remplis. Le critère D doit être rempli au moins partiellement. Si le critère E n'est pas clairement rempli, le diagnostic d'anorexie mentale atypique est recommandé

**Moroze et al.
(2015)**

Critère A : préoccupation obsessionnelle de manger des aliments sains en se concentrant sur la qualité et la composition des repas. Comprenant deux ou plusieurs des éléments suivants :

A1. Avoir un régime alimentaire déséquilibré sur le plan nutritionnel en raison de croyances préoccupantes sur les aliments « purs »

A2. Préoccupations et soucis de manger des aliments impurs ou malsains, et sur l'impact de la qualité et de la composition des aliments sur la santé physique et/ou émotionnelle

A3. L'évitement rigide des aliments considérés par l'individu comme « malsains », ce qui inclut des aliments contenant des matières grasses, des conservateurs, des additifs alimentaires, des produits d'origine animale ou d'autres ingrédients considérés comme malsains

A4. Pour les personnes qui ne sont pas des professionnels de l'alimentation, un temps excessif (par exemple trois ou plusieurs heures par jour) est passé à lire, à acquérir et/ou à préparer des aliments en fonction de leur qualité et de leur composition

A5. Sentiments de culpabilité et inquiétudes après des transgressions dans lesquelles des aliments « malsains » ou « impurs » sont consommés

A6. Intolérance des croyances alimentaires des autres

A7. Dépenser des sommes d'argent excessives par rapport à son revenu pour des aliments en raison de leur qualité et de leur composition

Critère B : les préoccupations obsessionnelles entraînent :

B1. Une altération de la santé physique due à des déséquilibres nutritionnels (par exemple, développement d'une malnutrition due à une alimentation déséquilibrée)

B2. Une détresse grave ou une altération du fonctionnement social, scolaire ou professionnel due à des pensées et des comportements obsessionnels axés sur les croyances de l'individu à manger sainement

Critère C : la perturbation n'est pas simplement l'exacerbation des symptômes d'un autre trouble, comme un trouble obsessionnel-compulsif, la schizophrénie ou un autre trouble psychotique

Critère D : le comportement n'est pas mieux expliqué par l'observance de croyances religieuses concernant la nourriture, d'une allergie alimentaire diagnostiquée ou des conditions médicales nécessitant un régime alimentaire spécifique

**Dunn &
Bratman (2016)**

Critère A : la préoccupation obsessionnelle de la nourriture saine, telle que définie par un ensemble de croyances propres au patient, est marquée par une détresse émotionnelle en lien avec des choix alimentaires perçus comme mauvais pour la santé ; une perte de poids peut résulter de ces choix alimentaires mais n'est pas le but principal

A1. Comportement compulsif et/ou préoccupations mentales concernant des pratiques alimentaires restrictives considérées par l'individu comme promouvant une santé optimale

A2. La violation des règles alimentaires auto-imposées provoque une peur exagérée de maladie, un sentiment d'impureté personnelle et/ou des sensations physiques négatives, accompagné d'anxiété et de honte

A3. Les restrictions alimentaires s'intensifient avec le temps et peuvent inclure l'élimination de groupes d'aliments entiers et impliquent progressivement plus de « nettoyages » fréquents et/ou sévères (jeûnes partiels) considérés comme purifiants ou détoxifiants. Cette escalade conduit généralement à une perte de poids, mais le désir de perdre du poids est absent, caché ou subordonné à idéation sur une alimentation saine

Critère B : une altération clinique est présente et peut se manifester soit par :

B1. Une malnutrition, une perte de poids importante ou d'autres complications médicales

B2. Une détresse et une altération des capacités sociales, académiques ou professionnelles conséquentes aux croyances et aux comportements concernant la nourriture saine

B3. Une image corporelle et une estime de soi positive ainsi que la satisfaction excessive d'être en accord avec sa définition d'une alimentation saine

Jusqu'à encore récemment la façon de catégoriser l'ON était source de débats. En effet, des études ont suggéré que l'ON pouvait être un trouble à part entière, distinct de ceux déjà présents dans le DSM-5 (American Psychiatric Association et al., 2013; Dunn et al., 2017), d'autres études ont suggéré que l'ON était proche de l'AN, de la BN, du trouble d'alimentation sélective et/ou d'évitement, des troubles obsessionnels-compulsifs et apparentés (TOC), ou même des troubles anxieux (Bartel et al., 2020; Brytek-Matera, 2012; Ryman et al., 2019). Dans un sondage réalisé en Allemagne auprès de psychothérapeutes, la majorité des participants interrogés ont rapporté observer plus fréquemment des comportements orthorexiques en tant que comorbidité d'un TCA typique ou atypique, ou d'un TOC, plutôt que comme un trouble principal (Barthels et al., 2015b). Pour Bhattacharya et al. (2022), l'ON ne constituerait pas un trouble mental distinct de ceux déjà présents dans les classification nosographiques mais serait plutôt une nouvelle manifestation culturelle de l'AN, une évolution dans les symptômes de l'AN, dans un contexte où la culture des régimes est très présente et où une forte responsabilité à prendre soin de sa santé est placée sur les individus.

3. Orthorexie : une conception bidimensionnelle (Barrada & Roncero, 2018)

Une grande partie des recherches scientifiques menées sur l'orthorexie s'est concentrée sur une conception unidimensionnelle et pathologique. Ainsi plusieurs outils de mesure ont été construits pour évaluer cette conception (cf. Chapitre 2, pp. 28-33). Barrada et Roncero (2018) ont proposé de ne plus considérer l'orthorexie comme un construit unidimensionnel mais comme un construit bidimensionnel, un style alimentaire composé non seulement d'une dimension pathologique (« *Orthorexia Nervosa* », ON) mais aussi d'une dimension saine/adaptative (« *Healthy Orthorexia* », HeOr) et ont développé la Teruel Orthorexia Scale (TOS)¹, première échelle conçue pour évaluer spécifiquement ces deux dimensions de façon distincte. Selon ces auteurs, certains aspects et caractéristiques de l'orthorexie sont considérés à tort comme pathologiques dans les outils de mesures développés pour évaluer l'ON alors que ces aspects relèveraient de la dimension adaptative de l'orthorexie (e.g., Hallit et al., 2021).

¹ Nous reviendrons plus amplement sur la TOS dans la partie 1.5 du chapitre 2 consacré aux outils de mesure d'orthorexie.

Barrada et Roncero (2018, p.289) définissent l'ON comme une « *préoccupation pathologique pour l'alimentation saine. [...] Les individus manifestant des niveaux élevés d'ON seraient hautement préoccupés et dépassés par leur préoccupation pour l'alimentation saine, ce qui les mèneraient à faire l'expérience de conséquences négatives telles que l'isolement social, l'auto-punition et la honte* ». Ils définissent l'HeOr comme la « *tendance à manger sain et l'intérêt à le faire [...] un intérêt sain pour l'alimentation saine, indépendant et même inversement associée à la psychopathologie. [...] Cet intérêt sain pour l'alimentation saine serait en accord avec les valeurs de l'individu, décrivant ses attitudes presque comme un mode de vie* ».

L'ON et l'HeOr sont liées de manière différente et opposée à certaines variables psychopathologiques, ce qui suggère que l'HeOr n'est pas un facteur atténué ou un facteur de risque de l'ON, mais qu'il s'agit bien d'une dimension différente. L'HeOr est corrélée positivement au bien-être, aux affects positifs (Barthels et al., 2019), à la satisfaction corporelle (Barrada & Roncero, 2018), et à la pleine conscience dispositionnelle (Strahler, 2021). L'HeOr est aussi corrélée négativement à différents indicateurs de psychopathologie (i.e., symptômes de TOC, symptômes de TCA, altération du fonctionnement dû aux TCA, et affects négatifs) et à l'indice de masse corporelle (IMC) (Barrada & Roncero, 2018; Zickgraf & Barrada, 2022). En revanche, l'ON est corrélée positivement à la détresse psychologique (Barthels et al., 2019), ainsi qu'à différents indicateurs de psychopathologie (i.e., symptômes de TOC, symptômes de TCA, altération du fonctionnement dû aux TCA, préoccupations face aux erreurs, affects négatifs, anxiété liée à la santé) (Barrada & Roncero, 2018; Chace & Kluck, 2021; Zickgraf & Barrada, 2022). L'ON est aussi corrélée négativement à la satisfaction corporelle (Barrada & Roncero, 2018; Chace & Kluck, 2021) et à la pleine conscience dispositionnelle (Strahler, 2021).

De même, les motivations derrière les choix alimentaires et les comportements de santé diffèrent entre l'ON et l'HeOr. Alors que l'HeOr est associée positivement à la santé et négativement à l'attrait sensoriel et au prix des aliments, l'ON est associée positivement au contrôle du poids corporel et à la régulation des affects et négativement à l'attrait sensoriel (Depa et al., 2019). L'HeOr est également associée positivement aux connaissances nutritionnelles et à la qualité de l'alimentation alors que l'ON est prédictrice d'une moins bonne connaissance nutritionnelle, d'une alimentation de moins bonne qualité, d'un comportement plus sédentaire, ainsi que d'une consommation problématique d'alcool et de tabac (Zickgraf & Barrada, 2022).

4. Vers une perspective consensuelle de l'orthorexie (Donini et al., 2022)

La diversité des définitions et des critères diagnostiques utilisés dans les études sur l'orthorexie, et le manque d'outils de mesure possédant de bonnes qualités psychométriques, rend difficile la comparabilité et la généralisation des résultats empiriques, et constitue un frein à l'avancée de la recherche sur ses facteurs de risque et de protection, ses conséquences, ainsi que sur les approches thérapeutiques fondées sur les preuves (Cena et al., 2018; Donini et al., 2022).

En novembre 2020, un panel international de 47 experts (i.e., chercheurs et professionnels de santé ayant publié au moins un article ou chapitre sur l'orthorexie) issus de 14 pays et 4 continents différents a été invité à participer à un groupe de réflexion dont le but premier était d'atteindre un consensus quant à la définition de l'ON et de ses critères diagnostiques. Ont aussi été discutés la catégorie nosographique du DSM dans laquelle l'ON devrait être inclus, son évolution, ses facteurs de risque et de protection, sa comorbidité médicale et psychiatrique, son diagnostic différentiel et ses conséquences. Ce consensus a été obtenu par l'utilisation de la méthode Delphi (Grime & Wright, 2016) en 3 phases, dans laquelle les participants devaient exprimer leur accord ou leur désaccord vis-à-vis de 67 déclarations concernant l'orthorexie et justifier leurs réponses lors de ces 3 phases. Les déclarations ayant atteint ou dépassé le seuil de 75% d'accord étaient considérées consensuelles et ont été consignées dans un article publié en novembre 2022 (Donini et al., 2022). La définition ainsi que les critères diagnostiques émanant du consensus du panel d'experts sont présentés dans le Tableau 2.

Tableau 2

Critères diagnostiques de l'ON résultant du consensus d'un panel d'experts, traduction libre de Donini et al. (2022)

Critères diagnostiques
Critère A: définition, aspects cliniques et durée
A1. Définition
L'orthorexie nerveuse (ON) se caractérise par une forte préoccupation à l'égard de son comportement alimentaire et par des règles auto-imposées, rigides et inflexibles, qui sont strictement contrôlées et qui incluent le fait de passer un temps excessif à planifier, acquérir, préparer et/ou manger sa nourriture.

La définition d'« alimentation saine » ou d'« alimentation pure » inclut une théorie alimentaire ou un ensemble de croyances dont les détails spécifiques peuvent varier. Les individus atteints d'ON qualifient souvent une alimentation « saine » comme étant pure, propre, organique, juste, correcte, naturelle, sûre ; une alimentation « malsaine » est souvent qualifiée de transformée, avec des ingrédients ajoutés, préparée, traitée, toxique, contaminée de manière à représenter des conséquences nocives pour la santé de l'individu. Cela peut également inclure toute autre définition de ce qui est sain ou malsain en fonction de l'individu concerné (son milieu/sa culture/ses connaissances/le moment de sa vie) ou des tendances et cultures alimentaires.

L'ON est un trouble mental associé à une diminution du bien-être et appartenant à la catégorie des troubles des conduites alimentaires et de l'ingestion d'aliments du DSM-5.

Les individus souffrant d'ON éprouvent une détresse émotionnelle, de l'anxiété (s'ils sont confrontés à des aliments considérés malsains et qu'ils craignent être affectés par leur consommation), des problèmes d'attention et de concentration (si l'individu passe sa journée à penser à une alimentation saine), et un sentiment de culpabilité comme conséquence de ne pas pouvoir manger sainement.

Dans l'ON, l'adhésion à des règles alimentaires auto-imposées influence de façon excessive l'auto-évaluation.

A2. Durée

Les symptômes doivent être présents durant les 6 dernier mois. Toutefois, en cas d'altération grave de la santé ou du fonctionnement psychosocial, le diagnostic peut être posé après seulement 3 mois.

Critère B: conséquences

Les comportements liés à l'ON impliquent des perturbations des habitudes alimentaires qui conduisent à un régime alimentaire nutritionnellement déséquilibré, ce qui affecte négativement l'état de santé (physique et mentale) et la qualité de vie.

L'ON implique des conséquences émotionnelles (e.g., sentiment de culpabilité après avoir mangé des aliments considérés comme malsains), cognitives (e.g., problèmes d'attention et

de concentration) et/ou sociales (e.g., exclusion sociale), qui ont un effet négatif sur la vie scolaire, professionnelle, ou sociale de l'individu.

En raison du temps excessif consacré à leur alimentation (lecture, acquisition et/ou préparation des aliments), l'ON a un impact négatif sur d'autres domaines importants du fonctionnement psychosocial et personnel.

La sélectivité alimentaire qui caractérise les individus souffrant d'ON, peut contribuer à provoquer des carences nutritionnelles (e.g., anémie, perte de poids extrême, malnutrition globale ou sélective) et des perturbations hormonales.

Les règles alimentaires rigides présentes dans l'ON peuvent entraîner un poids corporel faible qui correspond aux idéaux socioculturels de santé, du moins dans les pays occidentaux, ou qui se recoupe largement avec les idéaux de minceur et de musculature. Cependant, ce faible poids peut être mieux conçu comme un effet secondaire ou une conséquence de l'ON plutôt que comme le résultat d'une insatisfaction corporelle.

Critère C: apparition de l'ON

L'ON semble être associée au développement d'autres formes de TCA et/ou à la migration vers d'autres formes de TCA. Elle peut précéder d'autres TCA, coexister avec des TCA (lorsqu'une attitude orthorexique représente une façon plus acceptable socialement de déployer les TCA), suivre d'autres TCA (représentant une stratégie de coping défectueuse lorsqu'il n'est plus possible de pratiquer d'autres TCA), ou servir de stratégie de coping pour les personnes atteintes d'anorexie nerveuse afin de continuer à restreindre leur alimentation.

Les personnes peuvent développer une ON en conséquence de règles alimentaires prescrites ou autoprescrites, liées ou non à des conditions cliniques (e.g., personnes souffrant de maladies chroniques/somatiques nécessitant des restrictions spécifiques ; recherche de théories alimentaires à respecter pour guérir une maladie chronique telle que la fibromyalgie, des allergies ou des intolérances alimentaires). L'ON peut également représenter dans ces cas de figure un mécanisme d'adaptation aux maladies chroniques dans lesquelles un régime strict est nécessaire (sentiment de contrôle).

Critère D: critères d'exclusion

La sélection et/ou l'exclusion d'un aliment du régime alimentaire n'est pas attribuable à une prescription diététique clinique (e.g., en cas d'insuffisance rénale, d'obésité, d'allergies et d'intolérances alimentaires).

Si des conditions cliniques sont présentes et motivent la sélection et/ou l'exclusion d'aliments, l'apparition de l'ON est caractérisée par une sélection et/ou une exclusion d'aliments qui est excessive, inappropriée et va au-delà des conseils et pratiques médicales standards.

La sélection et/ou l'exclusion d'aliments n'est pas attribuable à des conditions économiques, à des valeurs, à la culture, à des croyances religieuses ou à des idées délirantes.

Chapitre 2 : Évaluation et prévalence de l'orthorexie

Dans cette partie, nous présenterons de manière chronologique les principaux outils de mesure de l'orthorexie. D'autres outils de mesure comme la Barcelona Orthorexia Scale (BOS ; Bauer et al., 2019), le Test of Orthorexia Nervosa (TON-17 ; Rogowska et al., 2021a), l'Orthorexia Nervosa Inventory (ONI ; Oberle et al., 2020), ou encore l'Échelle Française d'Orthorexie (EFO ; Dajon et al., 2020) ne seront pas présentés dans cette thèse car, à notre connaissance, aucune étude ne les a encore utilisés en dehors des études de validation de leur version originale.

1. Outils de mesure

1.1. Bratman's Orthorexia Test (BOT ; Bratman & Knight, 2001)

Le premier questionnaire pour évaluer l'ON, le BOT, a été développé par Bratman (Bratman & Knight, 2001). Il est composé de 10 items cotés sur une échelle dichotomique (*Oui* = 1, *Non* = 0). Plus le score total est élevé plus le niveau de symptomatologie orthorexique est considéré élevé. Une personne est considérée orthorexique dès lors que son score est supérieur ou égal à 4. La version originale n'a pas fait l'objet d'étude de validation par son auteur. Le BOT a été traduit et validé en allemand (Barthels & Pietrowsky, 2012), suédois (Eriksson et al., 2008), grec (Grammatikopoulou et al., 2018), et polonais (Dittfeld et al., 2017). Meule et al. (2020) ont considéré que le BOT, avec une procédure de cotation différente (i.e., échelle de Likert en 4 points allant de 1 = « pas du tout » à 4 = « tout à fait »), était un outil possédant de bonnes qualités psychométriques.

Au regard des avancées dans la littérature, notamment en ce qui concerne les critères diagnostiques proposés pour l'ON, Bratman (2017) a révisé son questionnaire en proposant l'Authorized Bratman Orthorexia Self-Test (ABOST) qu'il a publié sur son site web. À notre connaissance, ce questionnaire n'a, à ce jour, pas encore fait l'objet de publication dans une revue scientifique autre qu'un article de validation de sa version polonaise (Rogowska et al., 2021b). L'ABOST est un questionnaire de 6 items cotés sur une échelle dichotomique (*Oui* = 1, *Non* = 0). Selon Bratman (2017), si un individu adepte de régimes alimentaires sains répond « *Oui* » à l'ensemble des items, celui-ci pourrait développer une ON. Les résultats de Rogowska et al. (2021b) suggèrent une structure factorielle unidimensionnelle, une bonne validité convergente, et une bonne consistance interne de l'ABOST ($\alpha = .80$) avec une cotation des

items sur une échelle de Likert en 5 points (*Pas du tout d'accord* = 1, *Plutôt pas d'accord* = 2 ; *Je ne sais pas* = 3, *Plutôt d'accord* = 4, et *Tout à fait d'accord* = 5).

1.2. ORTO-15 (Donini et al., 2004, 2005)

L'ORTO-15 est un questionnaire auto-rapporté, basé sur le BOT (Bratman & Knight, 2001), développé par Donini et al. (2004, 2005) en italien dans le but d'évaluer l'ON. Il est composé de 15 items cotés sur une échelle en 4 points (*Toujours* = 1, *Souvent* = 2, *Parfois* = 3, et *Jamais* = 4). 6 items doivent être recodés avant le calcul de la somme totale : 4 devant être inversés (items 2, 5, 8, et 9) et 2 (items 1 et 13) ayant une procédure de recodage assez particulière (*Toujours* = 2, *Souvent* = 4, *Parfois* = 3, et *Jamais* = 1). Plus le score total est faible plus le niveau de symptomatologie orthorexique est considéré élevé. Pour Donini et al. (2005), un diagnostic d'ON peut être posé dès lors que le score à l'ORTO-15 est inférieur à la valeur seuil de 40, mais les auteurs indiquent également qu'en fonction de l'objectif dans lequel le questionnaire est utilisé il est également possible d'utiliser une valeur seuil de 35. Pour eux, lorsque l'objectif est de diagnostiquer l'ON il vaut mieux privilégier la valeur seuil de 40 (offrant une meilleure spécificité), et la valeur 35 à des fins de dépistage (offrant une meilleure sensibilité). Les deux cut-offs sont utilisés dans la littérature, ce qui rend difficile la comparaison des résultats entre les études.

Il s'agit du questionnaire le plus utilisé dans le champ de recherche sur l'orthorexie (62% d'occurrence sur Pubmed le 3 mars 2023 ; Grammatikopoulou et al., 2023). Il a été traduit et validé dans une douzaine de langues (Grammatikopoulou et al., 2023) dont le turc (Arusoglu et al., 2008), le portugais (Alvarenga et al., 2012; Pontes et al., 2014), le hongrois (Varga et al., 2014), le polonais (Brytek-Matera et al., 2014; Stochel et al., 2015), l'allemand (Missbach et al., 2015), l'espagnol (Parra-Fernandez et al., 2018; Roncero et al., 2017), le français (Babeau et al., 2019; Plasonja & Décamps, 2021), l'arabe (Haddad et al., 2020), l'indonésien (Supriyanto & Warsini, 2020), le grec (Gkiouras et al., 2022), et le chinois (Li et al., 2022). Bien que, pour des raisons éditoriales, les items de l'ORTO-15 aient été traduits en anglais par les auteurs et aient été présentés dans l'article de validation de la version originale (en italien ; Donini et al., 2005), nous n'avons pas trouvé de papier de validation d'une version anglaise. Il semblerait alors que les travaux ayant découlé de cette publication dans des échantillons anglophones se soient basés sur une version du questionnaire non validée et n'ayant pas fait l'objet d'une procédure de rétro-traduction.

Le questionnaire a été très largement critiqué, notamment en raison de mauvaises qualités psychométriques (e.g., Barnes & Caltabiano, 2017; Dunn et al., 2017; Meule et al., 2020; Missbach & Barthels, 2017; Reynolds, 2018; Roncero et al., 2017).

Les résultats des études concernant la structure interne de l'ORTO-15 et de ses adaptations sont inconsistants. Bien qu'aucune analyse factorielle n'ait été réalisée dans l'article de validation originale, Donini et al. (2005) ont suggéré l'existence de 3 facteurs (i.e., cognitif-rationnel, clinique, et émotionnel) dans leur questionnaire. Par la suite, ce modèle a été testé par Meule et al. (2020) ainsi que par Babeau et al. (2019). Alors que les résultats de Meule et al. (2020) infirment cette structure à 3 facteurs et soulignent des défauts psychométriques importants de l'ORTO-15, Babeau et al. (2019) confirment ce modèle à 3 facteurs et concluent à des qualités psychométriques satisfaisantes de l'ORTO-12 après omission de 3 items. Le nombre de facteurs retenus à travers les études varie de 1 à 3 (e.g., Alvarenga et al., 2012; Arusoglu et al., 2008; Brytek-Matera et al., 2014; Missbach et al., 2015; Roncero et al., 2017; Varga et al., 2014).

Pour ce qui est de la consistance interne de la version originale, celle-ci n'est pas indiquée dans le papier de validation (Donini et al., 2005). Lors de l'adaptation de l'ORTO-15 dans d'autres langues, des items sont supprimés dans une optique d'améliorer la validité et la consistance interne du questionnaire, variant ainsi de 9 (Brytek-Matera et al., 2014; Missbach et al., 2015) à 12 items (Alvarenga et al., 2012; Babeau et al., 2019). Alors que certaines études rapportent une consistance interne adéquate (i.e., $\alpha = .73$ pour l'ORTO-12 de Babeau et al. (2019), $\alpha = .82$ pour l'ORTO-11 de Varga et al., 2014), celle-ci est très insatisfaisante dans la majorité des études, avec des $\alpha < .70$ variant de .20 (ORTO-15 de Roncero et al., 2017) à .67 (ORTO-9 de Missbach et al., 2015).

La validité de construit est elle-aussi questionnable. L'ORTO-15 est composé en partie d'items qui ne sont pas spécifiques à l'ON (e.g., « En ce moment, êtes-vous seul(e) lorsque vous mangez ? ») et mesure un construit autre que des croyances et comportements alimentaires pathologiques (Heiss et al., 2019). Certaines conséquences de l'ON comme l'altération du fonctionnement social et professionnel ne sont pas évaluées (McComb & Mills, 2019). Donini et al. (2005) ont eux-mêmes souligné le manque d'efficacité de leur questionnaire pour distinguer des comportements alimentaires sains d'un intérêt pathologique obsessionnel pour l'alimentation saine. Selon Meule et al. (2020), les limites psychométriques de l'ORTO-15 sont

en partie dues à la procédure de cotation proposée par Donini et al. (2005) mais aussi à la formulation des items. Selon Barrada et Roncero (2018), l'ORTO-15 ne devrait plus être utilisé.

Une version plus courte et révisée de l'ORTO-15, l'ORTO-R (Rogoza & Donini, 2020) a été développée dans le but de pallier ces biais psychométriques. La validité de contenu reste toutefois questionnable. En effet, si l'on s'intéresse aux deux items suivants : « Au cours des trois derniers mois, est-ce que le fait de penser à la nourriture vous a fait ressentir de la culpabilité, de la honte et de l'anxiété ? » et « Est-ce que vous vous inquiétez plus de 3 heures par jour en pensant à la nourriture ? », « penser à la nourriture » ne concerne pas spécifiquement les préoccupations liées à une alimentation saine. Ces questions pourraient être considérées comme une mesure générale des troubles alimentaires, alors que l'ORTO est censé mesurer l'ON.

De ces différentes limites psychométriques découlent une absence d'estimations plausibles et fiables de la prévalence de l'ON dans la population, avec notamment une surestimation très importante de sa prévalence dans différents échantillons (e.g., Dunn et al., 2017; Valera et al., 2014).

Les résultats des études menées avec l'ORTO-15 ou ses adaptations sont à considérer avec prudence. Pour pallier ces différents biais, d'autres questionnaires ont été développés.

1.3. Eating Habits Questionnaire (EHQ ; Gleaves et al., 2013)

L'EHQ est un questionnaire développé, en langue anglaise, par Gleaves et al. (2013) afin de mesurer les cognitions, comportements et émotions associés à l'ON. Il est composé de 21 items, cotés sur une échelle de Likert en 4 points (de 1 = « *faux, pas du tout vrai* » à 4 = « *très vrai* »), répartis en 3 sous-échelles : problèmes associés à l'alimentation saine (12 items ; e.g., « Je passe plus de trois heures par jour à penser à la nourriture saine. »), connaissances sur l'alimentation saine (5 items ; e.g., « Je suis plus informé(e) que les autres au sujet de l'alimentation saine. »), et émotions positives à l'égard de l'alimentation saine (4 items ; e.g., « Je me sens en contrôle quand je mange sainement. »). La version originale de l'EHQ a démontré une bonne consistance interne avec un α de Cronbach = .90 (Gleaves et al., 2013).

Il a été traduit et validé en italien (Novara et al., 2017), français (Godefroy et al., 2020), espagnol (Parra-Fernández et al., 2021), polonais (Brytek-Matera et al., 2020) et arabe (Hallit et al., 2021).

Certaines limites de l'EHQ sont cependant à noter. En effet, l'EHQ a été critiqué pour ne pas prendre en compte les émotions négatives, l'auto-punition lors de la transgression des règles auto-imposées, et les comportements compulsifs (Barrada & Roncero, 2018; Koven & Abry, 2015). Concernant sa structure factorielle, des solutions à deux (Orthorexie saine, Orthorexie nerveuse : Hallit et al., 2021), à trois (Gleaves et al., 2013; Comportement alimentaire rigide, Sentiment positif de contrôle, Problèmes dans le contrôle attentionnel et dans les relations sociales : Godefroy et al., 2020; Comportements, Problèmes, et Sentiments : Oberle et al., 2017) et à quatre facteurs (Cognitions sur l'alimentation saine, Restriction alimentaire, Supériorité alimentaire, et Altération du fonctionnement social : Halim et al., 2020) ont été proposées. Même pour les solutions comportant le même nombre de facteurs (Gleaves et al., 2013; Godefroy et al., 2020; Oberle et al., 2017), la répartition des items par facteurs, et leur interprétation théorique diffèrent d'une étude à l'autre.

1.4. Düsseldorf Orthorexie Skala (DOS ; Barthels et al., 2015a)

La DOS est une échelle auto-rapportée développée par Barthels et al. (2015a), en langue allemande, dans le but de mesurer les comportements orthorexiques. Elle est composée de 10 items cotés sur une échelle de Likert en 4 points allant de « *Pas du tout* » = 1 à « *Tout à fait* » = 4. Un exemple d'item est « Je peux apprécier la nourriture seulement si elle est considérée comme bonne pour la santé. » Des scores élevés à cette échelle suggèrent des niveaux plus prononcés de comportements orthorexiques. Des scores seuils préliminaires ont été établis par les auteurs sur la base du 95^{ème} et du 90^{ème} percentile. Un score compris entre 25 et 29 suggérerait un risque d'ON, et un score supérieur ou égal à 30 indiquerait la présence d'ON (Barthels et al., 2015a; Chard et al., 2019). Cette échelle a été traduite et validée en espagnol (Depa et al., 2017; Parra-Fernández et al., 2019), anglais (Chard et al., 2019), chinois (He et al., 2019), polonais (Brytek-Matera, 2021), arabe (Hallit et al., 2021; Rogoza et al., 2021) et italien (Cerolini et al., 2022).

La structure factorielle de l'échelle n'est pas reproduite dans toutes les études. Alors que les études de Meule et al. (2020) et Parra-Fernández et al. (2019) confirment la solution à un facteur de la version originale, une solution à 3 facteurs (Obsession de l'alimentation saine, Respect des règles nutritionnelles, et Symptômes émotionnels) et à 2 facteurs (Orthorexie saine, Orthorexie nerveuse) ont été considérées dans son adaptation chinoise (He et al., 2019) et arabe (Hallit et al., 2021) respectivement.

Une bonne consistance interne a été retrouvée dans différents échantillons, avec des α de Cronbach entre .8 et .88 (Barthels et al., 2015a, 2017; Chard et al., 2019; Depa et al., 2017; He et al., 2019; Luck-Sikorski et al., 2019; Parra-Fernández et al., 2018; Rudolph, 2018).

1.5. Teruel Orthorexia Scale (TOS ; Barrada & Roncero, 2018)

La TOS est une échelle auto-rapportée développée par Barrada et Roncero (2018) dans le but d'évaluer l'orthorexie dans sa dimension saine et pathologique. Elle est composée de 17 items, cotés sur une échelle de Likert en 4 points (« *Pas du tout d'accord* » = 0 à « *Tout à fait d'accord* » = 4), répartis en deux sous-échelles : Orthorexie Nerveuse qui évalue « l'impact social et émotionnel négatif d'essayer d'adopter un mode d'alimentation rigide » (ON ; 8 items; e.g., « Des pensées concernant une alimentation saine m'empêchent de me concentrer sur d'autres tâches ») et Orthorexie Saine qui évalue la « tendance à manger sainement et l'intérêt à le faire » (HeOr ; 9 items; e.g., « Mon intérêt pour une alimentation saine définit ma manière d'être, de comprendre le monde »). Dans sa version originale, la TOS a montré une bonne consistance interne pour chacune de ses sous-échelles, i.e., α de Cronbach = .81 et .85 respectivement, ainsi qu'une interrelation modérée, i.e., $r_{ON-HeOr} = .43$ (Barrada & Roncero, 2018).

Elle a été traduite et validée en allemand (Strahler et al., 2020), arabe (Mhanna et al., 2021), portugais (da Silva et al., 2021), anglais (Chace & Kluck, 2021; Zickgraf & Barrada, 2022) et italien (Falgares et al., 2023). Les résultats de ces études supportent la structure bidimensionnelle ainsi que les bonnes qualités psychométriques de la TOS.

2. Prévalence

La majorité des études rapportant la prévalence de l'ON dans différentes populations s'appuient sur l'ORTO-15. Dans ces études, la prévalence a été estimée à 6,9 % dans la population générale (Donini et al., 2004) et entre 12,8% et 86 % dans des populations spécifiques telles que des professionnels de santé, des étudiants dans le domaine de la santé ou chez des personnes qui pratiquent le yoga (e.g., Asil & Sürücüoğlu, 2015; Bağcı Bosi et al., 2007; Bo et al., 2014; Fidan et al., 2010; Herranz Valera et al., 2014; Kinzl et al., 2006; Tremelling et al., 2017). Ces taux de prévalence élevés peuvent très certainement être interprétés comme le reflet d'importantes limites psychométriques de l'ORTO-15 plutôt que comme le reflet d'une réelle prévalence élevée de l'ON dans la population (Koven & Abry, 2015). En effet, une prévalence inférieure à 1% a été trouvée dans un échantillon d'états-unien

quand des questions supplémentaires concernant les conséquences négatives sur la santé et sur les relations avec la famille et les amis avaient été posés pour évaluer l'ON avec l'ORTO-15 (Dunn et al., 2017).

De plus, les études qui ont utilisé la DOS ou ses adaptations plutôt que l'ORTO-15 rapportent des prévalences d'ON variant de 1% à 6,9% dans la population générale ou dans des échantillons d'étudiants universitaires en Allemagne (Barthels et al., 2015a; Luck-Sikorski et al., 2019), et autour de 8% dans des échantillons d'étudiants universitaires aux USA ou en Chine (Chard et al., 2019; He et al., 2019), ce qui est bien inférieur aux estimations faites avec l'ORTO-15.

Chapitre 3 : Facteurs de risque et conséquences de l'orthorexie nerveuse

Dans ce chapitre, nous utiliserons les termes de facteurs de risque et de conséquences en nous référant aux termes employés/suggérés par les auteurs des recherches rapportées. Cependant, ces recherches ayant été réalisées avant qu'un consensus ne soit atteint sur la définition et les critères diagnostiques de l'ON, avec des outils présentant d'importantes limites psychométriques, et avec un design transversal, la véracité et la nature des différentes associations rapportées entre l'ON et différentes variables restent à confirmer/infirmes.

1. Facteurs de risque de l'orthorexie

Dans une revue systématique de la littérature incluant 54 études, McComb et Mills (2019) ont identifié un certain nombre de facteurs de risque psychosociaux de l'ON qu'elles ont formalisé sous la forme d'un modèle (Figure 1).

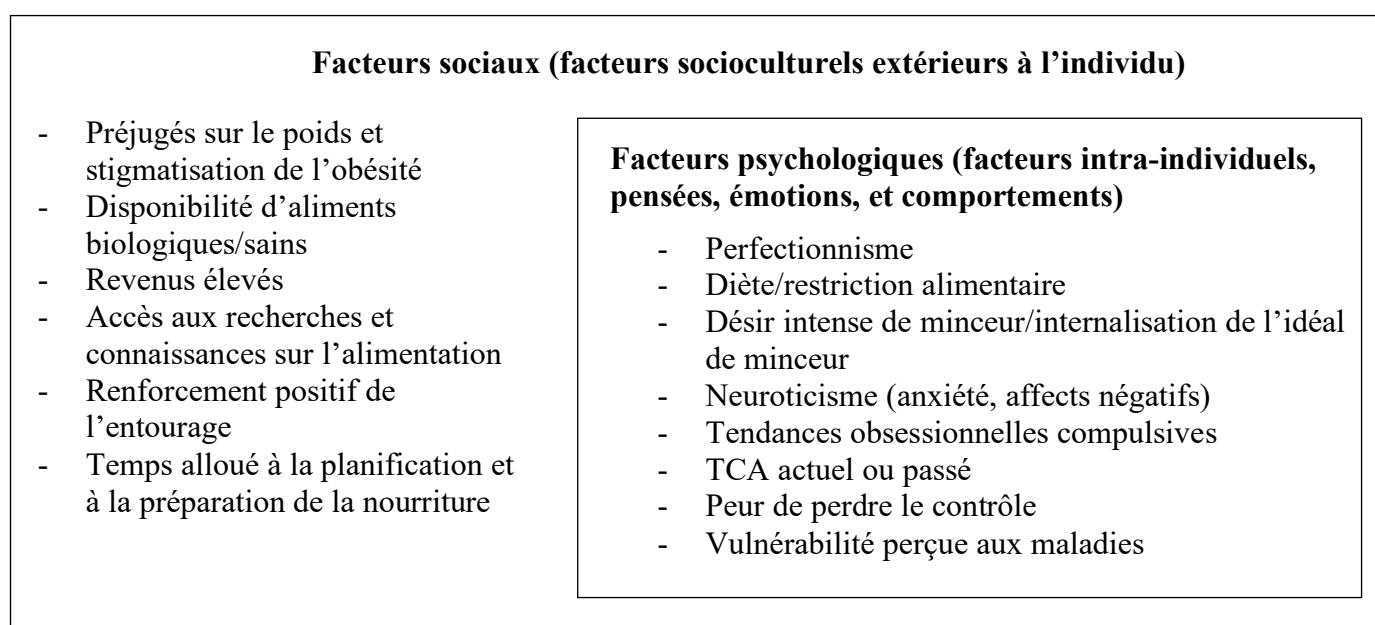


Figure 1. Modèle psychosocial de l'ON, traduit librement de McComb et Mills (2019).

De nombreuses variables pourraient constituer des facteurs de risque de l'ON : la personnalité² (e.g., perfectionnisme, neuroticisme, narcissisme, traits obsessionnels-compulsifs), la présence et/ou des antécédents de troubles psychopathologiques ou de TCA, des variables liées à l'alimentation (e.g., restriction alimentaire, boulimie et préoccupation concernant la nourriture, contrôle de la prise alimentaire, régimes végétariens, antécédents de pratique d'un régime alimentaire dans une optique de perte pondérale), ou des variables liées

² Le lien entre personnalité et ON sera développé plus amplement dans le Chapitre 4 de la partie théorique.

au corps, à l'apparence et au poids (e.g., investissement dans l'apparence, insatisfaction corporelle, préoccupation quant au surpoids) (McComb & Mills, 2019). Les résultats concernant les régimes végétariens comme facteur de risque au développement d'ON sont cependant à nuancer. En effet, Barthels et al. (2019) soulignent l'importance de prendre en compte les motivations sous-jacentes à l'adoption de régimes alimentaires, en mettant en avant que l'association entre l'ON et l'adoption d'un régime végétarien était basée sur des raisons de santé, d'esthétique et de guérison plutôt que sur des raisons de bien-être animal, éthiques, écologiques, ou politiques. L'IMC, le choix du domaine d'études ou du domaine professionnel ainsi que des facteurs socio-démographiques comme le genre, l'âge, et le niveau éducationnel ne semblent pas associés à un plus grand risque de développer de l'ON (McComb & Mills, 2019).

Selon le consensus d'experts (Donini et al., 2022), les variables suivantes constitueraient des facteurs de risque de l'ON :

- sports de compétition, préoccupations de performance athlétique et fréquence élevée d'activité physique
- antécédents d'autres TCA ou de troubles mentaux (e.g., TOC)
- problèmes (psycho)-somatiques, hypocondrie, symptômes dépressifs, anxiété (généralisée ou spécifique)
- perfectionnisme, besoin de contrôle, faible évaluation de soi, narcissisme, autocritique et tendance aux exigences élevées envers soi-même
- fait d'être excessivement influencé par les médias, les réseaux sociaux, les plates-formes en ligne et les sites web liés aux comportements alimentaires et/ou à l'apparence physique
- habitudes alimentaires végétaliennes ou végétariennes
- dérégulation des émotions
- choix universitaires et professionnels (e.g., diététicien, nutritionniste)

Des recherches supplémentaires sont cependant nécessaires afin d'augmenter le niveau de preuve scientifique concernant ces associations. De plus, aucun consensus n'a été atteint par le panel d'experts concernant des associations entre l'ON et des variables socio-démographiques (i.e., genre, âge, statut social, niveau d'éducation), des variables physiques ou alimentaires (i.e., préoccupations pondérales, variations pondérales au cours de la vie, troubles

de l'image du corps, impulsivité et anxiété liée à l'apparence) ; ou encore des variables concernant la consommation de substances.

2. Motivations sous-jacentes et conséquences

Les principales motivations derrière cette préoccupation excessive pour l'alimentation saine seraient un désir de guérir ou prévenir une maladie chronique, de contrôler ou de perdre du poids, d'améliorer son état de santé, ou de corriger de « mauvaises habitudes diététiques » (Bratman & Knight, 2001; Depa et al., 2019). Paradoxalement, cette obsession pour la santé et l'alimentation saine pourrait avoir des conséquences négatives sur la santé physique et psychologique.

D'un point de vue physique, des carences nutritionnelles pourraient résulter de l'ON, pouvant entraîner à leur tour de la fatigue, une anémie, des maux de tête, des étourdissements, des malaises, des problèmes digestifs, une aménorrhée, une perte de poids involontaire, ou encore de la malnutrition (Fidan et al., 2010; McGregor, 2017; Nevin & Vartanian, 2017).

D'un point de vue psychologique, l'ON pourrait être à l'origine de dépression, d'affects négatifs, et d'idéations suicidaires (Gleaves et al., 2013; Lopes et al., 2020; Oberle et al., 2017), de moindres niveaux de bien-être, d'estime de soi, et de capacité à se relaxer (Barthels et al., 2015a). L'ON pourrait également avoir des répercussions sur le domaine professionnel et social des individus avec une perte d'intérêt pour le travail et les relations interpersonnelles, un sentiment de supériorité envers les personnes ayant une alimentation différente de la leur, de la stigmatisation, et de l'isolement social (Bratman & Knight, 2001; Brytek-Matera, 2012; Nevin & Vartanian, 2017).

Bratman et Knight (2001) rapportent que dans des cas extrêmes l'ON pourrait même conduire à la mort. Pour Oberle et al. (2019), l'altération de l'état de santé physique chez les individus souffrants d'ON pourrait être expliquée soit comme une conséquence de l'ON (i.e., malnutrition causée par un régime alimentaire trop strict, et/ou une pratique excessive d'exercice physique) ou comme la raison principale ayant poussé les individus souffrants d'ON à changer leur alimentation dans un premier temps pour essayer de guérir leurs symptômes. Dans leur étude, le groupe d'individus orthorexiques pathologiques rapportait davantage de raisons apparentées à l'amélioration de la santé physique et psychologique (i.e., augmenter son énergie, améliorer son humeur, son attention et sa concentration) que les groupes contrôles pour

justifier leur recours aux médecines alternatives et complémentaires ainsi que leur consommation de compléments alimentaires.

Chapitre 4 : Orthorexie et personnalité

Jusqu'ici, seulement quelques études se sont intéressées aux liens pouvant exister entre ON et personnalité. Ces quelques études se sont concentrées sur des traits de personnalité distincts comme le perfectionnisme et le narcissisme (Oberle et al., 2017), et sur des modèles dimensionnels de la personnalité comme : le modèle du tempérament et du caractère de Cloninger (Gramaglia et al., 2019; Kiss-Leizer & Rigó, 2019), le modèle du Big-Five (Gleaves et al., 2013; Strahler et al., 2020), ou encore le modèle dimensionnel des troubles de la personnalité du DSM-5 (Roncero et al., 2021; Strahler et al., 2020).

1. Théories psychologiques de la personnalité

1.1. Modèle dimensionnel du Big-Five

Le modèle dimensionnel du Big-Five décrit la personnalité en 5 facteurs : « Ouverture à l'expérience », « Conscience », « Extraversion », « Agréabilité », et « Névrosisme » (Goldberg, 1981; McRae & Costa, 1991).

Un score élevé sur la dimension « Ouverture à l'expérience » caractérise les individus curieux, créatifs et non conformistes, en opposition aux individus réalistes et conformistes ayant un niveau d'analyse et un sens critique peu développés (Goldberg, 1981; McRae & Costa, 1991). La dimension « Conscience » fait référence à l'organisation, la motivation, et la persévérance (Goldberg, 1981; McRae & Costa, 1991). Un score élevé sur cette dimension caractérise les individus travailleurs, disciplinés et persévérants en opposition aux individus paresseux, insouciants, et négligents (Goldberg, 1981; McRae & Costa, 1991). Un score élevé sur la dimension « Extraversion » caractérise les individus sociables et bavards en opposition aux individus réservés et centrés sur la tâche (Goldberg, 1981; McRae & Costa, 1991). Un score élevé sur la dimension « Agréabilité » caractérise les individus altruistes, indulgents ou crédules, en opposition aux individus faisant preuve de cynisme, méfiance et de manipulation (Goldberg, 1981; McRae & Costa, 1991). Le « Névrosisme » est caractérisé par une propension à ressentir des émotions négatives et à utiliser des stratégies de coping inadaptées, en opposition à la stabilité émotionnelle (Goldberg, 1981; McRae & Costa, 1991).

1.2. Modèle du tempérament et du caractère de Cloninger

Le modèle du tempérament et du caractère de Cloninger (Cloninger et al., 1993) est un modèle biopsychologique de la personnalité composée de deux dimensions principales, le

tempérament et le caractère, elles-mêmes composées de sous-dimensions qui se combinent pour former des profils de personnalité.

Le **tempérament** représente la dimension biologique et innée de la personnalité, il est stable tout au long de la vie. Celui-ci est composé de 4 sous-dimensions :

- L'**évitement du danger** fait référence à la tendance à éviter les situations perçues comme dangereuses et/ou stressantes, et à faire l'expérience d'inquiétudes anticipatoires et de peur de l'incertitude ;
- La **recherche de nouveauté** décrit la tendance à rechercher de nouvelles expériences, la curiosité, la prise de risque, et l'impulsivité ;
- La **dépendance à la récompense** concerne la tendance à rechercher et à réagir positivement aux récompenses, comme l'approbation sociale, et à éviter les punitions ;
- La **persistance** représente la capacité à persévérer malgré la fatigue et la frustration (Cloninger et al., 1993).

Le **caractère**, quant à lui, fait référence aux aspects psychologiques et sociaux de la personnalité, il peut évoluer au cours du temps sous l'influence de l'environnement et des expériences. Celui-ci est composé de 3 sous-dimensions :

- L'**auto-détermination** représente la capacité à contrôler, à réguler, et à adapter son comportement pour atteindre ses objectifs personnels ;
- La **coopération** décrit la capacité d'une personne à être en bonne relation avec les autres et à coopérer pour atteindre des objectifs communs ;
- La **transcendance** fait référence à la spiritualité, à l'ouverture d'esprit, à la créativité, et à la transcendance de soi (Cloninger et al., 1993).

1.3. Modèle dimensionnel des troubles de la personnalité du DSM-5

Un modèle dimensionnel des troubles de la personnalité, alternatif au modèle catégoriel des troubles de la personnalité, a été développé dans le DSM-5 afin de pallier des défauts de l'approche catégorielle/traditionnelle des troubles de la personnalité (American Psychiatric Association, 2013).

Selon le modèle dimensionnel des troubles de la personnalité du DSM-5 (American Psychiatric Association, 2013), les troubles de la personnalité sont caractérisés par des traits de

personnalité pathologiques et par des altérations du fonctionnement de la personnalité dans au moins deux domaines parmi l'identité, l'autodétermination, l'empathie, et l'intimité. Les traits de personnalité pathologiques appartiennent à 5 domaines : affectivité négative, détachement, antagonisme, désinhibition et psychoticisme, eux-mêmes répartis en 25 facettes de traits de personnalité.

L'**affectivité négative** (en opposition à la stabilité émotionnelle) se définit par des « *expériences fréquentes et intenses de niveaux élevés d'une large gamme d'émotions négatives (p. ex. anxiété, dépression, culpabilité/honte, soucis, colère) et leurs manifestations comportementales (p. ex. auto-agression) et interpersonnelles (p. ex. dépendance)* » (American Psychiatric Association, 2013, p.1002).

Le **détachement** (en opposition à l'extraversion) se définit par un « *évitement des expériences socioprofessionnelles incluant à la fois le retrait des interactions interpersonnelles (allant des interactions quotidiennes épisodiques aux relations amicales intimes) et la restriction de l'expérience et de l'expression affectives, et en particulier une capacité hédonique limitée* » (American Psychiatric Association, 2013, p.1002).

L'**antagonisme** (en opposition à l'agréabilité) se définit par des : « *comportements qui mettent l'individu en désaccord avec autrui, avec un sens exagéré de sa propre importance et une attente concomitante d'un traitement spécial, de même qu'une dureté avec antipathie vis-à-vis des autres, comprenant tout à la fois le fait de méconnaître les besoins et les sentiments d'autrui et le fait d'être prêt à utiliser les autres au bénéfice de la valorisation de soi* » (American Psychiatric Association, 2013, p.1003).

La **désinhibition** (en opposition au caractère consciencieux) se définit par la « *recherche de satisfactions immédiates, conduisant à un comportement impulsif déterminé par des pensées, des sentiments et des stimuli externes du moment, sans tenir compte des leçons du passé ou sans considération pour les conséquences futures* » (American Psychiatric Association, 2013, p.1003).

Le **psychoticisme** (en opposition à la lucidité) se définit comme la manifestation d'une « *large gamme de cognitions et de comportements culturellement incongrus, bizarres, excentriques ou inhabituels à la fois en ce qui concerne le mécanisme (perception, dissociation) que le contenu (p. ex. croyances)* » (American Psychiatric Association, 2013, p.1004).

1.4. Modèle catégoriel des troubles de la personnalité du DSM-5

Dans la perspective catégorielle des troubles de la personnalité du DSM-5 (American Psychiatric Association et al., 2013), les troubles de la personnalité sont définis comme : « *un mode durable des conduites et de l'expérience vécue qui dévie notablement de ce qui est attendu dans la culture de l'individu, qui est envahissant et rigide, qui apparaît à l'adolescence ou au début de l'âge adulte, qui est stable dans le temps et qui est source d'une souffrance ou d'une altération du fonctionnement.* » (p.841). Les traits de personnalité sont quant à eux définis comme : « *des modalités durables d'entrer en relation, de percevoir et de penser son environnement et soi-même, qui se manifestent dans un large éventail de situations sociales et professionnelles.* » (American Psychiatric Association et al., 2013, p.843). Ces derniers sont considérés comme des troubles lorsqu'ils sont rigides et inadaptés et source de souffrance et/ou d'une altération significative du fonctionnement. Dix troubles de la personnalité, répartis en 3 clusters selon des caractéristiques communes, sont décrits dans le DSM-5.

Le cluster A, caractérisé par de la bizarrerie et de l'excentricité, regroupe les personnalités paranoïaques, schizoïdes et schizotypiques.

- « ***La personnalité paranoïaque*** est caractérisée par une méfiance soupçonneuse envers les autres dont les intentions sont interprétées comme malveillantes.
- ***La personnalité schizoïde*** est caractérisée par un détachement des relations sociales et une restriction de la variété des expressions émotionnelles.
- ***La personnalité schizotypique*** est caractérisée par une gêne aiguë dans les relations proches, par des distorsions cognitives et perceptuelles et des conduites excentriques. » (American Psychiatric Association et al., 2013, p.841)

Le cluster B, caractérisé par des individus d'apparence théâtrale, émotifs et capricieux, regroupe les personnalités antisociales, borderline, histrioniques et narcissiques.

- « ***La personnalité antisociale*** est caractérisée par un mépris et une transgression des droits d'autrui.
- ***La personnalité borderline*** est caractérisée par une impulsivité marquée et une instabilité des relations interpersonnelles, de l'image de soi et des affects.
- ***La personnalité histrionique*** est caractérisée par des réponses émotionnelles excessives et une quête d'attention.

- ***La personnalité narcissique** est caractérisée par des fantasmes ou des comportements grandioses, un besoin d'être admiré et un manque d'empathie. »* (American Psychiatric Association et al., 2013, p.841)

Le cluster C, caractérisé par de la crainte et de l'anxiété, regroupe les personnalités évitantes, dépendantes et obsessionnelles-compulsives.

- *« **La personnalité évitante** est caractérisée par une inhibition sociale, par des sentiments de ne pas être à la hauteur et une hypersensibilité au jugement négatif d'autrui.*
- ***La personnalité dépendante** est caractérisée par un comportement soumis et « collant » lié à un besoin excessif d'être pris en charge.*
- ***La personnalité obsessionnelle-compulsive** est caractérisée par une préoccupation par l'ordre, la perfection et le contrôle. »* (American Psychiatric Association et al., 2013, p.841)

Une comorbidité forte avec les troubles de l'axe I du DSM-IV a été rapportée chez des individus avec des troubles de la personnalité (Lenzenweger et al., 2007).

2. État des lieux

Oberle et al. (2017) ont rapporté que les différentes dimensions de l'ON évaluées avec l'EHQ, à savoir : « Comportements », « Problèmes », et « Sentiments », corrôlaient positivement avec le narcissisme (i.e., comportements grandioses, besoin d'être admiré, et manque d'empathie). Le score global de perfectionnisme corrôlait également positivement avec les trois dimensions de l'ON évaluées par l'EHQ. A l'inverse de la dimension « Problèmes » qui corrôlait positivement avec l'intégralité des sous-dimensions du perfectionnisme, les dimensions « Comportements » et « Sentiments » de l'EHQ ne corrôlaient positivement qu'avec les dimensions « Standards personnels » et « Organisation » du perfectionnisme.

L'étude de Gleaves et al. (2013) a quant à elle mis en avant des corrôlations positives entre la dimension « Conscience » du Big-Five et les sous-échelles « Connaissances sur l'alimentation saine » et « Émotions positives à l'égard de l'alimentation saine » de l'EHQ, ainsi qu'entre la dimension « Névrosisme » et les sous-échelles « Problèmes associés à l'alimentation saine » et « Émotions positives à l'égard de l'alimentation saine ». Des corrôlations positives entre l'ON et la dimension névrosisme, et positive entre l'HeOr et la

dimension « Conscience » viennent soutenir ces résultats (Strahler et al., 2020). L'ON serait également corrélée négativement avec la dimension « Agréabilité » et l'HeOr corrélée positivement avec la dimension « Extraversion » (Strahler et al., 2020).

Les études basées sur le modèle du tempérament et du caractère rapportent des plus hauts niveaux d'évitement du danger et de transcendance, des niveaux plus faibles d'auto-détermination chez les individus ayant de hauts niveaux d'ON comparativement aux individus ayant de faibles niveaux d'ON (Kiss-Leizer & Rigó, 2019) ainsi qu'une plus forte proportion d'ON chez les individus ayant des niveaux faibles/moyens de persistance (Gramaglia et al., 2019). Sur la base de ces résultats, Kiss-Leizer et Rigó (2019) décrivent la personnalité orthorexique comme caractérisée par des préoccupations excessives, de la timidité dans le contexte social, combinés avec le désir d'être parfait et accepté. Ils concluent également que l'alimentation caractéristique de l'ON serait le résultat d'un important besoin de contrôle ainsi qu'un moyen de compenser une faible estime de soi et un sentiment d'inefficacité dans la gestion des événements négatifs. Cependant, ces deux études ont utilisé l'ORTO-15 pour évaluer l'ON, ces résultats sont donc à considérer prudemment.

Deux études se sont basées sur le modèle dimensionnel des troubles de la personnalité du DSM-5, en utilisant toutes les deux la TOS pour évaluer l'orthorexie. Strahler et al. (2020) rapportent des corrélations positives entre l'ON et les 5 dimensions du modèle. Les mêmes résultats ont été observés dans l'étude de Roncero et al. (2021) à l'exception de la dimension « Antagonisme » qui n'était pas corrélée significativement avec l'ON. De plus, Roncero et al. (2021) rapportent que l'HeOr corrélait négativement avec la dimension « Désinhibition », et positivement avec la dimension « Psychoticisme ». Lorsque l'effet de l'ON était contrôlé, les 5 dimensions du modèle devenaient corrélées négativement à l'HeOr, à l'exception de la dimension « Détachement » qui ne corrélait pas significativement.

A ce jour, aucune étude n'a encore investigué les profils de personnalité pathologiques chez les individus ayant des comportements alimentaires orthorexiques pathologiques en utilisant l'approche catégorielle des troubles de la personnalité. Pourtant, cette approche des troubles de la personnalité est la plus couramment utilisée dans le milieu clinique et pourrait donc participer à l'identification des personnes à risque d'ON. De plus, un fort taux de comorbidité avec les troubles de l'axe I du DSM-IV (Lenzenweger et al., 2007) a été observé chez des individus présentant un trouble de la personnalité et pourrait donc avoir un intérêt dans le dépistage précoce de potentielles comorbidités. L'utilisation de cette approche des troubles

de la personnalité permettrait également une meilleure compréhension de potentielles difficultés et absences de résultats lors de prises en charge thérapeutiques. Il nous a alors semblé important de mener une étude ayant pour objectif de dresser les profils de personnalité pathologiques présents chez des jeunes adultes ayant des comportements alimentaires orthorexiques pathologiques.

Les troubles de la personnalité obsessionnelle-compulsive, borderline, et paranoïaque sont les plus fréquemment diagnostiquées chez les individus présentant un TCA (Farstad et al., 2016), et pourraient ainsi également être présents chez des individus présentant des comportements alimentaires orthorexiques. Les corrélations positives entre l'ON, ses différentes dimensions, et le narcissisme détaillées plus haut dans ce chapitre (Oberle et al., 2017) nous laissent supposer qu'un potentiel lien pourrait également exister entre l'ON et le trouble de la personnalité narcissique. En raison des croyances, comportements inhabituels, et pensées magiques qui peuvent être présentes chez des personnes ayant des comportements alimentaires orthorexiques pathologiques (Roncero et al., 2021), il pourrait alors également exister, en plus du potentiel lien entre l'ON et la personnalité paranoïaque, un lien avec la personnalité schizotypique. Il nous a alors semblé pertinent, pour cette étude, d'investiguer les profils de personnalité pathologiques de jeunes adultes ayant des comportements alimentaires orthorexiques pathologiques, en retenant les troubles de la personnalité schizotypique, obsessionnelle-compulsive, borderline, paranoïaque, et narcissique.

Chapitre 5 : Approche processuelle transdiagnostique de l'orthorexie

1. Modèle théorique

L'approche processuelle transdiagnostique en psychopathologie a été développée par Harvey et al. (2004) en réponse aux nombreuses limites présentées par l'approche biopsychosociale des classifications nosographiques (i.e., DSM et CIM). Parmi les critiques de l'approche catégorielle du DSM, nous retrouvons une faible fidélité test-retest pour différentes catégories diagnostiques, une forte hétérogénéité des manifestations symptomatiques au sein d'une même catégorie diagnostique, la présence de mêmes signes cliniques dans des entités nosographiques définies comme distinctes, l'existence d'une comorbidité très importante, l'absence de prise en compte du contexte relationnel et des causes sociales, ainsi qu'une pathologisation croissante de la population (Fried & Nesse, 2015; Kendler et al., 2011; Monestès & Baeyens, 2016; Regier et al., 2013; Van der Linden, 2016).

Le modèle de la détermination des troubles psychopathologiques (Kinderman, 2005, 2009; Kinderman & Tai, 2007) illustre cette approche processuelle transdiagnostique. Ce modèle stipule que l'influence des facteurs biologiques, sociaux et circonstanciels sur les troubles psychopathologiques est médiée par des processus psychologiques transdiagnostiques (Figure 2).

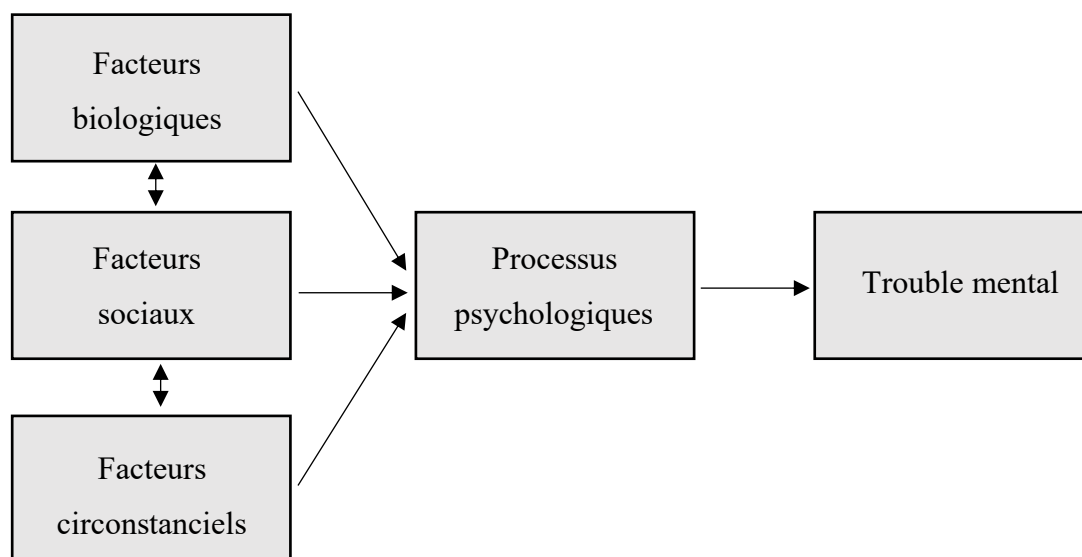


Figure 2. Modèle de la détermination des troubles psychopathologiques de Kinderman et Tai (2007)

Les facteurs biologiques, sociaux et circonstanciels, exercent, dans ce modèle, un rôle de causes distales agissant conjointement sur des processus psychologiques, qui eux occupent un rôle de causes proximales des troubles psychologiques. Philippot (2016) définit le processus psychologique comme un mécanisme qui transforme un élément psychologique en un autre élément psychologique. Les processus sont dits transdiagnostiques car ils sont communs à différents troubles psychologiques (Mansell et al., 2008).

2. Processus transdiagnostiques

Identifier les processus transdiagnostiques pouvant être communs entre l'ON, les TCA et les TOC nous apparaît intéressant dans la mesure où des chevauchements entre ces troubles ont été observés dans la littérature (Goutaudier & Rousseau, 2019; Koven & Abry, 2015; McGregor, 2017).

De plus, des études ont mis en évidence que l'ON pouvait être un antécédant, être comorbide à un TCA, survenir/s'intensifier après le traitement d'un TCA (Barthels et al., 2017; Brytek-Matera et al., 2015; Gramaglia et al., 2017; Kinzl et al., 2006; Segura-Garcia et al., 2015). Ces études suggèrent également que l'ON pourrait être un facteur de risque soit au développement d'un TCA soit à une rechute de TCA et que les symptômes résiduels d'ON pourraient être responsables d'un plus grand nombre de rechutes de TCA. Considérant le fort taux de rechute ainsi que le fort taux de mortalité survenant dans les TCA (e.g., Norring & Sohlberg, 1993), il nous semble important d'identifier les déterminants et processus transdiagnostiques communs entre l'ON et les TCA, et ce afin d'identifier et comprendre les facteurs de risque de rechute de ces troubles et déterminer des cibles pour le développement d'interventions psychothérapeutiques basées sur la prévention de la rechute. Nous avons souhaité nous concentrer sur le perfectionnisme, l'intolérance à l'incertitude et les ruminations mentales pour la dernière étude de cette thèse. En effet, comme nous allons le détailler ci-dessous dans les sous-parties de ce chapitre, ces trois processus transdiagnostiques ont particulièrement retenu notre attention de par leur lien avec les TCA et les TOC.

2.1. Perfectionnisme

Frost et al. (1990) ont défini le perfectionnisme comme un construit multidimensionnel caractérisé par une « *tendance à se fixer des niveaux élevés de performance, accompagnée d'auto-évaluations excessivement critiques* ». Dans la littérature, deux niveaux superordonnés

de perfectionnisme ont été identifiés : les efforts perfectionnistes et les préoccupations perfectionnistes (Stoeber et al., 2020; Stoeber & Otto, 2006).

La dimension « efforts perfectionnistes » est caractérisée par la recherche personnelle de la perfection et par des standards de performance élevés (Stoeber et al., 2020; Stoeber & Otto, 2006). Cette dimension est considérée comme une forme saine/adaptée de perfectionnisme car elle est associée à des variables psychologiques positives (e.g., coping actif, affects positifs ; Stoeber et al., 2020; Stoeber & Otto, 2006).

La dimension « préoccupations perfectionnistes » est caractérisée par des préoccupations à commettre des erreurs, par la peur d'être jugé négativement si la perfection n'est pas atteinte et par l'impression que les performances recherchées sont rarement atteintes (Stoeber et al., 2020; Stoeber & Otto, 2006). Cette dimension est considérée comme une dimension malsaine/inadaptée du perfectionnisme car elle est associée à des variables psychopathologiques/des aspects inadaptés du fonctionnement psychologique (e.g., coping passif, affects négatifs ; Stoeber et al., 2020; Stoeber & Otto, 2006). Les préoccupations perfectionnistes sont associées à différents troubles psychopathologiques dont les TCA et les TOC (Limburg et al., 2017; Sassaroli et al., 2008).

Selon Fairburn et al. (2003), le perfectionnisme joue un rôle majeur dans le développement et le maintien des TCA car il précède l'apparition des troubles et persiste après le traitement. Les études de Barnes et Caltabiano (2017) et Oberle et al. (2017) ont également mis en évidence une association entre l'ON et le perfectionnisme. Ce lien reste cependant à confirmer dans la mesure où ces études ont utilisé des questionnaires possédant de mauvaises qualités psychométriques.

2.2. Intolérance à l'incertitude

L'intolérance à l'incertitude est définie comme « *une caractéristique dispositionnelle qui résulte d'un ensemble de croyances négatives sur l'incertitude et ses conséquences et qui implique la tendance à réagir négativement sur le plan émotionnel, cognitif et comportemental aux situations et événements incertains* » (Buhr & Dugas, 2009, p.216).

La détresse liée à l'incertitude, l'utilisation de stratégies cognitives et comportementales pour réduire ou gérer l'anxiété liée aux potentielles conséquences redoutées, et l'augmentation

de la perception de certitude et de contrôle sont des éléments majeurs impliqués dans le développement et le maintien des TOC (Boswell et al., 2013).

L'intolérance à l'incertitude est une caractéristique également fréquemment observée dans les TCA (Reilly et al., 2021). En effet, des niveaux plus élevés d'intolérance à l'incertitude ont été rapportés chez des individus souffrant de TCA comparativement à des individus ne souffrant pas de TCA (Brown et al., 2017). L'intolérance à l'incertitude dans l'AN est associée au désir intense de minceur et à l'insatisfaction corporelle (Frank et al., 2012).

Les résultats de l'étude de Kiss-Leizer et Rigó (2019) rapportant de plus hauts niveaux d'évitement du danger chez des individus ayant de hauts niveaux d'ON nous amènent à penser qu'il pourrait exister un lien entre l'ON et l'incertitude à l'intolérance. En effet, la dimension « Évitement du danger » du tempérament est composée d'une sous-dimension « Peur de l'incertitude vs confiance » (Cloninger et al., 1993). Cette intolérance à l'incertitude, dans le contexte de l'ON, pourrait se manifester par exemple par une peur de l'incertitude quant à la composition ou la provenance de certains aliments, et le besoin de contrôle alimentaire extrême. A notre connaissance, une seule étude s'est intéressée au lien direct pouvant exister entre l'ON et l'intolérance à l'incertitude. Cette étude rapporte une corrélation positive entre ces deux construits (Giles et al., 2021). Cependant, ce lien reste à confirmer, dans la mesure où l'ON a été évaluée avec un outil de mesure possédant de mauvaises qualités psychométriques (i.e., l'ORTO-R).

2.3. Ruminations mentales

Les ruminations mentales ont été identifiées comme étant un processus transdiagnostique pouvant conduire à différents troubles psychopathologiques (Nolen-Hoeksema & Watkins, 2011).

Les ruminations mentales ont d'abord été conceptualisées et étudiées dans le cadre de la dépression avec la théorie des styles de réponses de Nolen-Hoeksema (1991). Elles sont définies comme « *un mode de réponse stable à la détresse, caractérisé par des pensées répétitives et passives sur les causes et conséquences des symptômes de détresse* » (Baeyens, 2016). Elles représentent un facteur d'installation, de maintien et de rechute dans la dépression (Michalak et al., 2011; Nolen-Hoeksema et al., 2008; Watkins, 2009).

Deux types de ruminations mentales ont été mis en avant au travers de l'analyse factorielle de la Ruminative Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991), échelle évaluant les ruminations mentales : le ressassement (i.e., comparaison passive entre la situation actuelle et certains standards non réalisés ; e.g., « Penser « Pourquoi est-ce que je réagis toujours de cette façon ? » ») et la réflexion (i.e., introspection volontaire pour s'engager dans une résolution de problèmes afin de soulager les symptômes dépressifs ; e.g., « Aller quelque part seul(e) pour penser à ce que vous ressentez. »).

La RRS a été adaptée afin d'évaluer les ruminations mentales liées à l'alimentation, au poids et à l'apparence (RRS-ED) qui semblent être de meilleurs prédicteurs des symptômes de TCA que les ruminations mentales plus « générales » évaluées avec la RRS (Cowdrey & Park, 2011). Les ruminations mentales liées à l'alimentation, au poids, et à l'apparence constituent un élément central des TCA, jouant un rôle dans l'installation et le maintien des troubles (Nolen-Hoeksema et al., 2007; Rawal et al., 2010).

A notre connaissance, aucune étude n'a été menée à ce jour sur les ruminations mentales dans le cadre de l'orthorexie. Cependant plusieurs éléments nous amènent à penser qu'un potentiel lien pourrait exister entre les ruminations mentales et l'ON. En effet, l'ON implique une forte préoccupation à l'égard du comportement alimentaire pouvant prendre la forme de pensées obsessionnelles liées à la nourriture, son contenu nutritionnel, sa pureté, etc. pouvant être source de détresse cliniquement significative, de culpabilité ou d'anxiété si les règles auto-imposées sont enfreintes et/ou qu'il y a confrontation à/ingestion d'un aliment auto-évalué comme malsain (Donini et al., 2022). Des ruminations mentales concernant leur propre personne, l'alimentation, la santé, le poids, ou l'apparence physique peuvent alors être présentes chez des individus souffrants d'ON (Donini et al., 2022).

PROBLEMATIQUE ET OBJECTIFS DE RECHERCHE

Comme nous l'avons développé précédemment, jusqu'ici, la littérature sur l'orthorexie a pris appui sur un grand nombre d'études dans lesquelles l'ORTO-15 (Donini et al., 2004, 2005) a été utilisé dans le but d'évaluer la symptomatologie orthorexique. Cependant, ce questionnaire a été largement critiqué en raison de nombreuses limites, tant au niveau psychométrique qu'au niveau du construit qu'il évalue. Celui-ci ne permettrait pas de faire la distinction entre ce qui relève de la pathologie et ce qui relève de comportements sains, menant alors à une large surestimation de l'ON dans la population générale (e.g., Barnes & Caltabiano, 2017; Dunn et al., 2017; Heiss et al., 2019; Oberle et al., 2017; Reynolds, 2018; Roncero et al., 2017) et de ce fait à une sur-pathologisation de comportements sains. De plus, au moment où nous avons commencé nos travaux sur l'orthorexie, aucun outil de mesure n'était disponible en langue française. Il nous a alors semblé important de procéder à la validation d'un outil de mesure possédant de bonnes qualités psychométriques. Cela nous permettra de débiter l'étude de l'ON au sein de la population française, d'évaluer sa prévalence ainsi que les facteurs qui y sont associés. Bien que l'ORTO-15 reste encore très utilisé dans la littérature, d'autres outils de mesure ont fait leur apparition dont la *Düsseldorfer Orthorexia Skala* (DOS ; Barthels et al., 2015a), échelle unidimensionnelle pour laquelle des cut-offs préliminaires ont été proposés, suggérant le risque de développer de l'ON ou la présence d'ON. Avec l'ORTO-15, la DOS est la seule échelle permettant d'établir des estimations de la prévalence de l'ON dans la population. Elle a d'ailleurs permis des estimations de la prévalence de l'ON, bien inférieures, et qui semblent plus réalistes que les estimations réalisées avec l'ORTO-15. De plus, elle est l'une des plus utilisées après l'ORTO-15 et a été adaptée et validée dans de nombreuses langues. Lorsque nous avons débuté nos travaux sur l'orthorexie, aucune limite psychométrique n'avait encore été adressée par rapport à son utilisation. En effet, les résultats d'études réalisées dans différents échantillons révèlent une bonne consistance interne de la DOS et de ses adaptations. Cette échelle de mesure nous semble alors prometteuse quant à l'évaluation des comportements alimentaires orthorexiques pathologiques, c'est pourquoi nous avons orienté notre choix vers celle-ci.

L'objectif de la première étude de cette thèse est de valider la DOS dans une population de jeunes adultes et de fournir une estimation de la prévalence de l'ON dans cette même population.

Étudier les liens pouvant exister entre les troubles de la personnalité, tels que modélisés par l'approche catégorielle du DSM, et l'ON nous apparaît intéressant dans une optique de prévention. En effet, certains troubles de la personnalité pourraient agir comme un facteur de vulnérabilité par rapport au développement de l'ON. De plus, cette étude pourrait également présenter un intérêt dans le dépistage précoce de potentielles comorbidités avec les troubles de l'axe I du DSM-IV (Lenzenweger et al., 2007). Enfin, cela permettrait de mieux comprendre les ressources dont disposent les individus présentant des comportements alimentaires orthorexiques ainsi que les potentielles difficultés et/ou absences d'efficacité lors de prises en charge thérapeutiques. Comme nous l'avons développé dans la partie théorique de ce travail (Chapitre 4.2.), les troubles de la personnalité les plus fréquemment diagnostiqués chez les individus souffrants de TCA sont les troubles de la personnalité obsessionnelle-compulsive, borderline, et paranoïaque (Farstad et al., 2016). De plus, l'ON corrélait positivement avec le narcissisme (Oberle et al., 2017). Enfin, des croyances, des pensées magiques (e.g., « Pour éviter la dégénérescence corporelle et les maladies, les aliments acides ne devraient pas représenter plus de 30 % de l'alimentation. », « Manger des aliments associés à son groupe sanguin prévient les maladies et augmente l'énergie et le bien-être. »), et des comportements pouvant être considérés comme excentriques ou bizarres, ont été observés chez des personnes ayant des comportements alimentaires orthorexiques (Koven & Abry, 2015; Roncero et al., 2021). Ces différents éléments nous laissent supposer que de potentiels liens pourraient exister entre l'ON et les troubles de la personnalité schizotypique, obsessionnelle-compulsive, borderline, paranoïaque, et narcissique. De même, l'anxiété généralisée, l'anxiété sociale, les TOC, la dépression, et la faible estime de soi sont fréquemment diagnostiqués chez des individus souffrants d'un TCA. Ces différents éléments nous laissent supposer que ces différents troubles psychopathologiques pourraient être associés à certains profils de personnalité d'individus ayant des comportements alimentaires orthorexiques pathologiques. Identifier les profils de personnalité ainsi que les comorbidités pouvant exister chez les individus ayant des comportements alimentaires orthorexiques pathologiques aurait un intérêt en terme de prévention, pour ce qui est de l'identification des personnes à risque de développer de l'ON. Cela permettrait également de déterminer des cibles psychothérapeutiques, d'adapter les interventions psychothérapeutiques pour mieux répondre aux besoins spécifiques des individus.

Le premier objectif de la deuxième étude de cette thèse est alors d'établir une typologie de jeunes adultes présentant des comportements alimentaires orthorexiques pathologiques sur la base de leurs traits de personnalité pathologiques (i.e., schizotypique, borderline,

paranoïaque, obsessionnelle-compulsive, narcissique) comme modélisés par l'approche catégorielle du DSM. Le second objectif de cette étude est d'évaluer le fonctionnement psychologique global (i.e., anxiété généralisée, anxiété sociale, troubles obsessionnels-compulsifs, dépression, et estime de soi) de chaque cluster identifié (i.e., la symptomatologie psychopathologique associée aux comportements alimentaires orthorexiques pathologiques).

Longtemps considérée uniquement sous le prisme psychopathologique, une conception bidimensionnelle de l'orthorexie proposée par Barrada et Roncero (2018) intégrant également un versant adaptatif (i.e., l'HeOr, orthorexie saine) a vu le jour. Dans le but de permettre l'évaluation spécifique de la dimension pathologique et de la dimension adaptative de l'orthorexie de façon distincte, ces auteurs ont développé la Teruel Orthorexia Scale (TOS). Cette échelle a été adaptée et traduite dans de nombreuses langues (Chace & Kluck, 2021; da Silva et al., 2021; Falgares et al., 2023; Mhanna et al., 2021; Strahler et al., 2020; Zickgraf & Barrada, 2022). Les résultats de ces études supportent la structure bidimensionnelle de la version originale ainsi que ses bonnes qualités psychométriques. De plus, des études récentes ont remis en cause la structure factorielle de la DOS (Hallit et al., 2021; He et al., 2019). Il nous paraît alors intéressant et important de disposer d'une échelle de mesure, possédant de bonnes qualités psychométriques, et distinguant les dimensions pathologique et saine de l'orthorexie, afin de pouvoir commencer à étudier l'orthorexie en population française en ne considérant pas toutes les préoccupations pour l'alimentation saine comme pathologiques.

L'objectif de la troisième étude de cette thèse est alors d'adapter et de procéder à la validation de la TOS en langue française dans la population générale.

Des études ont mis en évidence que l'ON pouvait être un antécédent, être comorbide à un TCA, survenir/augmenter après le traitement d'un TCA (Barthels et al., 2017; Brytek-Matera et al., 2015; Gramaglia et al., 2017; Kinzl et al., 2006; Segura-Garcia et al., 2015). Ces études suggèrent également que l'ON pourrait être un facteur de risque soit au développement d'un TCA soit à une rechute de TCA et que les symptômes résiduels d'ON pourraient être responsables d'un plus grand nombre de rechutes de TCA. Considérant le fort taux de rechute et de mortalité survenant dans les TCA, il semble important d'investiguer les relations qu'entretient l'orthorexie avec les TCA et autres symptômes associés, et ce afin d'identifier et comprendre les facteurs de risque de rechute de ces troubles et déterminer des cibles pour le développement d'interventions psychothérapeutiques basées sur la prévention de la rechute. Dans cette perspective, l'approche processuelle transdiagnostique nous apparaît

particulièrement intéressante pour aborder ces questions. Cette approche, basée sur le modèle de la détermination des troubles psychopathologiques de Kinderman et Tai (2007) stipule que l'influence des facteurs biologiques (e.g., genre, âge, présence de troubles psychologiques au sein de la famille), sociaux (e.g., relations avec les amis et la famille, participation à des activités sportives ou culturelles) et circonstanciels (e.g., antécédant d'agression sexuelle, de harcèlement scolaire) sur les troubles psychopathologiques est médiée par des processus psychologiques transdiagnostiques. Certains facteurs biologiques, sociaux, circonstanciels ainsi que certains processus psychopathologiques pourraient être communs aux TCA et à l'ON (e.g., perfectionnisme, Oberle et al., 2017).

L'objectif de cette quatrième et dernière étude de cette thèse est de poursuivre l'identification des facteurs de risque de l'ON en investiguant le rôle des processus transdiagnostiques psychopathologiques suivants : les ruminations mentales, l'intolérance à l'incertitude, et le perfectionnisme en utilisant notamment une échelle d'orthorexie de conception bidimensionnelle possédant de bonnes qualités psychométriques (i.e., TOS, Barrada & Roncero, 2018).

PARTIE EMPIRIQUE

Étude 1 : Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students (Lasson et al., 2021)

Cette étude a fait l'objet d'une publication dans la revue scientifique *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* (cf. Annexe 20). La référence détaillée de cet article scientifique est la suivante :

Lasson, C., Barthels, F., & Raynal, P. (2021). Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students. *Eating and Weight Disorders: EWD*, 26(8), 2589–2596. <https://doi.org/10.1007/s40519-021-01123-6>

Clotilde Lasson¹ · Friederike Barthels² · Patrick Raynal¹

¹ Laboratoire Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de La Santé, Université Toulouse-Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France

² Heinrich-Heine-University Düsseldorf, Universitätsstraße 1, 40225 Düsseldorf, Germany

Received: 30 September 2019 / Accepted: 20 January 2021

© The Author(s), under exclusive licence to Springer Nature Switzerland AG part of Springer Nature 2021

Abstract

Purpose This study aimed at obtaining a French version of the DOS (F-DOS) and evaluating its psychometric properties in a sample of university students, then assessing the prevalence of orthorexic eating behavior among the participants.

Methods The F-DOS was obtained using back translation, and then administered to 3235 university students (10.32% men, 89.67% women) with a mean age of 21.13 (SD = 2.23). The Eating Habits Questionnaire and Eating Attitudes Test were used to assess convergent and divergent validities, respectively. Confirmatory factor analysis was performed to explore the factor structure.

Results Ordinal ω of F-DOS was 0.87, indicating very good internal consistency. F-DOS and EHQ total scores were strongly correlated ($r_s = 0.74, p < 0.001$), indicating very good construct validity. Factor analysis revealed a well-fitted one-factor model. Regarding

Orthorexia Nervosa (ON) prevalence, according to DOS cut-off score, 3.28% of participants could be considered having ON, while an additional 11.31% could be at risk of developing ON.

Conclusions The F-DOS appears to be a valid and reliable instrument to assess orthorexic eating behavior. ON prevalence in college students appeared similar to Germany and lower than in the US.

Level of evidence Descriptive (cross-sectional) study, Level V.

Keywords Orthorexic behaviors · Eating disorders · Anorexia nervosa

1. Introduction

Orthorexia Nervosa (ON) is defined as an excessive preoccupation with healthy food, characterized by the adherence to strict dietary rules that might lead individuals to cut out some food or food categories of their diet, because they are considered not pure or bad for their health (Bratman & Knight, 2001). In a study in Belgium and the Netherlands, 66.7% of healthcare professionals reported to have observed this potential disorder in their own practice, and 68.5% expressed that the diagnosis of ON should deserve more attention (Vandereycken, 2011). To date, despite proposals of diagnostic criteria (i.e., obsessional preoccupation with eating “healthy food”, impairment of physical health, and impairment of social, academic or vocational functioning; Moroze et al., 2015), research has not yet allowed the categorization of ON as a separate mental disorder in classifications (Barthels et al., 2015b). This is partly due to an overlap of certain ON features with Anorexia Nervosa (AN), but also with other eating disorders or obsessive-compulsive disorder (Brytek-Matera, 2012; Ryman et al., 2019). However, on a theoretical level, ON and AN can be distinguished from each other on several aspects. For example, individuals with ON are essentially focused on food quality and its impact on health, while, in AN, the obsession is exclusively orientated on food quantity and fear of obesity (Koven & Abry, 2015). In addition, it has been suggested that ON could also serve as a healthier alternative or as a coping strategy for individuals suffering from AN, allowing them to eat more while maintaining control over food (Barthels et al., 2017). Regarding weight matters, it is unclear how far weight loss is intended in ON (Dunn & Bratman, 2016; Thibault et al., 2017) and there is a lack of a clear link between ON symptomatology and body mass index (BMI). Indeed, most studies found no significant relationship between ON and BMI, while others reported an increased ON symptomatology linked to greater BMI (Oberle et al., 2017). Besides weight loss, other negative effects of ON encompass different aspects, including

nutritional deficiencies (Dunn & Bratman, 2016; Molina Alén, 2006), hypoestrogenism (McGregor, 2017), depression (Lopes et al., 2020), social isolation (Bratman & Knight, 2001; Brytek-Matera, 2012) or stigmatization by others (Nevin & Vartanian, 2017). In community or student samples, positive correlations were found between ON symptomatology and depression symptoms, negative affects, or suicidal ideations (Gleaves et al., 2013; Oberle et al., 2017). In addition, negative correlations were reported between ON and well-being, self-esteem, and ability to relax (Barthels et al., 2015a). Moreover, children living with orthorexic parents can be exposed to harmful effects of malnutrition (Hunter & Crudo, 2018; von Rosenstiel et al., 2012).

ON prevalence in community or student samples was estimated between 6.9% (Donini et al., 2004) and 70% using ORTO-15 (Dunn & Bratman, 2016; Gramaglia et al., 2019), a widely used self-report questionnaire created to assess ON symptomatology (Donini et al., 2005). Regarding gender, a large meta-analytic work compiling 67 publications showed that tendencies toward orthorexic behaviors were comparable between genders, but pathological healthy eating appeared to be more pronounced in women (Strahler et al., 2020).

To date, the high prevalence rates of ON reported in some studies are thought to be due to psychometric limitations of ORTO-15. Indeed, ORTO-15 might also detect a construct other than pathological eating beliefs and behaviors (Heiss et al., 2019), as it includes items seemingly unspecific to ON, e.g., “At present, are you alone when having meals?” (Donini et al., 2005). It thus seems important to replicate those prevalence studies with more reliable measurement tools. Another instrument for assessing ON is the Eating Habits Questionnaire (EHQ) (Gleaves et al., 2013), but it has been criticized for not taking into account negative emotionality or other dimensions of ON (Barrada & Roncero, 2018; Koven & Abry, 2015). The EHQ was nonetheless used in this current study, because it has better psychometric properties than the ORTO-15 and seems, therefore, to be more appropriate to assess convergent validity. The Teruel Orthorexia Scale is a novel and promising tool as it attempts to distinguish ON from healthy orthorexia (interest in healthy eating) (Barrada & Roncero, 2018). It remains to be validated in different languages.

One validated and reliable instrument that was recently published is the Düsseldorf Orthorexia Skala (DOS) (Barthels et al., 2015a). The DOS has been used in various samples in Germany (e.g., Barthels et al., 2015a, 2017; Depa et al., 2017; Luck-Sikorski et al., 2019; Rudolph, 2018). It was also translated in English (Chard et al., 2019), Chinese (He et al., 2019),

and Spanish (Parra-Fernández et al., 2018), showing good psychometric properties in original or translated versions.

The aim of this study was to adapt the DOS into French and examine its psychometric properties (internal consistency, factor structure, and convergent and divergent validities) using a university student sample. To assess the convergent and divergent validities of the translated DOS, participants also completed the EHQ and the Eating Attitudes Test evaluating eating disorders (Garner et al., 1982). In addition, to address the links between ON and psychopathology, a correlational analysis was performed between ON symptomatology and markers of functioning and mental health status in students (i.e., results of the last semester, levels of anxiety, depression, and obsessional–compulsive symptoms).

2. Methods

2.1. Participants and procedure

The data were collected through an online survey that was distributed to students from different universities in France. The link was shared on social networks in groups specifically dedicated to students. To be eligible for participation, participants had to be university students and older than 18. Informed consent was obtained online before completing the survey and no compensation was offered to participate in the study. The study protocol was approved by the local ethics committee (Comité d’Ethique de la Recherche of Toulouse University).

This study’s participants were 3235 college students (10.32% men, 89.67% women), aged between 18 and 29 years (mean age = 21.13, SD = 2.23). Based on self-reported height and weight, calculated BMI ranged from 13.67 to 59.12 (mean = 22.04, SD = 4.06) kg/m². Other characteristics of participants are shown in Table 1. The majority of participants had a normal weight (68.9%) and did not follow a particular diet (79.3%), while 9.6% considered themselves as vegetarian, 3.9% flexitarian (i.e., a person with a primarily vegetarian diet with the occasional inclusion of meat or fish), and 2.9% vegan. Regarding fields of study, 40.9% of participants were in human sciences, 9.9% in law, 9.7% in literature and foreign language, 8.9% in sciences or engineering, 6.3% in history, geography, or political sciences, 5.2% in economics, 4.5% in medical/paramedical courses, 2.9% in art or design, 2.9% in art history or archeology, 2.6% in educational sciences, 2.2% in communication and information, and 4% in other fields.

2.2. Measures

Sociodemographic information was obtained including age, gender, height, weight, field of study, current year of study (first year's bachelor, second year's bachelor, etc.), and result of the last semester of participant's major course. Personal dietary style (vegetarian, vegan, etc.) was also assessed.

2.2.1. *The Düsseldorf Orthorexia Skala (DOS)*

The DOS is a self-report questionnaire measuring orthorexic behaviors using 10 items, each rated on a 4-point Likert scale (from 1 = “this does not apply to me” to 4 = “this applies to me”) (Barthels et al., 2015a). Higher scores suggest the presence of more pronounced orthorexic behaviors. A score ≥ 30 is considered as a cut-off to indicate the presence of ON, and a score ≥ 25 and ≤ 29 suggests a risk of ON (Barthels et al., 2015a; Chard et al., 2019). The DOS has shown high internal consistency, with Cronbach's α ranging from 0.8 to 0.88 (Barthels et al., 2015a, 2017; Chard et al., 2019; Depa et al., 2017; He et al., 2019; Luck-Sikorski et al., 2019; Parra-Fernández et al., 2018; Rudolph, 2018). In this current study, the DOS was translated from German to French using a back translation procedure (Brislin, 1970), i.e., the original version was translated into French and then back into German by two different translators. Differences were then discussed in a research meeting to decide the best translation for each item. The final version of the French version of the DOS (F-DOS) is presented in Table 2. For reviewing purpose, the corresponding items of the English version (E-DOS) (Chard et al., 2019) are also presented in Table 2.

2.2.2. *The Eating Habits Questionnaire (EHQ)*

The EHQ assesses cognitions, behaviors, and feelings related to an extreme focus on healthy eating (Gleaves et al., 2013). Participants filled in the 21-item version (Oberle et al., 2017). Each item is rated on a 4-point scale (from 1 = “false, not at all true” to 4 = “very true”). The EHQ is composed of 3 subscales: (1) problems associated with healthy eating (e.g., “I spend more than 3 h a day thinking about healthy food”); (2) knowledge of healthy eating (e.g., “I know more about healthy eating than do other people”); (3) feeling positively about healthy eating (e.g., “I feel in control when I eat healthily”). As no ON measurement tool existed in French at the time the current study began, the EHQ was translated by the authors for the purposes of the study and used as the gold standard for the assessment of convergent validity. Since the study was conducted, the EHQ has been validated in French (Yakın et al., 2020). The

EHQ demonstrated good internal consistency with a Cronbach's $\alpha = 0.90$ in the English version (Gleaves et al., 2013) and an Ordinal $\omega = 0.92$ in the current study.

2.2.3. The Eating Attitudes Test-26 (EAT-26)

EAT-26 is a standard assessment tool to measure pathological characteristics associated with anorexic and bulimic eating behavior (Garner et al., 1982). It is composed of 26 items and 3 subscales (Dieting, Bulimia and food preoccupation, and Oral control). An example item is "I avoid eating when I am hungry". The French adaptation (Leichner et al., 1994) was used. The internal consistency of the French version was demonstrated with a Cronbach's $\alpha = 0.86$ (Leichner et al., 1994) and an Ordinal $\omega = 0.94$ in the present study.

2.2.4. Psychopathology measures

Anxiety and depression symptoms were assessed using the Generalized Anxiety Disorder-7 and the Patient Health Questionnaire-9, respectively (Kroenke & Spitzer, 2002; Spitzer et al., 2006). Levels of obsessive-compulsive symptoms were evaluated with the Obsessive Compulsive Inventory-Revised (Foa et al., 2002). For these 3 scales, high scores suggest more pronounced symptoms. For the present study, the French versions (Carballeira et al., 2007; Micoulaud-Franchi et al., 2016; Zermatten et al., 2006) of these questionnaires were used. Good internal consistency of the French versions was demonstrated with Cronbach's of 0.90, 0.90, and 0.86, respectively, in the previous studies (Carballeira et al., 2007; Micoulaud-Franchi et al., 2016; Zermatten et al., 2006) and Ordinal ω of 0.92, 0.89, and 0.90, respectively, in the current study.

3. Data analysis

RStudio (Version 1.2.5033) for Macintosh was used for the analysis. Prior to statistical analysis, the assumption of normality was checked using an examination of skewness and kurtosis cues, as well as Shapiro–Wilk and Levene tests for normality and homoscedasticity. Due to significant deviation from normality in all the measures used in this study (Shapiro–Wilk < 0.001), we chose to implement nonparametric statistics. A Confirmatory Factor Analysis (CFA) based on the single-factor model of DOS was performed using the Lavaan and SemPlot packages from RStudio (Epskamp, 2015; Rosseel, 2012). Given the DOS 4-point Likert scale, we considered the data as categorical and we used the Weighted Least Squares with Mean and Variance (WLSMV) estimation method for the CFA (Li, 2016). F-DOS missing values (0.49%) were handled using listwise deletion before computing CFA, which is an

acceptable procedure in regards with Tabachnick & Fidell (2014)'s recommendations that removing missing data was acceptable when 5% or less of participants have missing data. To evaluate model fit we relied on the following recommendations: values of Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) greater than about 0.9 or greater indicate good fit of the model (Bentler, 1990), values of Root Mean Square Error of Approximation (RMSEA) about 0.08 or less suggest a reasonable model-data fit (Browne & Cudeck, 1992), and values of Root Mean Square Residual (RMSR) equal or less than 0.08 indicate a well-fitting model (Hu & Bentler, 1999). Reliability analysis was assessed using calculation of Ordinal ω (McDonald, 1999; Viladrich et al., 2017). To analyze convergent validity, Spearman's Rho correlations were examined between F-DOS and EHQ. To test divergent validity, these coefficients were examined between F-DOS and EAT-26.

4. Results

4.1. Confirmatory factor analysis (CFA)

A CFA was performed based on the single-factor model of DOS. The computation of the fit indices showed that the model had a good fit: $\chi^2(35) = 703.979, p < 0.001$; CFI = 0.941; TLI = 0.924; RMSEA = 0.077; SRMR = 0.065. The graphical representation of the CFA with standardized factor loadings is represented in Fig. 1.

4.2. Validity and reliability of F-DOS

The Ordinal ω value of the F-DOS was 0.87, showing strong internal consistency. For each F-DOS item, mean, SD, and item selectivity are presented in Table 2.

The total scores of the F-DOS and the EHQ were significantly correlated ($r_s = 0.74, p < 0.001$), suggesting good construct validity. Significant correlation coefficients were also found with the three subscales of the EHQ (knowledge: $r_s = 0.65$; problems: $r_s = 0.69$; feelings: $r_s = 0.62, p < 0.001$ for all). Regarding divergent validity, the relationship of each F-DOS item with the EAT-26 total or subscale scores revealed that coefficient correlations were in the 0.05–0.45 range. The correlation coefficient of F-DOS and EAT-26 total scores was 0.39 ($p < 0.001$).

4.3. Prevalence and psychopathology of ON

The mean total score of F-DOS for the sample was 19.2 (range 10–39; SD = 4.95). To assess the validity of the cut-offs previously reported, we applied the same method used in the original study (Barthels et al., 2015a). In this method, the 95th percentile corresponds to 29 and

a score equal or above 30 was suggested on the basis of this 95th percentile as a preliminary cut-off value for the presence of orthorexia (Barthels et al., 2015a). A score between 25 and 29 was suggested as an “at risk” preliminary cut-off based on the 90th percentile (Chard et al., 2019; He et al., 2019; Parra-Fernández et al., 2019). With this method, in our sample, the 95th percentile corresponds to 28, suggesting a score equal or above 29 as a cut-off value for the presence of orthorexia, and the 90th percentile corresponds to 25, suggesting a score between 26 and 28 as an “at risk” cut-off. Considering that 29 is very close to 30, that 26 is very close to 25, and that in every other article validating the DOS in different languages (Chard et al., 2019; He et al., 2019; Parra-Fernández et al., 2019), the preliminary recommended cut-offs of 30 and 25 were used, we chose to also use the cut-offs of 30 and 25. On this basis, 3.28% of participants could be considered having ON, while an additional 11.31% could be at risk of developing ON. No risk of ON was observed in 85.41% of the sample. No statistically significant relationships between the F-DOS categories and gender (Cramer’s $V = 0.013$, $p = 0.766$) or between the F-DOS and BMI categories ($r_s = 0.01$, $p = 0.39$) were observed. However, a positive significant correlation, yet very small, was observed between BMI and the F-DOS total score ($r_s = 0.04$, $p < 0.01$). Participants who indicated following a certain diet (vegetarian, vegan, flexitarian, etc.) were more likely to display ON or be at risk of developing ON (certain diet: ON: 8.4%, risk of ON: 27.7%; no certain diet: ON: 1.9%, risk of ON: 7.1%, Cramer’s $V = 0.311$, $p < 0.001$). Considering only vegetarians or vegans ($n = 404$), they were more likely to have ON (6.19% vs. 1.95%) or to be at risk of developing ON (29.95 vs. 7.05%) compared with students who did not follow a particular diet (Cramer’s $V = 0.281$, $p < 0.001$). Similarly, looking only at flexitarians ($n = 126$), they were more likely to have ON (4.76% vs. 1.95%) or to be at risk of developing ON (23.81 vs. 7.05%) compared with participants who did not follow a specific diet (Cramer’s $V = 0.14$, $p < 0.001$).

To address the links between ON and psychopathology, a correlational analysis was performed between the F-DOS total score, markers of functioning, and mental health status in students: results of the last semester, levels of anxiety, depression, and obsessional-compulsive symptoms. While no significant correlations were revealed between F-DOS and symptomatology of anxiety ($r_s = -0.005$, $p = 0.76$), depression ($r_s = -0.008$, $p = 0.64$), and obsessive-compulsive disorder ($r_s = -0.022$, $p = 0.23$), a small positive correlation was revealed between F-DOS and results of the last semester ($r_s = 0.071$, $p < 0.001$).

5. Discussion

This study is the first to describe a French version of the DOS. The so-called F-DOS showed good validity and reliability. Its Ordinal ω value (0.87) indicated a good internal consistency, in the same range (0.8 to 0.88) as the Cronbach's α of other DOS versions in different languages (Barthels et al., 2015a, 2015b; Chard et al., 2019; Depa et al., 2017; He et al., 2019; Luck-Sikorski et al., 2019; Parra-Fernández et al., 2019; Rudolph, 2018). In addition, the mean total score of F-DOS in this study ($M = 19.2$, $SD = 4.95$) was very close to that of the DOS obtained in young adults in Germany ($M = 17.75$, $SD = 5.44$) (Barthels et al., 2015a) or to that of the E-DOS in a US student sample with a women majority ($M = 20.02$, $SD = 5.95$) (Chard et al., 2019). Likewise, the ranges of mean score per item were highly similar between DOS (1.23–2.43), E-DOS (1.42–2.59), and F-DOS (1.27–2.65), further strengthening the validity of F-DOS. Similarly, the range of item selectivity values was also very comparable between DOS (0.49–0.63), E-DOS (0.56–0.73), and F-DOS (0.52–0.67) (Barthels et al., 2015a; Chard et al., 2019).

Regarding the factor analysis of the F-DOS, the single component model had a good fit. Regarding divergent validity, the correlational analysis of F-DOS and EAT-26 showed that these instruments evaluate distinct constructs, even though, as expected, some relations exist (Barthels et al., 2015a; Zickgraf et al., 2019). Altogether, these analyses indicate that the F-DOS displays significant reliability and validity, as well as specificity for ON among eating disorders.

With 3.28% of participants scoring above the cut-off, the prevalence of ON may appear very low in this study, compared to reports of ON prevalence rates as high as 30–70% in community or student samples (Dunn & Bratman, 2016; Gramaglia et al., 2019). However, these high rates are currently thought to reflect significant psychometric limitations when measuring ON with ORTO-15, rather than attesting a widespread prevalence of ON (Koven & Abry, 2015). Indeed, when additional criteria were used to assess ON using ORTO-15, a prevalence rate below 1% was found in a US sample (Dunn et al., 2017). Moreover, using the DOS or its adaptations rather than ORTO-15, the ON prevalence rate in community or student samples varied from 1 to 6.9% in Germany (Barthels et al., 2015a; Luck-Sikorski et al., 2019), and it was around 8% in samples of US or China university students composed with a majority of women (Chard et al., 2019; He et al., 2019). Therefore, the ON rate in French university

students appeared to be within the range reported in comparable samples assessed using the DOS or one of its adaptations.

Regarding BMI, this study found a small positive correlation between BMI and ON symptomatology, which is in line with recent reports showing positive links between ON and drive for thinness, a common underlying feature of AN (Barthels et al., 2015a, 2015b). However, other reports showed no major relation between ON and BMI in students or community samples (Barrada & Roncero, 2018; Chard et al., 2019; He et al., 2019; Varga et al., 2014). Additional research is thus required to clarify this area.

Looking at the general psychopathology of the sample, the results did not reveal any correlation between F-DOS total score and levels of anxiety, depression, and obsessive-compulsive symptoms; accordingly, it cannot be assumed that general psychopathology increases with higher levels of orthorexic eating behavior measured by the F-DOS. A possible explanation might be that people with slightly elevated DOS levels, without displaying any pathological features, feel better when they eat healthier, and thus, they display lower levels of general psychopathology. It could be further assumed that insight into illness might not be given in ON (Bratman & Knight, 2001). Hence, some individuals with high levels of orthorexic eating behavior, supposedly displaying a pathological behavior, might not be willing to admit that their well-being is impaired. These two possible explanations might then lead to an unclear pattern of the relationship between general psychopathology and F-DOS total scores. Yet, the F-DOS score was positively correlated with academic results. A possible reason of this association could be perfectionism, a trait linked with orthorexic behaviors (Barnes & Caltabiano, 2017; Koven & Abry, 2015; Parra-Fernández et al., 2018) but also with higher performance and academic achievement (Damian et al., 2017). Also, regarding these aspects, more research is needed to further analyze how orthorexic eating behavior elicits psychological distress.

This study is not without some limitations. First, the BMI was calculated with self-reported weight and size. The results regarding BMI should thus be considered with caution. In addition, the use of self-report questionnaires could be viewed as a weakness in trustworthiness of results, and semi-structured interviews could have strengthened the findings. Second, due to the transversal design of this study, test-retest reliability was not examined.

In conclusion, this study suggests that the F-DOS is a psychometrically adequate instrument to measure ON symptomatology in French-speaking populations, thereby providing a reliable instrument to assess ON in individuals in these populations. This report also shows an ON prevalence of 3.28% in young adults, while an additional 11.31% could be at risk of developing ON. The existence of a reliable assessment tool is important for future research, notably for identifying ON risk factors and protective elements, as well as for developing potential interventions.

What is already known on this subject? The aim of this study was to adapt the DOS into French and examine its psychometric properties.

What this study adds? This study provides an instrument to measure ON symptomatology in French-speaking populations, allowing future research on risk and protective factors, and the development of potential interventions.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40519-021-01123-6>.

Acknowledgements We are grateful to Fanny Gemieux for help in data collection.

Author contributions CL and PR designed the study and wrote the protocol. CL, FB, and PR conducted literature searches, provided summaries of previous research, and participated in the writing of the Introduction and Discussion sections. PR wrote the first draft of the Abstract, Method, and Conclusion sections. CL conducted statistical analyses and wrote the Results section. All authors contributed to and have approved the final manuscript.

Funding No funding was provided for this study.

Data availability The authors do not have permission to share data.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the Comité d’Ethique de la Recherche of the University of Toulouse (Registration number 2019-123) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all the participants included in this study.

Consent for publication All participants were informed that results from this study were going to be published in scientific journals or congress. Consent was obtained from all the participants included in this study.

Table 1. Participants' demographics and dietary style characteristics ($N = 3235$)

Age, years, mean (SD)	21.13 (2.23)
Gender, n (%)	
Men	334 (10.3)
Women	2901 (89.7)
Body mass index (kg/m^2), n (%)	
Underweight ($\text{BMI} < 18$)	446 (13.8)
Normal weight ($\text{BMI} 18\text{-}24.99$)	2228 (68.9)
Overweight ($\text{BMI} 25\text{-}29.99$)	412 (12.7)
Obese ($\text{BMI} > 30$)	137 (4.2)
Dietary style, n (%)	
Vegetarian	310 (9.6)
Vegan	94 (2.9)
Flexitarian (low in meat)	126 (3.9)
Low in sugar	32 (1.0)
Low in fat	25 (0.8)
Other (gluten-free, cetogenic etc.)	81 (2.5)
No specific dietary style	2567 (79.3)

Table 2. Mean, SD and item selectivity.

Item	Mean (SD)	Item selectivity
1. Manger de la nourriture bonne pour la santé est plus important pour moi que le plaisir. <i>1. Eating healthy food is more important to me than indulgence/enjoying the food</i>	2.46 (.73)	.58
2. J'ai établi des règles alimentaires auxquelles j'adhère. <i>2. I have certain nutrition rules that I adhere to.</i>	2.55 (.98)	.64
3. Je peux apprécier la nourriture seulement si elle est considérée comme bonne pour la santé. <i>3. I can only enjoy eating foods considered healthy.</i>	1.65 (.73)	.60
4. J'évite d'aller manger chez des amis lorsqu'ils ne veillent pas à avoir une alimentation saine. <i>4. I try to avoid getting invited over to friends for dinner if I know that they do not pay attention to healthy nutrition.</i>	1.35 (.65)	.62
5. Je trouve positif de faire plus attention que les autres à avoir une alimentation saine. <i>5. I like that I pay more attention to healthy nutrition than other people.</i>	2.65 (.90)	.55
6. Lorsque je mange quelque chose qui n'est pas bon pour la santé, je m'en veux. <i>6. If I eat something I consider unhealthy, I feel really bad.</i>	2.31 (.93)	.64
7. J'ai l'impression d'être exclu(e) par mes amis et mes collègues à cause de mon régime alimentaire strict. <i>7. I have the feeling of being excluded by my friends and colleagues due to my strict nutrition rules.</i>	1.27 (.59)	.52
8. Mes pensées sont centrées en permanence sur l'alimentation saine et j'organise ma journée en fonction de cela. <i>8. My thoughts constantly revolve around healthy nutrition and I organize my day around it.</i>	1.43 (.72)	.67
9. Il m'est difficile de transgresser mes règles alimentaires. <i>9. I find it difficult to go against my personal dietary rules.</i>	1.76 (.92)	.65
10. Je me sens déprimé(e) lorsque je mange quelque chose de mauvais pour la santé. <i>10. I feel upset after eating unhealthy foods.</i>	1.77 (.90)	.66

The corresponding items of E-DOS are shown in italics

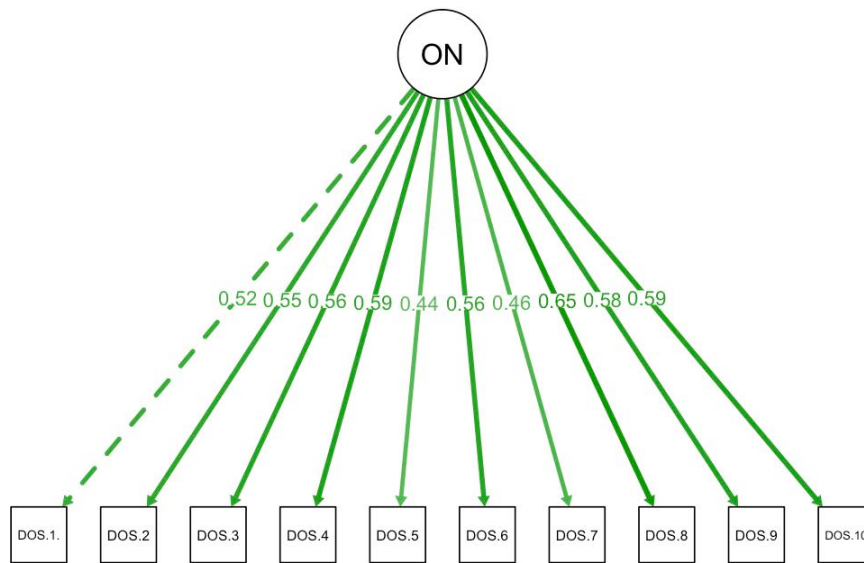


Fig. 1 Path diagram of the tested F-DOS with standardized factor loadings

Étude 2 : Personality profiles in young adults with orthorexic eating behaviors (Lasson & Raynal, 2021)

Cette étude a fait l'objet d'une publication dans la revue scientifique *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* (cf. Annexe 21). La référence détaillée de cet article scientifique est la suivante :

- **Lasson, C., & Raynal, P.** (2021). Personality profiles in young adults with orthorexic eating behaviors. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 26(8), 2727–2736. <https://doi.org/10.1007/s40519-021-01124-5>

Cette étude a également fait l'objet d'une communication affichée lors de la journée scientifique des doctorants de l'école doctorale CLESCO édition 2022. La référence détaillée de cette communication est la suivante :

- **Lasson, C., Raynal, P.** (2022, mars). *Personality profiles in young adults with orthorexic eating behaviors*. Communication affichée présentée à la Journée Scientifique des Doctorants de l'École Doctorale CLESCO (JSDOC) 2022, Toulouse, France.

Clotilde Lasson¹ · Patrick Raynal¹

¹ Laboratoire CERPPS (Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de La Santé), Université Toulouse Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France

Received: 10 August 2020 / Accepted: 20 January 2021

© The Author(s), under exclusive licence to Springer Nature Switzerland AG part of Springer Nature 2021

Abstract

Purpose Orthorexia nervosa (ON), defined as an excessive preoccupation with healthy eating, has gained more interest in the literature over these past few years. However, little is known about its risk and protective factors, in particular with regards to personality.

Methods A total of 3235 college students (10.32% men, 89.67% women) with a mean age of 21.13 (SD = 2.23) answered self-administered questionnaires assessing ON, psychopathological symptoms, and personality disorders including schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic personality. A subsample of 106 participants (91.51% women, mean age = 20.91, SD = 2.31) was selected based on the DOS cutoff score, and was then considered as the “orthorexic subsample”.

Results Hierarchical cluster analysis was performed in the orthorexic subsample and led to the identification of four groups: 1- a cluster with a low level of traits (L); 2- a cluster with moderate traits and low narcissistic traits (MD); 3- a cluster with a low level of traits and moderate narcissistic traits (MN); 4- a cluster with high paranoid and narcissistic traits (PN) and a moderate level of schizotypal and borderline traits. Levels of anxiety, obsessional-compulsive and depressive symptoms were higher in the PN and MD clusters than in the L and MN clusters. Social phobia was higher and self-esteem lower in the MD cluster and hypochondriasis was higher in the PN and MN clusters.

Conclusions This study suggests that ON can be associated with different personality profiles, some of them displaying significant psychopathological levels. It also emphasizes the importance of taking into account personality disorder traits of young adults with orthorexic eating behaviors.

Level of evidence Descriptive (cross-sectional) study, Level V.

Keywords Orthorexia nervosa · Personality disorder traits · Cluster classification · Young adults · Healthy eating.

1. Introduction

Orthorexia nervosa (ON) is defined as an excessive preoccupation with healthy food, characterized by the adherence to strict dietary rules that might lead individuals to cut out some food or food categories of their diet because they are considered not pure or bad for their health (Bratman & Knight, 2001). In a study asking healthcare practitioners (Vandereycken, 2011), 66.7 % of participants reported to have observed this potential disorder in their own practice, and 68.5 % expressed that the diagnosis of ON should deserve more attention. To date, despite proposals of diagnostic criteria (i.e., obsessional preoccupation with eating "healthy food", impairment of physical health, and impairment of social, academic or vocational functioning; Moroze et al., 2015), ON is not yet indexed into mental disease classifications. Indeed, research has not yet allowed to reach a consensus on how to categorize it. While some studies suggested that ON could be a distinct disorder than those already present in the DSM-5 (American Psychiatric Association et al., 2013; Dunn et al., 2017), other studies suggested that ON belongs to the eating disorder spectrum, considering that ON is close to anorexia nervosa, bulimia nervosa, avoidant/restrictive food intake disorder, obsessive-compulsive and related disorders or even anxiety disorders (Bartel et al., 2020; Brytek-Matera, 2012; Ryman et al., 2019).

Another study (Barthels et al., 2017) suggested that ON could also serve as a healthier alternative or as a coping strategy for individuals suffering from anorexia nervosa, allowing them to eat more while maintaining control over food.

Paradoxically, this obsession with health might lead to negative consequences such as nutritional deficiencies, unintended weight loss, and malnutrition (Fidan et al., 2010; Nevin & Vartanian, 2017). From a psychological point of view, a feeling of moral superiority to others not sharing their way of eating, a loss of interest in work and interpersonal relationships as well as a social isolation might also result from ON (Bratman & Knight, 2001; Brytek-Matera, 2012). In community or student samples, positive correlations were found between ON, depression, negative affects and suicidal ideations (Gleaves et al., 2013; Oberle et al., 2017).

The prevalence of ON in the general population remains a matter of debate. Indeed, a majority of studies reporting ON prevalence in different populations relied on the ORTO-15 (Donini et al., 2004), a self-report questionnaire created to assess ON symptomatology. However this scale has been questioned, notably due to psychometric limitations and the omission of ON characteristics, thereby overestimating the prevalence of ON (Barnes & Caltabiano, 2017; Oberle et al., 2017; Reynolds, 2018; Roncero et al., 2017). In these latter studies, prevalence was estimated at 6.9% in the general population (Donini et al., 2004) and from 12.8 to 86% in specific populations such as healthcare professionals, students in the health field, or yoga practitioners (e.g., Asil & Sürücüoğlu, 2015; Bağcı Bosi et al., 2007; Bo et al., 2014; Fidan et al., 2010; Herranz Valera et al., 2014; Kinzl et al., 2006; Tremelling et al., 2017). However, when using the Düsseldorf Orthorexia Skala or its adaptations rather than ORTO-15, the ON prevalence rate in community or student samples varied from 1 to 6.9% in Germany (Barthels et al., 2015a; Luck-Sikorski et al., 2019), and it was around 8% in the samples of US or China university students (Chard et al., 2019; He et al., 2019), which is much lower than the above estimates.

There have been only few studies on risk and protective factors in ON, in particular with regards to personality. These studies only focused on dimensional models of personality or separate personality traits, with Gleaves et al. (2013)'s one based on the Big-Five model, Gramaglia et al. (2019) and Kiss-Leizer and Rigó (2019)'s ones based on the temperament and character personality dimensions, and Oberle et al. (2017)'s one based on narcissism and perfectionism. Results of these studies suggested that ON could be linked to neuroticism (i.e., propensity to experience negative affects), perfectionism, narcissism (i.e., pervasive pattern of

grandiosity, need for admiration and lack of empathy), self-directedness (i.e., ability to regulate behavior to achieve goals), transcendence (associated with spiritual experiences and transpersonal identification), low and medium persistence (i.e., capacity of perseverance in spite of fatigue and frustration), and harm avoidance characterized by excessive worrying, pessimism, and shyness (Gleaves et al., 2013; Gramaglia et al., 2019; Kiss-Leizer & Rigó, 2019; Oberle et al., 2017). However, other models such as, for instance, categorical models (i.e., DSM, ICD approaches) assess more pathological aspects of personality. Based on the DSM personality categorical model, strong axis I disorders comorbidity has been reported in individuals with personality disorders (Lenzenweger et al., 2007) which makes this personality approach important to take into account when exploring possible risk and protective factors of ON.

To the best of our knowledge, this study is the first to explore possible links between orthorexic eating behaviors and personality traits based on the DSM categorical model of personality, including schizotypal, borderline, paranoid, obsessive-compulsive as well as narcissistic personality disorder traits. We hypothesized that at least some of these personality traits will be associated with orthorexic eating behaviors. The aim of our study was thus to establish a typology of young adults with orthorexic eating behaviors based on personality disorder traits.

2. Method

2.1. Participants and procedure

Participants were recruited via an advertisement posted on college students groups referenced on Facebook. Potential participants were provided with the link to an online questionnaire taking place on the LimeSurvey platform. Participants were told that if they agreed to take part in the study, they would be asked to answer questionnaires about their eating habits and personality traits. To be eligible for the participation, the participants had to be university students and 18 years or older. Two control questions (e.g., “Please tick the “yes, extremely” if you are careful in completing this questionnaire”) were added at half and three quarter of the questionnaire as inattention checks using the method described in Davidson et al. (2016). A total of 157 participants were excluded from the final analyses based on these checks. The study protocol was approved by the local ethics committee (Comité d’Ethique de la Recherche of Toulouse University). Participants involved in this study did not receive any compensation. The questionnaires were anonymous.

Data were collected from 3235 college students (10.32% men, 89.67% women) aged between 18 and 29 years, with a mean age of 21.13 years ($SD = 2.23$). This sample was used in a former study (Lasson et al., 2021). From this whole sample, based on the DOS cutoff (score of 30 or above, i.e., DOS cut-off score proposed by Barthels et al., (2015a)), a subsample of 106 participants was selected and considered as the “orthorexic subsample”. It was composed of 91.51% of women and 8.49% of men, aged between 18 and 28, with a mean age of 20.91 ($SD = 2.31$) and a mean BMI of 20.74 ($SD = 3.49$). The majority of them had a normal weight (66.60%) and half of them followed a particular diet (52.83%) while 16.0% described their diet as vegetarian, 12.3% low in fat, 7.5% vegan, 5.7% flexitarian (i.e., a person with a primarily vegetarian diet with the occasional inclusion of meat or fish), and 4.7% low in sugar. Regarding fields of study, 32.1% of participants were in human sciences, 15.1% in law, 15.1% in literature and foreign language, 7.5% in history, geography or political sciences, 6.6% in sciences or engineering, 6.6% in medical/paramedical courses, 4.7% in communication and information, 3.8% in economics, and 8.5% in other fields.

2.2. Measures

2.2.1. Personal information

Personal information was collected by asking participants their age, gender, height, weight, current level of study, field of study, presence or absence of a specific diet, and motives for following such a diet.

2.2.2. Orthorexia nervosa

Orthorexic eating behaviors was assessed using the French version of the Düsseldorf Orthorexia Skala (DOS; Barthels et al., 2015a; Lasson et al., 2021), a unidimensional self-report questionnaire. The DOS includes 10 items scored on a four-point Likert-scale (1 = *This does not apply to me*, 4 = *This applies to me*). An example item is “If I eat something I consider unhealthy, I feel really bad”. Higher scores indicate higher level of orthorexic behavior. Cronbach’s α of the original version was 0.84 (Barthels et al., 2015a), Ordinal ω of the French version was 0.87 in a former study using the same sample (Lasson et al., 2021) and Cronbach’s α was 0.81 in this study.

2.2.3. Eating behavior

Symptoms of eating disorders were assessed using the Eating Attitudes Test-26 (EAT-26; Garner et al., 1982; Leichner et al., 1994), a 26-item self-report questionnaire composed of three subscales: (1) dieting (13 items, e.g., “I avoid foods with sugar in them”), (2) bulimia and

food preoccupation (6 items, e.g., “I have the impulse to vomit after meals”), and (3) oral control (7 items, e.g., “I display self-control around food”). Items are scored on a six-point Likert-scale (1 = *Never*, 6 = *Always*). A score equal or above 20 indicates disordered eating attitudes and behaviors. The French version showed good internal consistency for each subscale as well as for the global score, Cronbach's $\alpha = 0.85, 0.62, 0.54$, and 0.86 , respectively (Leichner et al., 1994).

2.2.4. Personality disorder traits

2.2.4.1. Schizotypal personality traits

Schizotypal traits were measured using the Schizotypal Personality Questionnaire-Brief (SPQ-B; Ferchiou et al., 2017; Raine & Benishay, 1995), a self-report questionnaire including 22 dichotomous items scored 0/1 (no/yes). An example of item is “People sometimes find me aloof and distant”. Cronbach's α of the French version was 0.88 in a former study (Ferchiou et al., 2017) and 0.83 in this study.

2.2.4.2. Obsessive-compulsive personality traits

Obsessive-compulsive traits were measured using the eight relevant items of the Personality Diagnostic Questionnaire-4 (PDQ-4; Bouvard, 2002; Hyler et al., 1988). Items (e.g., “I waste time trying to make things too perfect.”) were scored 0 (*false*) or 1 (*true*). Cronbach's α of the French version was 0.47 in a former study (Chabrol et al., 2007) and 0.43 in this study.

2.2.4.3. Borderline personality traits

Borderline traits were assessed through the nine relevant items of the Personality Diagnostic Questionnaire-4 (PDQ-4; Bouvard, 2002; Hyler et al., 1988). Items (e.g., “I either love someone or hate them, with nothing in between.”) were scored 0 (*false*) or 1 (*true*). Cronbach's α was 0.69 of the French version in a former study (Chabrol et al., 2012) and 0.65 in this study.

2.2.4.4. Paranoid personality traits

Paranoid traits were measured using the six relevant items of the Symptoms Check List-90R (SCL-90R; Derogatis, 1979; Fortin et al., 1985). Items (e.g., “Feeling that you are watched or talked about by others”) were scored on a five-point Likert scale (0 = *Not at all*, 4 =

Extremely). Cronbach's α of the French version was 0.91 in a former study (Fortin et al., 1985) and 0.75 in this study.

2.2.4.5. Narcissistic personality traits

Narcissistic traits were assessed using the Narcissistic Personality Inventory-16 (NPI-16; Ames et al., 2006; Braun et al., 2016), a self-report questionnaire including 16 items consisting of pairs of narcissistic and nonnarcissistic sentences (e.g., "I think I am a special person" vs. "I am not better or no worse than most people."). For each item, participants were asked to choose the sentence which fit them best. Narcissistic sentences were scored 1 and nonnarcissistic sentences were scored 0. Cronbach's α of the French version was 0.92 in a former study (Braun et al., 2016) and 0.62 in this study.

2.2.5. Psychopathological symptoms

2.2.5.1. Somatization and hypochondriasis symptoms

Hypochondriasis and somatization were assessed using the WHITELEY-7 scale (Fink et al., 1999), a self-report questionnaire including seven items (e.g., "Is it hard for you to believe the doctor when he tells you there is nothing to worry about?"). Items were scored on a four-point Likert scale (1 = *Totally false*, 4 = *Totally true*). Cronbach's α of the original version was 0.73 in a former study (Lee et al., 2011) and 0.79 in this study.

2.2.5.2. Depressive symptoms

Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9; Carballera et al., 2007; Kroenke et al., 2010), a self-report questionnaire including nine items (e.g., "Little interest or pleasure in doing things") in which participants are provided with a list of symptoms and are asked how often they have been bothered by these symptoms over the past 2 weeks on a 4-point scale (0 = *Not at all*, 3 = *Nearly every day*). Higher scores indicate higher depressive symptomatology, with a score between 5 and 9 indicating mild depressive symptoms, between 10 and 14 mild, between 15 and 19 moderately severe and above 20 severe depression. Cronbach's α of the French version was 0.86 in a former study (Arthurs et al., 2012) and 0.85 in this study.

2.2.5.3. Anxious symptoms

Anxious symptoms were assessed using the GAD-7 (Micoulaud-Franchi et al., 2016; Spitzer et al., 2006), a self-report questionnaire including seven items (e.g., "Not being able to

stop or control worrying”) in which participants are provided with a list of symptoms and are asked how often they have been bothered by these symptoms over the past 2 weeks on a 4-point scale (0 = *Never*, 3 = *Almost everyday*). Higher scores indicate higher anxious symptomatology, with a score between 5 and 9 indicating mild, between 10 and 14 moderate, and above 15 severe anxiety. Cronbach’s α of the French version was 0.9 in a former study (Micoulaud-Franchi et al., 2016) and 0.89 in this study.

2.2.5.4. Social phobia symptoms

Social phobia symptoms were measured using the Mini-Social Phobia Inventory (Mini-SPIN; Connor et al., 2001; Radomsky et al., 2006), a self-report questionnaire including three items. Each item (e.g., “I avoid activities in which I am the center of attention”) is scored on a five-point Likert scale (0 = *Not at all*, 4 = *Extremely*). Scores equal or above 6 indicate possible problems with social phobia. Cronbach’s α of the French version was 0.93 in a former study (Radomsky et al., 2006) and 0.78 in this study.

2.2.5.5. Obsessive-compulsive symptoms

Obsessive-compulsive symptoms were assessed using the Obsessive Compulsive Inventory Revised (OCI-R; Foa et al., 2002; Zermatten et al., 2006), a self-report scale including 18 items. Each item (e.g., “I get upset if others change the way I have arranged things”) is scored on a five-point Likert scale (0 = *Not at all*, 4 = *Extremely*). Higher scores indicate higher obsessive-compulsive symptomatology, with a score equal or above 21 indicating the likely presence of obsessive-compulsive disorder. Cronbach’s α of the French version was 0.86 in a former study (Zermatten et al., 2006) and 0.86 in this study.

2.2.6. Other psychological measures

2.2.6.1. Self-esteem

Self-esteem was measured using the Rosenberg Self Esteem Scale (Rosenberg, 1989; Vallieres & Vallerand, 1990), a unidimensional scale including ten items. Each item (e.g., “On the whole, I am satisfied with myself”) is scored on a four-point Likert scale (1 = *Strongly agree*, 4 = *Strongly disagree*). Items 2, 5, 6, 8, and 9 are reverse scored. Higher scores indicate higher self-esteem. Cronbach’s α of the French version was between 0.83 and 0.90 in a former study (Vallieres & Vallerand, 1990) and 0.89 in this study.

3. Data analysis

A cluster analysis was performed in the orthorexic subsample in two steps to identify distinct profiles of participants based on their standardized total scores (z score) for the following personality traits: schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic. In the first step, a hierarchical cluster analysis was conducted (Ward's method with Euclidean distance), and the resulting dendrogram and agglomeration schedule were used to identify the number of clusters. As a second step, K-means clustering was used to assign each individual to the identified clusters. Cluster differences in level of orthorexic eating behaviors and psychopathological variables were tested using ANOVA and Tukey post-hoc tests. Statistical analyses were performed using IBM SPSS Statistics version 24.

4. Results

4.1. Descriptive statistics

As reported in a former study using the same sample (Lasson et al., 2021), 3.28% of participants could be considered having ON. The F-DOS mean scores of the whole sample and the orthorexic subsample were 19.2 (SD = 4.95) and 32.62 (SD = 2.27) respectively. Scores on personality disorder traits and psychopathological variables, descriptive statistics of the whole sample and of the orthorexic subsample are shown in Table 1 (left part).

4.2. Cluster analysis

Considering the 106 participants of the orthorexic subsample, a cluster analysis was performed to identify the personality profiles of the participants, based on their scores in schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic traits. In the first step, a hierarchical cluster analysis was performed. The agglomeration schedule and dendrogram were then used to identify the number of clusters. The agglomeration schedule showed a sudden increase in linkage distance (nearly doubling from 24.7 to 48.1) when four clusters merged to three clusters. This indicated that the passage from four to three clusters would have more impact on cluster heterogeneity than the previous stages of the analysis. The dendrogram also clearly indicated a four-cluster solution (Fig. 1, four shaded areas). Therefore, the four-cluster solution was chosen.

In the second step, K-means clustering was used to assign individuals to each of the four clusters. A discriminant analysis showed clear differences between clusters (Wilks' $\lambda = 0.087$,

$p < 0.001$) with 92.5% of cases correctly classified. Figure 2 represents the mean score of each trait for the four clusters. The first cluster, called “Low traits” (L, $n = 37$, 34.9%), was composed of participants with scores of the five personality traits lower than the sample mean. The second cluster, named “Moderately Disturbed” (MD, $n = 36$, 40.0%), aggregated persons with scores of schizotypal, borderline, paranoid, and obsessive-compulsive traits higher than the mean by at least one-half standard deviation (SD). Another cluster called “Paranoid and Narcissistic” (PN, $n = 5$, 4.7%) gathered students with paranoid and narcissistic scores higher than the mean by more than one and a half SD. The fourth cluster, labeled “Moderately Narcissistic” (MN, $n = 28$, 26.4%), was constituted of participants with a narcissistic trait score higher than the mean by nearly one SD value and with other scores lower than, or close to the mean.

These clusters were then compared to each other using ANOVA (Table 1, right part). Significant inter-cluster differences were found regarding all personality trait factors, which further validated the classification (with large effect sizes, η^2 range = 0.42–0.55). No significant difference was observed between clusters in terms of orthorexic behaviors, eating disorder, and BMI. In contrast, when considering variables assessing psychopathology, the clusters showed a number of significant differences (with large effect sizes, η^2 range = 0.25–0.40). Indeed, the MD and PN clusters displayed higher levels of anxiety, depression, and obsessional-compulsive symptoms when compared to the L and MN clusters. In addition, the MD cluster showed higher social phobia and lower self-esteem than the L and MN clusters. The clusters also differed significantly on the hypochondriasis score, with the PN cluster showing the highest score, the MD and MN clusters displaying intermediate scores.

5. Discussion

This study sought to establish a typology of young adults with orthorexic eating behaviors based on personality disorder traits. To our knowledge, this is the first study to explore possible links between orthorexic eating behaviors and personality traits related to personality disorders, as modeled by the DSM categorical approach.

In the current study, young adults with orthorexic eating behaviors met criteria for risk of eating disorders, having a mean score on the EAT-26 above the threshold (i.e., mean above 20), meaning a possible high level of concerns about dieting, body weight or problematic eating behavior. They also displayed scores above thresholds for the PHQ-9 (i.e., mean between 5 and 9), GAD-7 (i.e., mean between 5 and 9), and scored on the Mini-SPIN slightly below the

threshold (i.e., mean slightly below 6), indicating possible moderate depression, general anxiety disorder and subclinical social phobia.

Cluster analysis led to the identification of four groups. The MD cluster was characterized by moderate levels of schizotypal, borderline, paranoid, and obsessive-compulsive traits, higher than the mean by at least one-half SD. The PN cluster, typified by high paranoid and narcissistic traits and moderate schizotypal and borderline traits, with paranoid and narcissistic traits being the highest component and the most differentiated from the other clusters, deviating from more than 1.5 S.D. The MN cluster was characterized by moderate narcissistic traits and low levels of schizotypal, borderline, paranoid, and obsessive-compulsive traits. Lastly, the L cluster showed levels below the mean of schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic traits. Regarding psychopathological symptomatology, a number of significant differences were shown between clusters with large effect sizes ($\eta^2 = 0.25\text{--}0.40$). Indeed, the PN and MD clusters displayed higher scores on psychopathological symptomatology compared to L and MN regarding general anxiety, depressive, and obsessive-compulsive symptoms. In addition, the MD cluster showed higher social phobia and lower self-esteem compared to MN and L clusters. The PN cluster showed higher scores on psychopathological symptomatology compared to MD with regards to hypochondriasis symptoms. The MN cluster also scored higher on hypochondriasis symptomatology compared to L cluster. In our study, the most striking differences between clusters were the prominence of obsessive-compulsive symptoms but also depressive, anxious, and social phobic symptoms, with scores twice higher in PN and MD clusters than in L and MN clusters. Furthermore, PN and MD scores on those variables were above threshold for those psychopathological variables, indicating moderate to severe depression and general anxiety, likely presence of obsessive-compulsive disorder and possible problems with social phobia. Considering that altogether PN and MD represent almost half of young adults in our orthorexic subsample, these results suggest that obsessive-compulsive disorder, depression, general anxiety and social phobia are very frequent comorbidities in young adults with orthorexic eating behaviors. Given the ON characteristics and consequences that have been reported in the literature (e.g., guilty feelings after food rules transgression, excessive amount of time spent thinking about healthy food, social isolation, loss of interest in work and leisure activities, neuroticism; Bratman & Knight, 2001; Brytek-Matera, 2012; Gleaves et al., 2013; Moroze et al., 2015; Oberle et al., 2017), comorbidities between orthorexic eating behaviors and these disorders are not surprising. Results of our study then suggest that schizotypal, borderline,

paranoid, obsessive-compulsive, and narcissistic traits might be relevant to the classification of ON and subclinical ON.

These results are consistent with the past studies showing the level of ON symptomatology to be positively correlated to harm avoidance, transcendence, and neuroticism, and negatively correlated to self-directedness (Gleaves et al., 2013; Kiss-Leizer & Rigó, 2019), personality dimensions which have been shown to be related to the ten DSM personality disorders (Conrad et al., 2007; Ha et al., 2007). In addition, consistent with these results, strong DSM axis I disorder (e.g., eating, obsessive-compulsive, addictive, and anxious disorders) comorbidity in individuals with personality disorders has been demonstrated in the literature (Lenzenweger et al., 2007). These findings also provide support to Apfeldorfer (2008)'s statement which is, when ON becomes severe, individuals may turn to paranoia, becoming fervent followers of the conspiracy theory, showing suspiciousness towards food, the ones producing it, worrying that these ones intend to poison them by negligence, to make money or by pure malignity. It also provides support to Bratman and Knight (2001)'s statement describing ON as an obsession “with a sense of compulsions beginning to override free choice” in which individuals are spending a great amount of time thinking about food. These results also bring additional support to Oberle et al. (2017) who found a positive correlation between ON and narcissism, and suggested that individuals with orthorexic eating behaviors “likely take pride in their self-control, resisting temptation, and eating a near-perfect diet that they believe is superior to other's diets”.

Further studies should then investigate personality profiles in population with orthorexic eating behaviors including the remaining personality disorder traits (i.e., schizoid, antisocial, histrionic, avoidant, and dependent personality disorder traits), as well as in population with low levels of orthorexic eating behaviors, to compare with samples with high orthorexic behaviors. It would also be interesting to reproduce this study with an orthorexic eating behavior multidimensional measurement tool. Indeed, there is a quite recent ongoing discussion about the multidimensionality of orthorexia in the recent studies (Barrada & Roncero, 2018; Barthels et al., 2019; Depa et al., 2019), proposing to distinguish between healthy orthorexia (i.e., adaptive dimension, “tendency to eat healthy food and interest in doing so”) and orthorexia nervosa (i.e., the pathological dimension of orthorexia, “pathological preoccupation with a healthy diet”), with only the latter being linked to problems and psychological distress as measured by the problems subscale of the Eating Habits Questionnaire (Gleaves et al., 2013) or by the Teruel Orthorexia Scale (Barrada & Roncero, 2018).

There are various limitations in our study. First, the small sample size and the composition of only college students, making it hard to generalize our results to other groups. Replication with other samples would help to overcome these limitations. Second, the ON criteria adopted by our study, although widely adopted by ON researchers, have not yet received a general consensus. Third, the PN cluster ($n = 5$, 4.7%) represents only a small proportion of our orthorexic subsample, which limits the generalizability of conclusions drawn by the differences found between clusters in this study. Fourth, the Cronbach's α for obsessive-compulsive traits indicates a low internal consistency of the subscale, which is not unusual in the literature. This could be due to the dichotomous scoring format that was used in this study. A Cronbach's $\alpha = 0.62$ of the obsessive-compulsive subscale of the PDQ-4 was obtained in a Spanish sample when using a five-point Likert scale (Fonseca-Pedrero et al., 2013). The authors of this study (Fonseca-Pedrero et al., 2013) suggested using Likert response format in order to improve score reliability. Fifth, the cross-sectional design of the study does not allow to draw conclusion about the cause and effect relationships between variables. Further studies should then be conducted to explore the links between development and maintenance of ON with other psychopathological disorder variables, using a longitudinal design.

6. Conclusion

To conclude, this study suggests that ON can be associated with different personality profiles, some of them displaying significant psychopathological levels. It may also contribute to identify the more-at-risk of ON groups, emphasizing the importance of taking into account personality disorder traits of young adults with orthorexic eating behaviors, but also to use this personality categorical model when exploring risk and protective factors of ON. Given that the research on ON is a quite recent field and that very less information is available in the literature about the protective and risk factors of this potential condition, results of our study are particularly useful to gain a better understanding of factors which might be involved in its development and maintenance so as to develop guidelines regarding prevention and therapeutic intervention programs.

What is already known on this subject? Some studies suggested that ON could be linked to personality features such as neuroticism, perfectionism, narcissism, self-directedness, transcendence, low and medium persistence, and harm avoidance.

What does this study add? The results indicate that orthorexic eating behaviour in young adults can be associated with different personality profiles, some of them displaying significant psychopathological levels.

Declarations

Author contributions CL and PR designed the study and wrote the protocol. CL conducted literature searches, provided summaries of previous research and wrote the first draft of the following sections of the manuscript: Abstract, Introduction, Method, Discussion, and Conclusion sections. PR conducted statistical analyses, wrote the first draft of the Results section and supervised the writing process. All authors contributed to and have approved the final manuscript.

Funding No funding was provided for this study.

Data availability The authors do not have permission to share the data.

Code availability Not applicable.

Conflict of interest The authors declare that they have no conflict of interest.

Compliance with ethical standards

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the Comité d'Ethique de la Recherche of the University of Toulouse (Registration number 2019-123) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all the participants included in this study.

Consent for publication All participants were informed that the results from this study were going to be published in scientific journals or congress. Consent was obtained from all the participants included in this study.

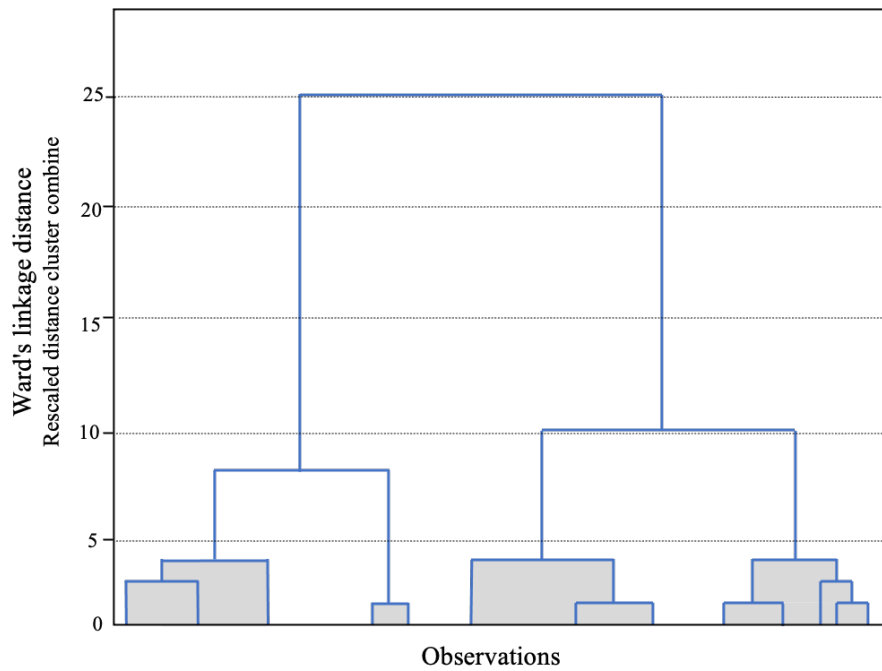


Figure 1. Hierarchical clustering dendrogram

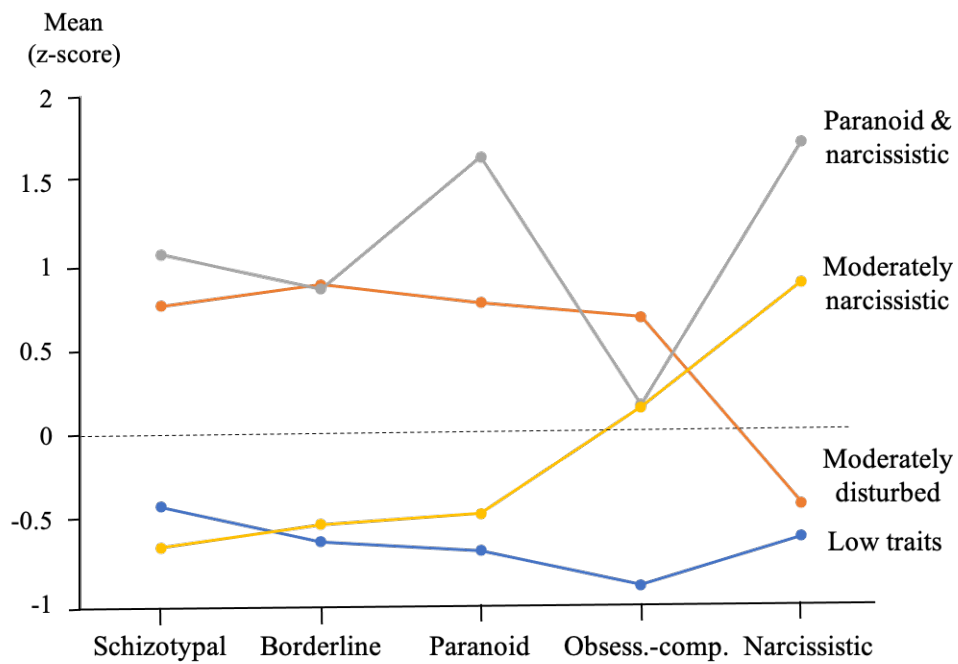


Figure 2. Four-cluster solution based on the 5 personality disorder traits indicated on the x-axis.

Table 1

Descriptive statistics and typology of individuals with ON on five traits of personality disorders
(cluster comparison using ANOVA and Tukey post hoc test)

	Whole	Cron-	Range	Orthorexic	Cluster <i>M (SD)</i>					<i>F</i>	η^2	Significant comparisons
	sample	bach's		subsample	Low	Moderately	Paranoid &	Moderately				
	(<i>N</i> = 3235)	alpha		(<i>N</i> = 106)	traits (L)	Disturbed (MD)	Narcissist. (PN)	Narcissist. (MN)				
	<i>M (SD)</i>			<i>M (SD)</i>	<i>n</i> = 37 34.9%	<i>n</i> = 36 40.0%	<i>n</i> = 5 4.7%	<i>n</i> = 28 26.4%				
Personality traits												
Schizotypal	9.01 (4.87)	0.83	0 - 22	8.23 (4.84)	6.27 (3.54)	11.94 (4.44)	13.40 (3.78)	5.11 (2.85)	25.08*	0.42		L, MN < MD, PN
Borderline	3.70 (2.14)	0.65	0 - 9	3.49 (1.96)	2.30 (1.22)	5.25 (1.70)	5.20 (1.79)	2.50 (1.07)	35.36*	0.51		L, MN < MD, PN
Paranoid	6.8 (4.68)	0.75	0 - 24	6.28 (4.45)	3.35 (2.61)	9.81 (3.78)	13.6 (3.21)	4.32 (2.39)	41.18*	0.55		L, MN < MD < PN
Obsessive-compulsive	3.89 (1.61)	0.43	0 - 8	3.92 (1.45)	2.68 (0.97)	4.94 (1.09)	4.20 (0.45)	4.18 (1.31)	26.93*	0.44		L < MN, MD, PN
Narcissistic	4.14 (2.59)	0.62	0 - 15	4.45 (2.85)	2.84 (1.67)	3.39 (1.55)	9.40 (2.70)	7.07 (2.62)	38.33*	0.53		L, MD < MN, PN
Eating behaviors												
Orthorexic behaviors	19.2 (4.95)	0.81	10 - 39	32.62 (2.27)	32.41 (2.36)	32.81 (2.31)	33.2 (2.17)	32.57 (2.18)	0.30	n.a.		
Eating disorder	10.92 (11.13)	0.89	0 - 77	35.92 (17.97)	35.51 (16.17)	37.56 (20.27)	40.80 (15.30)	33.46 (18.03)	0.40	n.a.		
BMI	22.04 (4.06)	n.a.	13.7 - 59.1	20.74 (3.49)	21.43 (3.35)	20.42 (2.95)	17.32 (2.82)	20.82 (4.10)	2.26	n.a.		
Psychopathology												
Self-esteem	27.43 (6.08)	0.89	10 - 40	27.03 (6.2)	29.08 (4.30)	22.89 (5.38)	25.5 (10.63)	29.81 (6.08)	10.91*	0.25		MD < L, MN
Hypochondriasis	15.04 (4.78)	0.79	6 - 28	14.51 (4.92)	11.57 (3.57)	17 (4.70)	21 (8.16)	14.37 (3.70)	13.20*	0.29		L < MN, MD < PN
Obsess.-compuls. sympt.	17.3 (11.05)	0.86	0 - 69	16.29 (11.16)	9.69 (6.70)	25.26 (10.90)	23.00 (9.52)	12.42 (8.11)	20.78*	0.40		L, MN < MD, PN
Social anxiety	5.84 (3.38)	0.78	0 - 12	5.35 (3.48)	4.44 (2.97)	8.06 (2.83)	6.00 (2.94)	3.04 (2.68)	17.50*	0.32		L, MN < MD
Anxiety symptoms	7.06 (5.36)	0.89	0 - 21	6.37 (5.11)	3.58 (2.76)	9.85 (5.55)	11.00 (5.35)	5.00 (3.99)	19.18*	0.35		L, MN < MD, PN
Depression symptoms	9.86 (5.76)	0.85	0 - 27	8.97 (6.08)	5.36 (2.82)	13.00 (5.90)	17.5 (6.56)	7.44 (5.42)	15.02*	0.37		L, MN < MD, PN

* $p < 0.05$ *n.a.*, not applicable

Étude 3 : Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS) (Lasson et al., 2023)

Cette étude a fait l'objet d'une publication dans la revue scientifique *Journal of Eating Disorders* (cf. Annexe 22). La référence détaillée de cet article scientifique est la suivante :

- **Lasson, C.**, Rousseau, A., Vicente, S., Goutaudier, N., Romo, L., Roncero, M., & Barrada, J. R. (2023). Orthorexic eating behaviors are not all pathological: A French validation of the Teruel Orthorexia Scale (TOS). *Journal of Eating Disorders*, 11(1), 65. <https://doi.org/10.1186/s40337-023-00764-5>

Elle a également fait l'objet de deux communications affichées à des congrès, les références détaillées de ces communications sont les suivantes :

- **Lasson, C.**, Rousseau, A., Vicente, S., Goutaudier, N., Romo, L., Roncero, M., & Barrada, J.R. (2022, septembre). *Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS)*. Communication affichée présentée au congrès de l'European Association for Behavioural And Cognitive Therapies (EABCT) 2022: Re-Thinking CBT: providing strategies for a new way of living, Barcelone, Espagne.
- **Lasson, C.**, Rousseau, A., Vicente, S., Goutaudier, N., Romo, L., Roncero, M., & Barrada, J.R. (2022, décembre). *Évaluation psychométrique de la version française de la Teruel Orthorexia Scale (TOS)*. Communication affichée présentée au congrès de l'Association Française de Thérapie Comportementale et Cognitive (AFTCC) 2022, Paris, France.

Clotilde Lasson^{1*}, Amélie Rousseau¹, Siobhan Vicente², Nelly Goutaudier², Lucia Romo³, María Roncero⁴ and Juan Ramón Barrada⁵

Abstract

As no French validated measurement tool distinguishing healthy orthorexia (HeOr) from orthorexia nervosa (OrNe) currently exists, this study aimed at examining psychometric properties of the French version of the Teruel Orthorexia Scale (TOS). A sample of 799 participants (Mean [SD] age: 28.5 [12.1] years-old) completed the French versions of the TOS, the Düsseldorf Orthorexia Skala, the Eating Disorder Examination-Questionnaire, and the Obsessive–Compulsive Inventory-Revised. Confirmatory factor analysis and exploratory structural equation modeling (ESEM) were used. Although the bidimensional model, with

OrNe and HeOr, of the original 17-item version showed an adequate fit, we suggest excluding items 9 and 15. The bidimensional model for the shortened version provided a satisfactory fit (ESEM model: CFI = .963, TLI = .949, RMSEA = .068). The mean loading was .65 for HeOr and .70 for OrNe. The internal consistency of both dimensions was adequate ($\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .81$). Partial correlations showed that eating disorders and obsessive–compulsive symptomatology measures were positively related to OrNe and unrelated or negatively related to HeOr. The scores from the 15-item French version of the TOS in the current sample appears to present an adequate internal consistency, pattern of associations in line with what was theoretically expected, and promising for differentiating both types of orthorexia in a French population. We discuss why both dimensions of orthorexia should be considered in this area of research.

Keywords Orthorexia, Healthy orthorexia, Orthorexia nervosa, Psychometric evaluation, Healthy eating, Eating disorders, Obsessive–compulsive disorders

Plain English summary

Orthorexia ('right appetite', from the Greek) covers two dimensions: (1) orthorexia nervosa (OrNe), a strong preoccupation with healthy diet with negative emotional, cognitive, and/or social consequences while trying to approach this goal and when the eating behavior deviates from it, and (2) healthy orthorexia (HeOr), which can be defined as a healthy interest in diet, (self-assessed) healthy behavior with regard to diet and eating healthily as part of one's identity. OrNe is not yet indexed into mental disorder classifications. Some prominent measurement tools in the area of orthorexia present important limitations: it is unclear if they validly assess OrNe and they do not tap HeOr by design. To overcome these limitations, a promising self-reported instrument was developed: the Teruel Orthorexia Scale (TOS), a bidimensional questionnaire whose structure has been replicated in different samples. Our research based on 799 participants aimed to adapt this instrument in a French speaking population. The results revealed that the French version of the TOS is an empirically supported tool allowing to differentiate both forms of orthorexia (healthy and nervosa). It also suggests that OrNe is associated with psychopathological symptoms while opposite patterns were found with HeOr. We discuss the importance of measuring both orthorexia dimensions.

1. Background

The health benefits of a healthy lifestyle including healthy eating and physical activity have been widely reported over the years (e.g., World Health Organization, 2016). However, for some individuals, ideas and interest about healthy eating might become pathological, reaching an obsession with eating they deem healthy, feeling guilty or punishing themselves for deviating from their own standards of healthy diet, and with negative impact in their social lives (orthorexia nervosa, OrNe; Cena et al., 2018). For other individuals, their interest in healthy eating is not associated with psychological or social problems (healthy orthorexia, HeOr) and may even be negatively associated with pathological symptoms (Barrada & Roncero, 2018).

Thus, orthorexia ('right appetite', from the Greek) comprises two dimensions that can and should be differentiated. While HeOr can be defined as an healthy interest in diet, (self-assessed) healthy behaviors with regard to diet, and eating healthily as part of one's identity (Barrada & Roncero, 2018; Depa et al., 2019), the core element of OrNe is a strong preoccupation with healthy diet with negative emotional, cognitive, and/or social consequences while trying to approach this goal and when the eating behavior deviates from it. As Roncero et al. (2021) noted: "HeOr is not a measure of healthy eating and, thus, should not be confused with it. People who score high on HeOr indicate that healthy eating is an important part of their life and that they devote time and energy to it. However, their beliefs about healthy eating may not coincide with an objective or real definition of healthy eating. For this reason, the two terms should not be taken as synonyms because a high score on HeOr does not necessarily mean that the person is eating healthily" (p. 2).

Despite that these past few years, several diagnosis criteria proposals were made for OrNe (with converging criteria being: obsessional preoccupation with eating "healthy food", severe distress, impairment of physical health, and impairment of social, academic or vocational functioning) (Barthels et al., 2015b; Bratman, 2017; Bratman & Knight, 2001; Dunn & Bratman, 2016; Moroze et al., 2015), OrNe is not yet indexed into mental disorder classifications and the way to categorize it is currently under debate. Some studies suggested that OrNe belongs to the eating disorder spectrum (Bartel et al., 2020; Brytek-Matera, 2012; Ryman et al., 2019), considering that OrNe is close to anorexia nervosa, bulimia nervosa, and avoidant/restrictive food intake disorder. Others have indicated the overlap with obsessive-compulsive and related disorders or even with anxiety disorders (Brytek-Matera, 2012; Ryman

et al., 2019). The convenience of distinguishing OrNe from other eating disorders have even been questioned. Meule et Voderholzer (2021) considered that “it is not clear whether ON [OrNe] is actually a diagnostic entity that is distinct from established eating disorders” (p. 1). From our point of view, Meule and Voderholzer (2021) confused overlap (and it is clear that OrNe and other eating disorders are related) with equivalence. For instance, Zickgraf and Barrada (2022) showed that, controlling for a general measure of eating disorders, orthorexia scores were still related to additional variables. Bhattacharya et al. (2022) have argued that OrNe is a "new cultural manifestation" of anorexia nervosa. From our point of view, current knowledge about OrNe allows us to discard this. Indeed, while a key diagnostic criteria of anorexia nervosa in the DSM-5 (American Psychiatric Association et al., 2013) is a significant low body weight, previous research has shown that OrNe is unrelated to body mass index (e.g., Barrada & Roncero, 2018; Depa et al., 2019). This lack of consensus on its categorization or even the need for a new diagnosis is notably due, at least in part, to methodological issues in the orthorexia field with important validity problems with some prominent measurement tools (Missbach & Barthels, 2017).

So far, the main focus of the orthorexia literature has been on its pathological form, OrNe (Barthels et al., 2019 ; for a review see: McComb & Mills, 2019), with the majority of studies relying on the ORTO-15 (or any of its derivatives) to assess the construct (Donini et al., 2004, 2005). The ORTO questionnaires have been widely criticized (Barnes & Caltabiano, 2017; Dunn et al., 2017; Meule et al., 2020; Missbach & Barthels, 2017; Reynolds, 2018; Roncero et al., 2017). Donini et al. (2005) pointed out the lack of efficiency of their questionnaire to distinguish healthy eating behaviors from a pathological obsessive interest in healthy eating. Although a shorter and revised version has been proposed (Rogoza & Donini, 2020), the main problem is still present: questionable content validity. Consider the items "In the last three months, did thoughts of food make you feel guilt, ashamed and anxious?" and "Does thinking about food excessively worry you for more than three hours a day?". "Thinking about food", clearly, is not tapping specifically concerns about healthy eating. Those items could be considered as a general measure of eating disorders, while the ORTO is supposed to measure OrNe. The results of studies based on these assessment tools should then be considered with caution.

To overcome these limitations, several other measurement tools were developed for the assessment of OrNe, mainly, including the Eating Habits Questionnaire (EHQ; Gleaves et al., 2013) and the Düsseldorf Orthorexia Skala (DOS; Barthels et al., 2015a). Both share a

characteristic: their internal structure is unclear. It is not clear how many dimensions are being assessed or how to interpret those factors. For the EHQ, solutions of two (Hallit et al., 2021), three (Gleaves et al., 2013; Godefroy et al., 2020; Oberle et al., 2017), and four factors (Halim et al., 2020) have been proposed. Even for solutions with the same number of factors, neither the distribution of items by factors, nor their theoretical interpretation were equivalent. While Meule et al. (2020) found an adequate fit for the original structure on a German sample of 511 participants, no other models were tested. Regarding the DOS, data did not support the presence of a single dimension for the Arabic (Hallit et al., 2021), German (Barthels et al., 2015a), English (Chard et al., 2019), and Chinese (He et al., 2019) versions of the scale. The model fit of the unidimensional solution in the French sample was not satisfactory (Lasson et al., 2021). In the Spanish version, a unidimensional model offered an excellent fit (Parra-Fernández et al., 2019). For the Chinese version, a three-dimensional solution was considered, with factors labeled Obsession in Healthy Food, Adherence to Nutrition Rules, and Emotional Symptoms. Meule et al. (2020) obtained a good fit for the unidimensional solution. Although multidimensional solutions have been commonly proposed for the EHQ and the DOS, it has been a common practice to compute just a single total score. For a recent review showing how these instruments have been used, see Atchison and Zickgraf (2022).

Importantly, the DOS and the EHQ could be inadvertently covering both HeOr and OrNe, while they are supposed to be only assessing OrNe (Hallit et al., 2021; Zickgraf et al., 2019). Two specific items from the EHQ: "I am more informed than others about healthy eating" or "Eating the way I do gives me a sense of satisfaction" are currently considered as indicative of OrNe. Nevertheless, why they should be considered as indications of OrNe is difficult to see, but it has been used as such in many publications. The same can be said about these items from the DOS: "Eating healthy food is more important to me than indulgence/enjoying the food" or "I have certain nutrition rules that I adhere to". Considering that the pattern of associations of OrNe and HeOr with third variables is different, combining items from these two dimensions into a single total score can lead to results difficult to interpret.

Recently, Barrada and Roncero (2018) proposed to no longer consider orthorexia as a unidimensional construct but as a bidimensional construct with not only a pathological form (OrNe; e.g., "I feel overwhelmed or sad if I eat food that I consider unhealthy") but also an healthy form (HeOr; e.g., "I think that my way of eating is healthier than that of most people") and developed a promising self-report questionnaire called the Teruel Orthorexia Scale (TOS). As Atchison and Zickgraf (2022) noted, "the Teruel Orthorexia Scale (TOS) is the only one of

the currently available self-report instruments designed to measure both healthy orthorexia and orthorexia nervosa, and differentiate between these two constructs". Its structure has been replicated across different samples and languages.

The TOS was originally developed in Spanish (Barrada & Roncero, 2018) showing a clear bidimensional structure and its scores indicated good psychometric properties. Further studies have examined the psychometric properties of the bidimensional model of orthorexia in German (Strahler et al., 2020), Arabic (Mhanna et al., 2021), Portuguese (da Silva et al., 2021), and English (Chace & Kluck, 2021; Zickgraf & Barrada, 2022) versions and cross-validated the Spanish version (Barthels et al., 2019). While some studies have used exploratory techniques (Barrada & Roncero, 2018 [CFI = .965, TLI = .954, RMSEA = .060]; Barthels et al., 2019 [two samples; CFI = .960/.973, TLI = .947/.965, RMSEA = .070/.062]; Chace & Kluck, 2021 [CFI = .98, TLI = .97, RMSEA = .06]; Zickgraf & Barrada, 2022 [two samples; CFI = .978/.967, TLI = .971/.957, RMSEA = .078/.057]), others have used confirmatory factor analysis (CFA) (Strahler, 2020 [CFI = .873, RMSEA = .085]; Mhanna et al., 2021 [CFI = .954, RMSEA = .069]; da Silva et al., 2021 [CFI = .94, TLI = .93, RMSEA = .09]).

It can be seen that those studies using exploratory techniques have obtained better model fits. CFAs present an important drawback with respect to exploratory analysis to test the internal structure of a questionnaire. In the most common way of using CFAs, secondary loadings are fixed to zero, that is, there are many parameters fixed to a value different from what is plausible in the population, as we can expect secondary loadings to be minor, but not nul. These restrictions imply that the recovered parameters, both loadings and interfactors correlations, are distorted. Although the presence of relevant cross-loadings can be detected via modification indices in CFA, it is common that researchers do not check relevant areas of localized strain if an adequate fit for the overall model is found (Brown, 2015). Exploratory techniques tend to show a better model fit, but, more importantly, can better recover the underlying structure (Asparouhov & Muthén, 2009).

The original validation study of the TOS (Barrada & Roncero, 2018) indicated the presence of minor, but not zero, secondary loadings. Overall, the different studies have supported the internal structure of the TOS, although with some nuances. In their English validation, Chace and Kluck (2021) suggested removing Item 13 ("I would rather eat a smaller portion of healthy food than get full from food that may not be healthy"), as it showed poor differentiation between the factors, and found that Item 9 ("My concern with healthy eating

takes up a lot of my time”) presented a secondary loading over .30. Zickgraf and Barrada (2022) worked with two samples, both English versions of the TOS. High secondary loadings (over |.30|) were found for Item 1 (“I feel good when I eat healthy food”; sample 1), Item 9 (sample 2), and Item 15 (“I try to convince the people in my life to follow my healthy eating habits”; sample 1), with almost equal loadings for this item in sample 2. In a Lebanese sample, Mhanna et al. (2021), with a CFA, found that OrNe and HeOr factors showed a high correlation ($r = .74$), much higher than that found with exploratory techniques (e.g., $r = .43$ in Barrada & Roncero, 2018 ; $r = .44/.49$ in Barthels et al., 2019). As we have said, fixing the secondary loadings to zero can distort the recovered interfactor correlations. These results stress that using exploratory approaches is more adequate, as there are reasons to expect secondary loadings clearly different from zero. Regarding exploratory approaches for testing the internal structure of questionnaires, we direct readers to several publications (Marsh et al., 2010, 2014; Sánchez-Carracedo et al., 2012; Steenkamp & Maydeu-Olivares, 2023).

The studies using the TOS have provided evidence for the validity of the two-dimensionality of orthorexia. Both factors relate differently and oppositely to various psychopathology variables, suggesting that HeOr is not an "attenuated" OrNe factor or a risk factor, but that they are different dimensions. Studies have shown that HeOr was positively correlated with well-being, positive affect, dispositional mindfulness, and negatively correlated with psychopathology (eating disorders, obsessive-compulsive disorder, negative affect, antagonism, disinhibition, psychoticism) and BMI. On the other hand, OrNe was positively correlated with psychological distress, restrained eating, obsessive-compulsive symptoms, perfectionism, low physical self-esteem, negative affect, detachment, disinhibition, psychoticism, weight control, health anxiety, substance use, sedentary behavior, and negatively correlated with dispositional mindfulness (Barrada & Roncero, 2018; Barthels et al., 2019; Chace & Kluck, 2021; Depa et al., 2019; Roncero et al., 2021; Strahler, 2021; Zickgraf & Barrada, 2022). HeOr was also positively correlated with nutrition knowledge and diet quality whereas OrNe was negatively correlated with nutrition knowledge and diet quality (Zickgraf & Barrada, 2022). These patterns of associations were clearer when partial correlations were used, that is, when the partial overlap between OrNe and HeOr (Pearson correlation between both dimensions typically in the range .30–.50) was statistically adjusted. In addition, a high stability of both dimensions has been observed over an 18-month interval, with a correlation above .70 for both factors (Barrada & Roncero, 2018).

So far, the TOS has not been translated and validated in French language population. The aim of this study was thus to adapt the TOS into French language and examine its psychometric properties (internal consistency, factor structure, convergent and discriminant validities) in French population as to provide an empirically supported tool to start studying orthorexia both in its healthy and pathological forms in French population, without considering all healthy eating concerns as pathological. Participants also provided responses to another measure of orthorexia, the DOS (Lasson et al., 2021). To assess the convergent and discriminant validities of the translated TOS, participants also completed measures of eating disorders (Eating Disorder Examination-Questionnaire; Carrard et al., (2015)) and obsessive-compulsive disorder (OCD; Obsessive-Compulsive Inventory-Revised; Zermatten et al., (2006)) in their French versions. Our first hypothesis was that the French version of the TOS would replicate the bidimensional structure of the original Spanish TOS as well as equivalent psychometric properties. In line with Zickgraf and Barrada (2022), as a second hypothesis, we expected that both TOS subscales would be correlated with the DOS, but with OrNe to a greater extent. Although the internal structure of the DOS is unclear, we considered relevant to include this widely used measure in our study to try to understand what this instrument is measuring, as several studies have used it. As prior findings evidenced that DOS items can be a mixture of OrNe and HeOr, the correlations of TOS scores and DOS scores cannot be interpreted as an evidence of convergent validity. Based on results of previous studies using the TOS, our third hypothesis was that OrNe would be positively linked to eating and obsessive-compulsive symptomatology, whereas HeOr would be negatively associated with these variables, after adjusting for the other orthorexia dimension. Recently Atchison and Zickgraf (2022) noted that "[...] the true nature of the relationship between ON [OrNe] and eating disorder symptoms may be best explored in study designs that control for the closely related construct of healthy orthorexia. Because of this, statistically adjusting for healthy orthorexia may be necessary to accurately describe the relationship between ON [OrNe] and disordered eating" (p. 2). The convenience of adjusting for the other orthorexia dimension to more accurately describe the associations with different variables can and should be generalized. By doing so, associations are easier to interpret, as the shared variance between OrNe and HeOr is removed. Different studies that have simultaneously considered OrNe and HeOr have used this approach (e.g., Barrada & Roncero, 2018; Hallit et al., 2021; Roncero et al., 2021; Zickgraf & Barrada, 2022). Partial correlations were preferred over other analytical alternatives as regression models — perhaps more commonly reported — for several reasons. First, Pearson and partial correlations are more easily comparable, as both can range from -1 to $+1$, while this is not the case for

regression coefficients (even for standardized coefficients). Second, partial correlations and regression coefficients lead to the same inferential conclusions, as both share identical *p*-values.

2. Materials and Methods

2.1. Participants and procedure

Participants were recruited via an advertisement posted on Facebook groups of university students and people with an interest in food and nutrition. Potential participants were provided with the link to an online questionnaire and were told that if they agreed to take part in the study, they would be asked to answer questionnaires about their eating habits. Only those who gave their informed consent and were aged 18 or above could access the questionnaire. Participants involved in this study did not receive any compensation. The questionnaires were anonymous. The study protocol was approved by the ethics committee of the University of Lille (Registration number 2021-514-S95).

Participants of this sample were 799 adults (82.9% women, 16.1% men, and 1.0% other genders) aged between 18 and 73 years ($M = 28.5$, $SD = 12.1$). Based on self-reported height and weight, mean BMI was 23.5 ($SD = 4.96$). The majority of participants were students (58.8%).

2.2. Measures

2.2.1. Socio-demographic data.

Participants provided information about their gender, age, height, weight, and professional status.

2.2.2. Teruel Orthorexia Scale (TOS; Barrada & Roncero, 2018).

This scale assesses orthorexia in two separate dimensions: OrNe (8 items; e.g., “Thoughts about healthy eating do not let me concentrate on other tasks”) and HeOr (9 items; e.g., “My interest in healthy food is an important part of the way I am, of how I understand the world”). Responses are scored on a four-point Likert scale ranging from 0 = *completely disagree* to 3 = *completely agree*.

In the current study, the TOS was translated from Spanish to French by bilingual researchers, using a back-translation procedure (Brislin, 1970). The TOS was first translated into French and then back translated into its original language. The expert committee worked on the discrepancy between the original version and the back translated version to ensure the

equivalence of the construct between the original version and the French version as well as the correct understanding of all items. Fifteen freshmen were asked to complete the TOS. Once they responded, a discussion was initiated to ensure that all questions were understandable and that none were problematic. We did not receive any feedback on the meaning and structure of the items.

The final version of the French version of the TOS is presented as an Appendix. Item wording in English can be seen in Table 2.

2.2.3. *Düsseldorf Orthorexia Skala (DOS; Barthels et al., 2015a).*

This 10-item scale assesses orthorexic eating behaviors. Responses are scored on a four-point Likert-scale ranging from 1 = *this does not apply to me* to 4 = *this applies to me*. An example item is “If I eat something I consider unhealthy, I feel really bad”. Higher scores are interpreted as indicative of higher levels of orthorexic eating behaviors. We used the French version (Lasson et al., 2021). Cronbach’s α value was .84 in this study. As we have noted in the introduction, the internal structure and interpretation of DOS scores are not completely clear.

2.2.4. *Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994).*

This questionnaire assesses symptoms of eating disorders over the past 4 weeks. Items are scored on two seven-point scales ranging from 0 = *no days* to 6 = *every day* or from 0 = *not at all* to 6 = *markedly*, and are divided into 4 subscales: Restraint (5 items), Eating Concern (5 items), Weight Concern (5 items), and Shape Concern (8 items). Higher scores indicate higher eating or body concerns or behaviors. We used the French version (Carrard et al., 2015). In this study, Cronbach’s α values were .83 for Restraint; .78 for Eating concern; .81 for Weight Concern, and .91 for Shape concern.

2.2.5. *Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002).*

This 18-item self-report scale assesses obsessive-compulsive symptoms. Each item (e.g., “I get upset if others change the way I have arranged things”) is scored on a five-point Likert scale ranging from 0 = *not at all* to 4 = *extremely*. We used the French version (Zermatten et al., 2006). Cronbach’s α was .89 in this study.

3. Data analysis

The internal structure of the TOS scores was analyzed with a CFA and an Exploratory Structural Equation Model (ESEM) (Asparouhov & Muthén, 2009). ESEM is a technique that,

unlike CFA, estimates all secondary loadings and, unlike exploratory factor analysis, allows the incorporation of correlated uniquenesses. Previous analyses have found that, although the internal structure of the TOS was clear and theoretically interpretable, secondary loadings cannot be expected to be equal to zero. In cases like this, a CFA would distort the recovered parameters and could achieve inadequate model fit that could lead to the rejection of theoretically useful and interpretable models. If an adequate model fit was reached, fixing to zero parameters whose value is not null in the population would still distort the recovered parameters. We used CFA to show the limitations of this analytical approach in cases like the TOS scores. Previous validation studies of this scale have used CFAs, with the exposed limitations. We consider that one of the reasons for doing so may be that ESEM is not still well-known in this area of research. If we only computed ESEM analysis (although this would be a reasonable psychometric approach), we would miss the opportunity to show the comparison between these two approaches. For comparability, we also tested a unidimensional model for the DOS scores. (For unidimensional models CFA and ESEM are equivalent). We defined a single factor as this has been the standard interpretation of this scale. As we used a four-point Likert scale and responses should be considered as ordinal (Finney & DiStefano, 2013), models were analyzed using robust weighted least squares (WLSMV estimator in *MPlus*). Geomin rotation was used. According to conventional cut-offs (Hu & Bentler, 1999), comparative fit index (CFI) and Tucker Lewis index (TLI) with values greater than .95 and RMSEA less than .06 were indicative of a satisfactory fit. It should be noted that these cutoffs were developed for CFAs with continuous responses, so these values should be interpreted with caution (Xia & Yang, 2019). Additionally, these cut-off values should be considered as rough guidelines and not interpreted as “golden rules” (Marsh et al., 2004). Local fit was evaluated using modification indices. Internal consistencies of the TOS scores for both dimensions were computed with Cronbach's alpha.

We computed descriptive statistics (means, standard deviations, skewness, and kurtosis) and correlations between the two orthorexia dimensions and the six additional variables (DOS scores, four EDE-Q scores, and OCI-R score). We present Pearson correlations for all the bivariate associations. We compared the correlation sizes for the six additional variables and the two orthorexia factors with Hittner, May, and Silver's technique (Hittner et al., 2003), a modification of Dunn & Clark's z (1969), that is, we computed if the subtraction of the correlations with OrNe and HeOr were different from zero. Considering that OrNe and HeOr can be expected to be partially overlapped, we computed partial correlations for all the

associations between orthorexia and other variables while controlling for the other orthorexia dimension. By doing so, we expected to better assess the associations of HeOr (or OrNe) with the six psychopathological indicators while controlling for OrNe (or HeOr). The analyses were performed with MPlus 8.4 and R 4.1.1.

4. Results

4.1.1. Internal structure and reliability

Results of model fit for the different models can be found in Table 1. As we anticipated, the model fit of the CFA for the TOS scores was clearly inadequate (CFI = .881, TLI = .863, RMSEA = .106). This model was greatly improved when scores were modeled with an ESEM, that is, when cross-loadings were also estimated (CFI = .948, TLI = .932, RMSEA = .075), although fit was still below commonly used cut-off points. As can be seen in Table 2, in this model each item presented its higher loading in the intended factor and all cross-loadings could not be considered as relevant ($\leq .30$), but the one for Item 9 (cross-loading = 0.40). We decided to remove this item for two reasons: first, empirical, given that cross-loading; second, theoretical. While concern with healthy eating is a core element of OrNe, devoting long time is not, as indicated by the fact that Item 2 ("I spend a lot of time buying, planning, and or/preparing food so my diet will be as healthy as possible") clearly loads in HeOr.

The higher modification index (MI = 108.4) in this model indicated that model fit would be improved if we added the correlation of item uniquenesses from Item 14 ("I avoid eating with people who do not share my ideas about healthy eating") and Item 15. These two items belong to different factors, and we could not find any theoretical justification –apart from the general reference to 'people'– for the incorporation of this new parameter. Considering that Item 15 has been found to be problematic in previous analysis of the TOS (Zickgraf & Barrada, 2022), we decided to remove that item. By doing so, we avoided incorporating correlated uniquenesses without any a priori expectation and theoretical justification for doing so.

For the shortened TOS, without Item 9 and Item 15, model fit was improved, although with TLI and RMSEA results slightly over the cut-point (CFI = .963, TLI = .949, RMSEA = .068). As no modification index clearly stood out (maximum MI = 25.3), we considered that no respecification of the model was to be considered. The loadings in this model basically followed what was expected. For HeOr, the mean loading was 0.65 (maximum = 0.96, "I mainly eat foods that I consider healthy"; minimum = 0.46, "I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy"). For OrNe, the mean loading was 0.70

(maximum = 0.86, "If, at some point, I eat something that I consider unhealthy, I punish myself for it"; minimum = 0.52, "I avoid eating with people who do not share my ideas about healthy eating"). The mean unsigned cross-loading was small, 0.13, with a maximum 0.28 for Item 7 ("I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy").

For both the initial TOS and final versions the latent correlation between HeOr and OrNe was the same, .32. Importantly, the correlation between the initial and final versions was .99 for both HeOr and OrNe. The internal consistency of both TOS dimensions was adequate (initial version: $\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .83$; shortened version: $\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .81$).

In accordance with previous results, the fit of the unidimensional model of the DOS scores was clearly inadequate (CFI = .877, TLI = .842, RMSEA = .152).

4.1.2. Descriptives and associations with other variables

Table 3 shows the descriptive statistics and the associations among the different variables. As could be expected, the mean of HeOr was higher than for OrNe. Also, HeOr presented a more symmetrical shape than OrNe, with a positive skewness for the latter.

Both TOS dimensions presented a positive correlation with DOS score, with TOS OrNe showing a higher association ($r = .57$ with TOS HeOr; $r = .73$ with TOS OrNe). While HeOr presented small correlations with the different EDE-Q and OCI-R scores ($M_{|r|} = .07$, minimum = .02, maximum = .24; none statistically significant, but the latter), the associations with OrNe were much higher ($M_{|r|} = .43$, minimum = .31, maximum = .52; all statistically significant).

Associations between DOS, EDE-Q and OCI-R with TOS showed significant differences when comparing the coefficients found for HeOr and OrNe [$r(\text{variable}, \text{OrNe}) - r(\text{variable}, \text{HeOr})$], that is, all the measures indicative of disorders were more related with OrNe than with HeOr. The size of these differences ranged from .16 for DOS to .50 for Eating Concern, with all $ps < .001$.

When controlling for the other orthorexia dimension, the pattern of partial correlations for HeOr presented interesting differences with respect to Pearson correlations (see Table 3). While the association with DOS scores was reduced from .57 to .44, the partial correlation still indicated a relevant overlap. For EDE-Q and OCI-R scores, the only positive and statistically significant Pearson correlation was now a near-zero and non-significant partial correlation (from .24 to .05) and all the other near-zero Pearson correlations showed then negative and

statistically significant partial association in the range $[-0.24, -0.17]$. With respect to OrNe, the association with DOS scores was slightly reduced when controlling for HeOr (from .73 to .66). The partial correlations with EDE-Q and OCI-R scores increased for all variables except for Restraint.

5. Discussion

To date, several orthorexia measurement tools have been translated and validated in French language (i.e., the ORTO-15, Babeau et al., 2019; the EHQ, Godefroy et al., 2020; and the DOS, Lasson et al., 2021). However, all those instruments, arguably, present several limitations (Barnes & Caltabiano, 2017; Barthels et al., 2015a; Chard et al., 2019; Dunn et al., 2017; Gleaves et al., 2013; He et al., 2019; Lasson et al., 2021; Missbach & Barthels, 2017; Oberle et al., 2017; Reynolds, 2018; Roncero et al., 2017). There is evidence that the DOS and the EHQ, simultaneously, tap both OrNe and HeOr (Hallit et al., 2021; Zickgraf & Barrada, 2022), but it is still common practice in the area of orthorexia to compute total scores for those scales (see Atchison and Zickgraf (2022) for a review about the associations of those scores with other eating disorders).

In comparison, the TOS presents several advantages. First, it explicitly covers the healthy side of orthorexia. Second, the validity of its scores seems, up to now, clearer. The aim of the current study was thus to examine psychometric properties of the French version of the TOS. To the best of our knowledge, this is the first study proposing a French validation of a questionnaire taking into account both the healthy and pathological forms of orthorexia.

One would expect OrNe and HeOr to represent a continuum, ranging from no interest in healthy eating to an important negative impact of deviance from own healthy eating standards, with an optimal interest as a middle point. However, as noted in previous studies (e.g., Barrada & Roncero, 2018), these two factors can and should be separated. In this study, for both the initial TOS and final versions the latent correlation between HeOr and OrNe was the same, that is .32. Comparing the correlations showed with both dimensions, they are very different and opposite for most factors, mainly when controlling for the other orthorexia dimension (Depa et al., 2019; Roncero et al., 2021; Strahler, 2021; Zickgraf & Barrada, 2022). A person can score high on HeOr without necessarily experiencing distress or interference in their life. This is very important, as it indicates that interest for healthy eating and considering that life-style option as part of own identity is not associated to psychopathology. In fact, HeOr negatively correlates with psychopathology and positively correlates with positive affect

(Barrada & Roncero, 2018; Barthels et al., 2019). This pattern of associations can be seen in the results found in the present study with the French version of the TOS.

Unlike prior validation studies (da Silva et al., 2021; Mhanna et al., 2021; Strahler, 2021) exploring the bidimensional structure of the TOS using CFA, we used an ESEM allowing estimation of secondary loadings and correlated uniquenesses. As anticipated, the model fit of the CFA for the TOS scores was clearly inadequate and it was greatly improved when using ESEM. Our general advice would be to avoid CFA when cross-loadings can be expected (and this is more the norm than the exception), so exploratory approaches should be favored. Similarly, the CFA conducted on the DOS scores showed an unsatisfactory fit, questioning the unidimensional structure of the measure (Lasson et al., 2021). Based on ESEM, we obtained a 15-item two-factor solution that provided a good fit with the data and clearly replicated the bidimensional structure found in several TOS validation studies (Barrada & Roncero, 2018; Chace & Kluck, 2021; da Silva et al., 2021; Mhanna et al., 2021; Strahler, 2021; Zickgraf & Barrada, 2022). Nevertheless, while the Portuguese (da Silva et al., 2021), Arabic (Mhanna et al., 2021), and one of the English validation studies (Zickgraf & Barrada, 2022) replicated a 17-item version of the TOS, which was consistent with the original Spanish version (Barrada & Roncero, 2018), we chose to retain a 15-item solution and removed Item 9 and Item 15. Regarding Item 9, cross-loadings were already found in other validation studies (Chace & Kluck, 2021; Zickgraf & Barrada, 2022). On a theoretical standpoint, we may consider that while “concern with healthy eating” is a core component of OrNe, it can also cover several activities such as planning, shopping or cooking already assessed by Item 2, which is clearly on the HeOr factor. Another important point to emphasize is that this time-consuming component might be considered subjectively depending on people and Item 9 does not specify an amount of time above which a pathological behavior could be considered. Thus, the cross-loading of this item could be explained by its non-specific and vague nature. Regarding Item 15, an English validation study (Zickgraf & Barrada, 2022) has already questioned its relevance given that reverse patterns of loadings were observed between the two samples recruited in the study. Thus, trying to convince others to consume healthy food would not be specific to one type of orthorexia, suggesting the need to focus on motivations underlying eating habits that could play a part in the development of each type of orthorexia.

Regarding scale properties, in line with previous studies (Barrada & Roncero, 2018; Chace & Kluck, 2021; da Silva et al., 2021; Mhanna et al., 2021; Strahler, 2021; Zickgraf & Barrada, 2022), the OrNe and HeOr subscales showed only moderate latent intercorrelations (r

= 0.32). The internal consistency of both TOS dimensions was adequate (initial version: $\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .83$; shortened version: $\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .81$) and of comparable magnitude of values reported in the original Spanish version (Barrada & Roncero, 2018) as well as in other TOS validation studies (Chace & Kluck, 2021; Mhanna et al., 2021; Strahler, 2021), suggesting that this version of the TOS is an empirically supported tool to explore orthorexia both in its healthy and pathological forms in French samples.

Although both TOS subscales were found to be associated with another measure of Orthorexia Nervosa –the DOS–, providing support for convergent validity, the strongest correlation was observed with the OrNe subscale ($r_{\text{DOS-OrNe}} = .73$ vs. $r_{\text{DOS-HeOr}} = .57$). As was noted in previous research (Zickgraf & Barrada, 2022), if the DOS was a pure marker of OrNe, that is, it was assessing other constructs to a large degree, controlling for TOS-OrNe, TOS-HeOr would be minimally correlated with the DOS. We did not find such associations. This result, combined with the unidimensional model fit with these data and previously reported data, indicates that the DOS is a measure which should be further improved.

Regarding the relationships with measures of disordered eating behaviors and obsessive-compulsive symptoms, as predicted, HeOr and OrNe showed opposite patterns of correlations, which is in line with previous validation studies (Barrada & Roncero, 2018; Zickgraf & Barrada, 2022). As expected, the correlation between HeOr and obsessive-compulsive symptoms (OCI-R) was near-to-zero while it was significant but moderate with OrNe. Interestingly, when controlling for the other dimension, the OCI-R-HeOr partial correlation became significant but negative, however small, with the reverse pattern for the OCI-R-OrNe that slightly increased. These results suggest that OrNe and OCD share common clinical manifestations. According to the literature, the overlapping symptoms might be obsessions, preoccupations specifically oriented towards healthy eating, a considerable amount of time devoted to obsessions and preoccupations (planning, shopping, preparation), and an important rigidity concerning certain rules leading to guilt if not followed.

Concerning the relationships between HeOr and eating disorder symptoms (EDE-Q four subscales: Restraint, Eating Concern, Weight Concern and Shape Concern), the correlations were non-significant except for one –Restraint– which was small, whereas the correlations between EDE-Q subscales and OrNe were all much higher and statistically significant. More interestingly, the partial correlations between HeOr and EDE-Q subscales became all significant and negative, yet small, when controlling for OrNe, except with the Restraint

subscale that became a near-to-zero and non-significant partial correlation. On the contrary, the partial correlations between EDE-Q subscales and OrNe all increased, except for the Restraint subscale that slightly decreased. These results confirm previous findings and the two-dimensional conception of orthorexia (Barrada & Roncero, 2018; Chace & Kluck, 2021; Mhanna et al., 2021; Zickgraf & Barrada, 2022). One important finding is indeed the negative relationships found here between the HeOr dimension and the eating, shape and weight concern symptoms that are core features of eating disorders. Overall, these findings suggest the importance of distinguishing HeOr from OrNe.

As Valente et al. (2022) have pointed, the proposal of OrNe leads to the emergence of a discursive tension: are we pathologizing healthy eating? From our point of view, the researchers in the area of OrNe should acknowledge that we, to some degree, have been “anti-health” and pathologizing healthy eating and healthy life choices. For many years, the main instrument to measure OrNe has been the ORTO-15. Among its items we can find "Are you willing to spend more money to have healthier food?" or "Do you think that on the market there is also unhealthy food?". That is, an economic compromise with healthy food has been used as a marker of a (new proposed) eating disorder. Willing to spend money on health was indicative of pathology. Also, having basic nutritional knowledge (not all what is sold in a market is healthy) has also been used as a marker of eating disorder. As we have already noted, other questionnaires present similar problems. If part of the general public has understood that the proponents of OrNe were trying to pathologize healthy eating (Ross Arguedas, 2020), we should accept that, to some degree, it has been a fault from our research community.

Clearly separating between what is pathological and what is not, between OrNe and HeOr can clarify both constructs. People highly engaged with healthy eating and no pathological approach to healthy eating (high HeOr, low OrNe) will not recognize themselves with the OrNe items of the TOS. We are offering a label for those that could identify with HeOr (healthy interest in diet, self-assessed healthy behavior with regard to diet, and eating healthily as part of one's identity).

From our point of view, the bidimensional structure of orthorexia has been useful to advance the understanding of the topic. First, it has offered a theoretical model that has helped to understand the structure of some commonly used questionnaires in the area. Second, it has clearly shown that some elements that, at a superficial inspection, could be considered as elements of OrNe, in fact, are not, like devoting a long time to prepare food or considering that

our own diet is healthier than that of most people. This helps us to refine how we conceptualize OrNe. A high engagement with healthy eating is not a problem. The disorder is based on feeling guilty, punishing for eating what is considered unhealthy, or social isolation.

Despite several strengths in the current study (sample size, wide age range, data gathered in the general population, accurate statistical analyses, validated tools for exploring convergent and discriminant validities), some limitations need to be acknowledged. Although the study was conducted on a large sample of participants, there is, as for prior validation studies (Chace & Kluck, 2021; Mhanna et al., 2021), an over representation of women (82.9%) which limits the representability of the results. Moreover, professional domains of activities and socioeconomic status were not specifically requested, and such lifestyle-related variables may have a considerable influence on nutrition knowledge and food quality availability. In addition, it is noteworthy that data were collected during the COVID-19 pandemic which might have influenced eating habits and/or general mental health. Finally, the cross-sectional design of the study precludes drawing conclusions about the causality between OrNe and symptoms of eating disorders and obsessive-compulsive disorder.

6. Conclusions

The current study provides additional evidence for a bidimensional conception of orthorexia and suggests that the TOS, in a 15-item version, could be an empirically supported instrument for differentiating both type of orthorexia (i.e., OrNe vs. HeOr) in a French population. To date, the available measurement tools in French language showed some discrepancies and limited psychometric properties (Babeau et al., 2019; Lasson et al., 2021). Beyond such inconsistencies, none of the existing French assessment tools have yet considered a bidimensional approach of orthorexia. Thus, the current validation of the TOS could have important implications for future studies in French speaking populations and could allow the replication of international studies. Regarding clinical implications, our findings suggest the need to provide appropriate psychoeducative information to individuals demonstrating healthy food preoccupation to avoid the development of pathological manifestations. Future studies should include measures of quality of life, distress, motivations, and emotion regulation in order to better characterize the pathological and non-pathological dimensions of orthorexia.

Acknowledgements

We are grateful to Jeanne Danel for her help in back-translating the TOS, and to Clarisse

Morgado, Clémence Bourgeois, Léa Wlodek, Lucie Tricoteaux, and Marie-Aubine Tur for their help in data collection.

Author contributions

CL, AR, SV, NG, LR designed the study, wrote the protocol, and participated in the back translation of the questionnaire. AR and CL wrote the Ethics Committee application form and collected data. CL wrote the first draft of the Introduction and Methods sections. JB conducted statistical analyses and wrote the Data Analysis and Results sections. CL, AR, SV, NG, LR, MR and JB wrote the Discussion and Conclusion sections, revised the first draft, and approved the final manuscript.

Funding

No funds, grants, or other support was received.

Data availability

The data that support the findings of this study are available from the corresponding author (CL), upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the ethics committee of the University of Lille (Registration number 2021–514-S95) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all the participants included in this study.

Consent for publication

All participants were informed that results from this study were going to be published in scientific journals or congress.

Competing interest

The authors declare no competing interests.

Author details

¹Laboratoire CERPPS (Centre d'Etudes Et de Recherches en Psychopathologie Et Psychologie de La Santé), Université Toulouse-Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France.

²Centre de Recherches Sur La Cognition Et L'Apprentissage–CeRCA-(CNRS, UMR 7295) MSHS, Université de Poitiers, 5 Rue Théodore Lefebvre, 86073 Poitiers Cedex 9, France.

³UR4430 CLIPSYD, Université Paris Nanterre; HU Raymond-Poincaré, Inserm CESP 1018 UPS, Nanterre, France.

⁴Departamento de Personalidad, Evaluación y Tratamientos Psicológicos, Facultad de Psicología, Universitat de València, Valencia, Spain.

⁵Departamento de Psicología y Sociología, Universidad de Zaragoza, Zaragoza, Spain.

Received: 6 December 2022

Accepted: 26 February 2023

Published online: 28 April 2023

Table 1.

Goodness of fit indices for the different models.

Models	χ^2	<i>df</i>	CFI	TLI	RMSEA
TOS CFA	1181.3	118	.881	.863	.106
TOS ESEM	565.2	103	.948	.932	.075
TOS ESEM No Items 9 & 15	353.9	76	.963	.949	.068
DOS	683.0	35	.877	.842	.152

Notes: *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; TOS = Teruel Orthorexia Scale; DOS = Düsseldorf Orthorexia Skala; CFA = confirmatory factor analysis; ESEM = exploratory structural equation model. All *p*-values for the χ^2 test were < .001.

Table 2. Item loadings of the initial and final version of the Teruel Orthorexia Scale-French version.

	Initial Version		Final Version	
	HeOr	OrNe	HeOr	OrNe
1. I feel good when I eat healthy food	0.64	0.00	0.65	0.01
2. I spend a lot of time buying, planning, and or/preparing food so my diet will be as healthy as possible	0.72	0.09	0.71	0.08
3. I think that my way of eating is healthier than that of most people	0.84	-0.19	0.83	-0.18
4. I feel guilty when I eat food that I do not consider healthy	-0.01	0.72	0.00	0.73
5. My social relationships have been negatively affected by my concern about eating healthy food	0.18	0.56	0.18	0.57
6. My interest in healthy food is an important part of the way I am, of how I understand the world	0.59	0.23	0.57	0.23
7. I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy	0.47	0.27	0.46	0.28
8. I mainly eat foods that I consider healthy	0.95	-0.18	0.96	-0.17
9. My concern with healthy eating takes up a lot of my time	0.40	0.51	—	—
10. I am concerned about the possibility of eating unhealthy foods	0.21	0.60	0.20	0.59
11. I don't mind spending more money on food if I think it's healthier	0.54	0.02	0.54	0.03
12. I feel overwhelmed or sad if I eat food that I consider unhealthy	-0.01	0.83	0.00	0.84
13. I would rather eat a smaller portion of healthy food than get full from food that may not be healthy	0.51	0.25	0.51	0.27
14. I avoid eating with people who do not share my ideas about healthy eating	0.28	0.51	0.21	0.52
15. I try to convince the people in my life to follow my healthy eating habits	0.46	0.19	—	—
16. If I ever eat something I consider unhealthy, I punish myself for it	-0.05	0.85	-0.07	0.86
17. Thoughts about healthy eating prevent me from concentrating on other tasks	0.03	0.82	0.00	0.82

Notes: HeOr = Healthy Orthorexia; OrNe = Orthorexia Nervosa. Gray shaded cells indicate the factor where the item theoretically belongs. Black shaded cells indicate that the item was removed in the reduced version. Loadings in bold indicate unsigned loadings above $|\lambda| \geq .30$. For both versions, $r_{\text{HeOr, OrNe}} = .32$.

Table 3. Descriptive statistics and correlations.

	Descriptives				Pearson Correlations							Differences in Correlations		Partial Correlations	
	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>K</i>	1	2	3	4	5	6	7	<i>diff r</i>	<i>p diff</i>	HeOr	OrNe
1. TOS HeOr	12.84	4.69	−0.26	−0.22								—	—	—	—
2. TOS OrNe	5.23	3.78	0.88	0.55	.40							—	—	—	—
3. DOS	18.30	5.29	0.72	0.50	.57	.73						.16	<.001	.44	.66
4. EDE-Q Restraint	7.18	7.80	1.07	0.23	.24	.48	.56					.25	<.001	.05	.44
5. EDE-Q Eating Concern	4.37	5.90	1.66	2.14	.02	.52	.44	.54				.50	<.001	−.24	.56
6. EDE-Q Shape Concern	20.80	14.20	0.19	−1.19	.02	.43	.40	.62	.67			.41	<.001	−.19	.46
7. EDE-Q Weight Concern	11.24	8.44	0.37	−1.00	.02	.41	.39	.60	.69	.91		.39	<.001	−.17	.44
8. OCI-R	38.35	12.59	0.55	−0.17	−.05	.31	.24	.19	.39	.29	.27	.36	<.001	−.20	.36

Notes. HeOr = healthy orthorexia, OrNe = orthorexia nervosa, *diff r* corresponds to the difference $r(\text{variable}, \text{OrNe}) - r(\text{variable}, \text{dimension}, \text{HeOr})$, *p diff* corresponds to the statistical significance of that difference. Partial correlations are controlling for the other orthorexia dimension. Bold values correspond to statistically significant associations and differences, $p < .05$.

Étude 4 : Identifying psychological processes involved in orthorexia nervosa: a processual transdiagnostic approach

Cette étude a fait l'objet d'une communication orale dans un open paper symposium lors d'un congrès. La référence détaillée de cette communication orale est la suivante :

- **Lasson C.**, Rousseau, A., Callahan, S., Vicente, S., Goutaudier, N., Romo, L., Roncero, M., & Barrada, J.R. (2023, octobre). *Identifying psychological processes involved in orthorexia nervosa : a processual transdiagnostic approach*. Présentation orale lors du congrès de l'European Association for Behavioural And Cognitive Therapies (EABCT) 2023 : CBT in a Changing World : Migration and Cultural Diversity, Antalya, Turquie.

Clotilde Lasson¹, Amélie Rousseau¹, Stacey Callahan¹, Siobhan Vicente², Nelly Goutaudier², Lucia Romo³, María Roncero⁴, and Juan Ramón Barrada⁵

¹Laboratoire CERPPS (Centre d'Etudes Et de Recherches en Psychopathologie Et Psychologie de La Santé), Université Toulouse-Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France.

²Centre de Recherches Sur La Cognition Et L'Apprentissage–CeRCA-(CNRS, UMR 7295) MSHS, Université de Poitiers, 5 Rue Théodore Lefebvre, 86073 Poitiers Cedex 9, France.

³UR4430 CLIPSYD, Université Paris Nanterre; HU Raymond-Poincaré, Inserm CESP 1018 UPS, Nanterre, France.

⁴Departamento de Personalidad, Evaluación y Tratamientos Psicológicos, Facultad de Psicología, Universitat de València, Valencia, Spain.

⁵Departamento de Psicología y Sociología, Universidad de Zaragoza, Zaragoza, Spain.

Abstract

Purpose The current study aimed at identifying transdiagnostic psychopathological processes (i.e., perfectionism, intolerance of uncertainty, and mental ruminations) that can contribute to explaining the manifestations of ON.

Methods A sample of 511 participants (81.8% female) with a mean age of 37.56 (SD = 15.15) completed the Teruel Orthorexia Scale, the Ruminative Response Scale for Eating Disorders, the Intolerance of Uncertainty Scale, and the Multidimensional Perfectionism Scale.

Results Psychological processes were more strongly correlated with ON than with healthy orthorexia (HeOr). Backward stepwise regression analysis revealed that only the two types of mental ruminations (i.e., brooding and reflection) about eating, body weight and physical appearance as well as personal standards predicted ON.

Conclusions This study suggests that mental ruminations about eating, body weight and physical appearance, as well as personal standards may be involved in the development and maintenance of ON. Clinical implications are discussed.

Keywords Orthorexia nervosa · Healthy orthorexia · Eating Disorders · Processual transdiagnostic approach · Relapse prevention · Healthy eating.

1. Introduction

Orthorexia nervosa (ON) is a strong preoccupation with healthy diet with negative emotional, cognitive, and/or social consequences while trying to approach this goal and when the eating behavior deviates from it (Donini et al., 2022). Barrada and Roncero (2018) proposed to consider orthorexia as a bidimensional construct composed not only by a pathological dimension (ON), but also by a healthy dimension (“Healthy orthorexia”, HeOr, i.e., interest in and tendency to eat healthily). Research has shown that ON is positively associated with indicators of psychopathology, while HeOr was not associated or inversely associated with these indicators (e.g., Barrada & Roncero, 2018; Barthels et al., 2019; Chace & Kluck, 2021).

Many studies investigated risk factors associated with ON (McComb & Mills, 2019), however most of these studies used measurement tools criticized for significant psychometric limitations (Barnes & Calabiano, 2017; Dunn et al., 2017; Meule et al., 2020; Missbach & Barthels, 2017; Reynolds, 2018; Roncero et al., 2017). Results of these studies should then be taken cautiously.

Overlaps between ON and eating disorders (EDs) have been observed in the literature (Goutaudier & Rousseau, 2019; Koven & Abry, 2015; McGregor, 2017). Moreover, studies suggest that ON can be an antecedent or comorbid with an ED; similarly, ON can occur and/or intensify after treatment of EDs (Barthels et al., 2017; Brytek-Matera et al., 2015; Gramaglia et

al., 2017; Kinzl et al., 2006; Segura-Garcia et al., 2015). These studies also suggest that ON could be a risk factor for either the development or the relapse of an ED, and that residual ON symptoms could be responsible for a greater number of relapses in EDs.

Considering the high relapse rate and high mortality rate associated with EDs (e.g., Norring & Sohlberg, 1993), it seems important to investigate the relationship existing between ON and EDs and other associated symptoms, in order to identify and understand the risk factors for relapse in these disorders, and to determine targets for the development of psychotherapeutic interventions based on relapse prevention. From this perspective, we find the transdiagnostic processual approach a particularly interesting way of addressing these issues. Based on a transdiagnostic processual approach, it is likely that biological, social, and circumstantial factors, as well as psychopathological processes (e.g., perfectionism, Oberle et al., 2017), are common and transdiagnostic elements across EDs and ON. This approach, illustrated by the mediating psychological processes model from Kinderman and Tai (2007), stipulates that the influence of biological, social, and circumstantial factors on psychopathological disorders is not direct but mediated by transdiagnostic psychological processes (see Figure 1).

Perfectionism is characterized by the setting of excessively high standards for performance accompanied by overly critical self-evaluation (Frost et al., 1990). According to Fairburn et al. (2003), it is a key factor in the development and maintenance of EDs, since it precedes the onset of the disorder and persists after treatment. Studies of Barnes and Caltabiano (2017) and Oberle et al. (2017) have shown significant associations between perfectionism and ON. However, as these studies used questionnaires with poor psychometric qualities, this link remains to be confirmed.

Intolerance of uncertainty is defined as a « dispositional characteristic that results from a set of negative beliefs about uncertainty and its implications and involves the tendency to react negatively on an emotional, cognitive, and behavioral level to uncertain situations and events. » (Buhr & Dugas, 2009, p.216). Intolerance of uncertainty is frequently observed in EDs (Reilly et al., 2021). Indeed, higher levels of intolerance of uncertainty have been reported in individuals suffering from EDs compared to individuals without EDs (Brown et al., 2017). In AN, intolerance of uncertainty is positively associated to drive for thinness and body dissatisfaction (Frank et al., 2012). High levels of harm avoidance have been reported in individuals showing high levels of ON (Kiss-Leizer & Rigó, 2019), suggesting that a link between ON and intolerance of uncertainty could exist. Indeed, the “harm avoidance”

dimension of temperament is composed of a "fear of uncertainty vs. confidence" sub-dimension (Cloninger et al., 1993). To the best of our knowledge, only one study investigated the link that may exist between ON and intolerance of uncertainty. This study reported that both variables were positively correlated (Giles et al., 2021). However, as ON was assessed using a questionnaire with poor psychometric qualities (i.e., the ORTO-R; Rogoza & Donini, 2020), this link remains to be confirmed.

Mental ruminations are defined as « a stable distress response mode, characterized by repetitive, passive thoughts about the causes and consequences of distress symptoms» (Baeyens, 2016). Mental ruminations about food, weight and appearance are a central feature of EDs, playing a role in the onset and maintenance of the disorders (Nolen-Hoeksema et al., 2007; Rawal et al., 2010). To the best of our knowledge, no studies have investigated mental ruminations in the context of orthorexia. However, several elements lead us to believe that a potential link could exist between mental ruminations and ON. Indeed, ON involves a strong preoccupation with eating behavior that can take the form of obsessive thoughts related to food, its nutritional content, purity, etc. (Donini et al., 2022). These thoughts can be a source of clinically significant distress, guilt or anxiety if self-imposed rules are broken and/or there is confrontation with/ingestion of a food self-assessed as unhealthy (Donini et al., 2022). Mental ruminations about self, food, health, weight or physical appearance may then be present in individuals suffering from ON.

The aim of the current study is to investigate the role of the following psychological processes in ON : mental ruminations, intolerance of uncertainty, and perfectionism, using a bidimensional orthorexia scale with good psychometric properties (i.e., TOS, Barrada & Roncero, 2018; Lasson et al., 2023). As previously discussed, these psychological processes contribute to the development and maintenance of EDs. Due to the commonalities between EDs and ON, it seemed interesting to us to determine whether these processes could also explain the manifestations of ON. Results of this study should allow the identification and the understanding of risk factors associated with these disorders, as well as the development of specific interventions for screening and prevention purposes.

2. Materials and methods

2.1. Participants and procedure

Participants were recruited via an advertisement posted on Facebook groups of university students and people interested in food and nutrition. Potential participants were provided with a link to an online questionnaire taking place on the LimeSurvey platform, and were told that if they agreed to take part in the study, they would be asked to answer a questionnaire about thoughts and beliefs involved in their eating habits. Only those who gave their informed consent and were aged 18 or above could access the questionnaire. The study protocol was approved by the local ethics committee (Comité d'Ethique de la Recherche of Toulouse University, Registration number 2021-459). Participants involved in this study did not receive any compensation. The questionnaires were anonymous.

Participants of this sample were 511 adults (81.21% women) aged between 18 and 91 years ($M = 37.56$, $SD = 15.15$). Based on self-reported height and weight, mean BMI was 24.45 ($SD = 5.63$). The majority of participants were either employees (41.45%) or students (33.99%). Regarding dietary style, the majority of participants considered themselves as omnivorous (55.58%) or flexitarian (33.46%). Other characteristics of participants are shown in Table 1.

2.2. Measures

2.2.1. Socio-demographic data.

Participants provided information about their gender, age, height, weight, professional status, and dietary style.

2.2.2. Teruel Orthorexia Scale (TOS; Barrada & Roncero, 2018).

This scale assesses orthorexia in two separate dimensions: ON (8 items; e.g., “Thoughts about healthy eating do not let me concentrate on other tasks”) and HeOr (9 items; e.g., “My interest in healthy food is an important part of the way I am, of how I understand the world”). Responses are scored on a four-point Likert scale ranging from 0 = *completely disagree* to 3 = *completely agree*. We used the French version (Lasson et al., 2023). In the current study, Cronbach’s α values were 0.82 for HeOr; and 0.79 for ON.

2.2.3. Ruminative Response Scale for Eating Disorders (RRS-ED; Cowdrey & Park, 2011).

This scale assesses mental ruminations about food, weight and appearance in two separate dimensions: Brooding (6 items; e.g., “Think ‘why can't I handle my eating better?’”)

and Reflection tendencies regarding undesired eating behavior and concerns with food consumption (3 items; e.g., “Write down what you think about your eating, weight and/or shape and analyse it”). Responses are scored on a four-point Likert scale ranging from 0 = *almost never* to 3 = *almost always*. Higher score indicates a higher tendency of ruminating. We used the French version (Douilliez et al., 2016). In the current study, Cronbach’s α values were 0.92 for Brooding; and 0.61 for Reflection.

2.2.4. Frost Multidimensionnal Perfectionism Scale (FMPS; Frost et al., 1990)

This scale assesses six dimensions of perfectionism: Concern over Mistakes (9 items; e.g., “If I do not do well all the time, people will not respect me.”), Personal Standards (7 items; e.g., “If I do not set the highest standards for myself, I am likely to end up a second-rate person.”), Parental Expectations (5 items; e.g., “My parents set very high standards for me.”), Parental Criticism (4 items; e.g., “As a child, I was punished for doing things less than perfectly.”), Doubts about Actions (4 items; e.g., “Even when I do something very carefully, I often feel that it is not quite right.”), and Organization (6 items; e.g., “Organization is very important to me.”). Responses are scored on a five-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The global score is computed by adding the total scores of each dimension, except for that of the Organization dimension. We used the French version (Bouvard et al., 2000). In the current study, Cronbach’s α values were 0.91 for Concern over Mistakes; 0.85 for Personal Standards, 0.88 for Parental Expectations, 0.82 for Parental Criticism, 0.78 for Doubts about Actions, and 0.71 for Organization.

2.2.5. Intolerance of Uncertainty Scale (IUS; Freeston et al., 1994)

This scale is a unidimensional scale assessing intolerance of uncertainty in 27 items. An example of item is “Uncertainty stops me from having a firm opinion”. Responses are scored on a five-point Likert scale ranging from 1 = *not at all characteristic* to 5 = *entirely characteristic*. The total score is computed by the addition of all items. Cronbach’s α value was 0.96 in the current study.

3. Data analysis

RStudio (version 2023.06.2+561) for Macintosh was used for the analysis. We computed descriptive statistics (means, standard deviations, skewness, and kurtosis) and correlations between the two orthorexia dimensions and the nine additional variables (two RRS-ED scores, IUS score, and six FMPS scores). We present Pearson correlation for all the bivariate associations. We compared the correlation sizes for the nine additional variables and the two

orthorexia factors with Hittner et al. (2003)'s technique, a modification of Dunn and Clark (1969)'s one, that is, we computed if the subtraction of the correlations with ON and HeOr were different from zero. Considering that ON and HeOr can be expected to be partially overlapped, we computed partial correlations for all the associations between orthorexia and other variables while controlling for the other orthorexia dimension. By doing so, we expected to better assess the associations of ON (or HeOr). A backward stepwise linear regression was used to identify possible predictors of the outcome ON out of the following candidate variables: RRS-ED Brooding, RRS-ED Reflection, IUS, FMPS Concerns Over Mistakes, FMPS Personal Standards, FMPS Parental Expectations, FMPS Parental Criticism, FMPS Doubts About Actions, and FMPS Organization. As we had 9 predictors, the 9 best models with different sizes were identified: the best 1-variable model, the best 2-variables model, ..., the best 9-variables model. The 9 models were compared based on the R^2 (the higher the better the model), as well as RMSE and MAE metrics (the lower the better the model).

4. Results

Descriptive statistics as well as the associations among the different variables are shown in Table 2. While HeOr presented small correlations with IUS and the different RRS-ED and FMPS subscales ($M_{|r|} = .09$, minimum = .03, maximum = .18; all negative except for Personal Standards and Organization, and all statistically significant, except for Reflection, Parental Expectations and Parental Criticism), the associations with ON were much higher ($M_{|r|} = .31$, minimum = .31, maximum = .57; all statistically significant and positive).

Associations between IUS and the different RRS-ED and FMPS subscales with TOS showed significant differences when comparing the coefficients found for HeOr and ON [$r_{(\text{variable}, \text{OrNe})} - r_{(\text{variable}, \text{HeOr})}$], that is, all the psychological processes, except for Organization, were more related with ON than with HeOr. The size of these differences ranged from $r = .13$ for Parental Expectations to $r = .68$ for Brooding, with all $ps < .05$.

When controlling for ON, the partial associations between HeOr, IUS, and the different RRS-ED and FMPS subscales increased (from $r = .36$ to $r = .19$) except for Organization that slightly decreased (from $r = .18$ to $r = .14$). Also, Reflection was now negatively correlated to HeOr ($r = -.19$) while Personal Standards did not significantly correlate anymore with HeOr ($r = -.00$, $p > .05$). When controlling for HeOr, the partial associations between ON, IUS, and the different RRS-ED and FMPS subscales slightly increased (from $r = .33$ to $r = .64$) except

for Personal Standards, Parental Expectations, Parental Criticism, and Organization that slightly decreased (from $r = .11$ to $r = .30$).

The backward stepwise regression analysis revealed that the final model (see Table 3) composed of Brooding, Reflection, and Personal Standards as predictors, explained a significant portion of the variance in ON, $R^2 = 0.356$, $F(3, 507) = 94.84$, $p < 0.001$.

5. Discussion

The role and importance of mental ruminations, intolerance of uncertainty, and perfectionism in EDs has now been widely studied and demonstrated in the literature (Brown et al., 2017; Fairburn et al., 2003; Rawal et al., 2010). However, research on potential links between these psychological processes and orthorexia is limited, either non-existent, or unreliable. In light of this gap, the current study sought to investigate mental ruminations, intolerance of uncertainty, and perfectionism in orthorexia, utilizing a reliable orthorexia measurement tool with robust psychometric properties. To the best of our knowledge, this is the first study that endeavors to identify and explore psychological processes that may contribute to orthorexia nervosa from a processual transdiagnostic perspective.

As expected, in the current study, while correlations between HeOr and psychological processes were either not significant, near-zero positive correlations, or weak and negative, all correlations between psychological processes and ON were significantly much higher (except for Organization which did not differ between the two orthorexia dimensions) and all positive and significant. When controlling for the other orthorexia dimension, partial HeOr negative correlations were slightly higher for the two types of mental ruminations (with Reflection which became significant), Intolerance of uncertainty, Concerns over mistakes, and Doubts about actions. When controlling for ON, HeOr was not associated with Personal standards anymore. When controlling for HeOr, ON partial associations with the two types of mental ruminations, as well as with Intolerance of uncertainty, Concerns over mistakes, and Doubts about actions were a bit stronger, with Brooding correlating the most. Interestingly, only Personal standards, and the two types of mental ruminations predicted ON, with Brooding being the strongest predictor. These results suggest that, although all psychological processes are associated with ON to some degree, they may not be equally influential in predicting the presence or severity of ON. Brooding, reflection, and personal standards may have direct and important effects, being involved in the development and maintenance of ON. Other psychological processes may have weaker associations or indirect effects on ON that require further study. Our results are

consistent with the results of studies finding ON associations with perfectionism (Barnes & Caltabiano, 2017; Oberle et al., 2017) and intolerance of uncertainty (Giles et al., 2021). Our results are also consistent with studies reporting that ON was associated with indicators of psychopathology, while HeOr was not or inversely (Barrada & Roncero, 2018; Barthels et al., 2019; Chace & Kluck, 2021).

The current study highlights the complexity of ON and the need for further research to gain a better understanding of its underlying psychological processes. It also brings additional support to the distinct nature of the two dimensions of orthorexia and provides new elements to better understand ON.

Based on the findings of the current study, individuals with ON can be characterized as individuals who set very high standards for themselves. They tend to have a lower tolerance for uncertainty which can lead to distress when their strict self-imposed dietary rules are challenged or disrupted by uncertain situations. Individuals with ON also may experience doubts and fear of making mistakes regarding their eating choices and behaviors, potentially leading to a cycle of mental ruminations about eating, weight, and/or body shape, as well as excessive preoccupations with improving their diet or adhering to strict dietary rules.

Our study is not without limitations. Indeed, the cross-sectional design of the current study prevents us from drawing conclusions about cause-and-effect relationships. Further studies using an experimental approach (e.g., inducing mental ruminations) with a longitudinal design will be necessary. Also, the sample of our study is from the general population, making it of interest to confirm these results with clinical samples (e.g., in EDs centers).

6. Conclusion

The results of this study indicate that psychological processes implicated in EDs also contribute to ON. Specifically, mental ruminations about eating, weight, and shape, as well as personal standards may be involved in the development and maintenance of ON. This provides new clinical perspectives for the treatment of ON and EDs. Therapists and health care professionals working with individuals with ON should address personal standards by helping individuals to develop more flexible standards for themselves and address mental ruminations with cognitive restructuring or mindfulness-based cognitive therapy, for example. Furthermore, the development of clinical interventions based on common underlying processes,

rather than specific disorders, with the goal of enhancing flexibility in these processes, may help in the treatment of comorbidities and the prevention of relapses in these disorders.

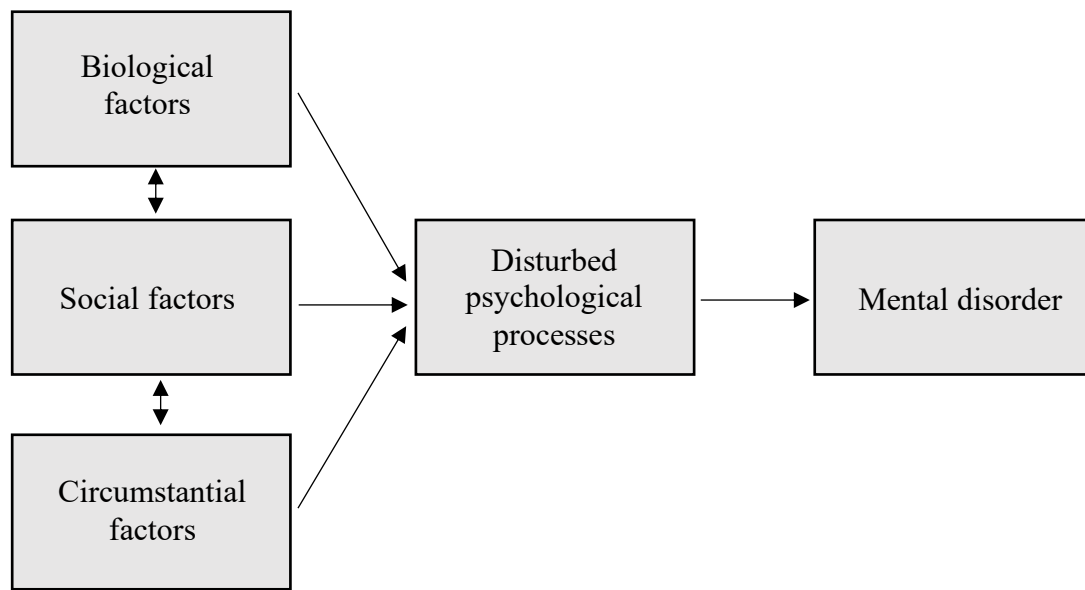


Figure 1. The mediating psychological processes model from Kinderman and Tai (2007)

Table 1. Participants' demographics and dietary style characteristics (N = 511)

Age, years, mean (SD)	37.56 (15.15)
Gender, <i>n</i> (%)	
Man	93 (18.20)
Woman	415 (81.21)
Other	3 (0.59)
Body mass index (kg/m ²), <i>n</i> (%)	
Underweight (BMI < 18.5)	32 (6.26)
Normal weight (BMI 18.5-24.99)	314 (61.45)
Overweight (BMI 25-29.99)	96 (18.79)
Obese (BMI ≥ 30)	69 (13.50)
Professional status, <i>n</i> (%)	
Student	173 (33.99)
Employee	211 (41.45)
No professional activity	31 (6.09)
Retired	30 (5.89)
Other	64 (12.57)
Dietary style, <i>n</i> (%)	
Omnivorous	284 (55.58)
Flexitarian (low in meat)	171 (33.46)
Vegetarian	27 (5.28)
Vegan	15 (2.93)
Biological	79 (15.46)
Other (gluten-free, ketogenic, etc.)	124 (24.27)

Table 2. Descriptive statistics and correlations.

	Descriptives				Pearson Correlations												Partial Correlations	
	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>K</i>	1	2	3	4	5	6	7	8	9	10	<i>diff_r</i>	HeOr	ON	
1. TOS HeOr	13.75	4.36	-0.27	-0.07											—	—	—	
2. TOS ON	5.52	3.6	0.71	0.16	.30										—	—	—	
3. RRS-ED Brooding	11.33	4.92	0.71	-0.64	-.11	.57									.68	-.36	.64	
4. RRS-ED Reflection	3.89	1.38	1.96	4.04	-.03	.44	.63								.47	-.19	.47	
5. IUS	62.43	24.51	0.5	-0.29	-.11	.32	.42	.33							.43	-.23	.37	
6. FMPS Concerns Over Mistakes	25.36	8.85	0.02	-0.7	-.11	.31	.39	.27	.66						.41	-.22	.36	
7. FMPS Personal Standards	22.27	6.17	-0.22	-0.2	.08	.31	.28	.23	.46	.66					.22	-.00	.30	
8. FMPS Parental Expectations	12.9	5.65	0.2	-1.01	.08	.21	.21	.23	.31	.43	.43				.13	.02	.20	
9. FMPS Parental Criticism	9.91	4.27	0.38	-0.65	.06	.24	.26	.22	.37	.44	.35	.74			.18	-.01	.23	
10. FMPS Doubts About Actions	11.42	3.85	0.03	-0.56	-.13	.27	.33	.26	.65	.63	.42	.28	.33		.40	-.23	.33	
11. FMPS Organization	22.38	4.64	-1.03	2.19	.18	.15	.10	.14	.22	.15	.40	.12	.00	.13	-.03	.14	.11	

Notes. TOS = Teruel Orthorexia Scale, HeOr = healthy orthorexia, ON = orthorexia nervosa, RRS-ED = Ruminative Response Scale for Eating Disorders, IUS = Intolerance of Uncertainty Scale, FMPS = Frost Multidimensionnal Perfectionism Scale, *diff_r* corresponds to the difference $r(\text{variable}, \text{ON}) - r(\text{variable}, \text{HeOr})$. Partial correlations are controlling for the other orthorexia dimension. Bold values correspond to statistically significant associations and differences, $p < .05$.

Table 3. Final model of the backward stepwise regression analysis.

Model	B	SE	Beta	t	P
Intercept	-1.44	0.55	—	-2.64	< 0.001
RRS-ED Brooding	0.34	0.03	0.46	9.86	< 0.001
RRS-ED Reflection	0.29	0.12	0.11	2.41	< 0.05
FMPS Personal Standards	0.09	0.02	0.15	4.18	< 0.001

Notes. RRS-ED = Ruminative Response Scale for Eating Disorders,
FMPS = Frost Multidimensionnal Perfectionism Scale.

DISCUSSION GÉNÉRALE

Le premier grand objectif de ce travail de thèse était de permettre une meilleure évaluation de l'orthorexie en prenant notamment en considération l'aspect bidimensionnel de celle-ci et d'en explorer la prévalence au sein de la population française. Lorsque nous avons débuté nos travaux, aucun outil de mesure d'orthorexie n'était disponible en langue française. Une grande partie des connaissances accumulées sur l'orthorexie à l'international repose sur les résultats d'études basées sur l'ORTO-15 (Donini et al., 2004, 2005). Ce questionnaire a été très largement critiqué dans la littérature pour d'importants problèmes psychométriques (e.g., Barnes & Calabiano, 2017; Dunn et al., 2017; Meule et al., 2020; Missbach & Barthels, 2017; Reynolds, 2018; Roncero et al., 2017) ainsi que pour son manque d'efficacité à distinguer des comportements alimentaires sains d'un intérêt pathologique obsessionnel pour l'alimentation saine (Donini et al., 2005). L'utilisation massive de ce questionnaire a certainement contribué à entraver la bonne compréhension de l'orthorexie, l'identification de ses facteurs de risque et de protection, l'impact de celle-ci au niveau de l'adaptation psycho-sociale ainsi que le développement et l'évaluation de l'efficacité de prises en charge thérapeutiques spécifiques. Grâce à nos travaux, nous disposons désormais d'outils de mesure d'orthorexie empiriquement validés en langue française avec de bonnes qualités psychométriques, à savoir : la *Düsseldorfer Orthorexia Skala* (DOS ; étude 1, Lasson et al., 2021), et la *Teruel Orthorexia Scale* (TOS ; étude 3, Lasson et al., 2023). Cela présente un intérêt tant pour la recherche que pour la clinique. Cela permet l'étude de l'orthorexie en population française, et donc d'élargir nos connaissances sur l'orthorexie, d'explorer les facteurs de risque et processus psychologiques qui y sont associés.

La DOS est, à ce jour, l'outil de mesure le plus utilisé après l'ORTO-15, ainsi que l'unique outil de mesure avec de bonnes qualités psychométriques pour lequel des scores seuils ont été proposés, permettant ainsi de fournir des estimations de la prévalence de l'ON. Dans notre échantillon d'étudiants universitaires, la prévalence de l'ON a été estimée à 3,28%. Considérant l'ON comme une nouvelle forme de psychopathologie alimentaire, ces chiffres nous apparaissent plus réalistes que les estimations plus qu'alarmantes qui ont pu être avancées avec l'ORTO-15. Cependant celle-ci est à considérer avec prudence car les scores seuils proposés par les auteurs de l'échelle ont été fixés non pas sur la base de raisons théoriques ou empiriques mais sur la base d'une technique utilisant les percentiles, ce qui peut constituer un biais non négligeable au regard de l'estimation obtenue. De plus, ces scores seuils ont été établis

dans une population d'individus allemands, ce qui peut également constituer un biais lorsqu'appliqués dans d'autres populations ayant une culture différente. Des recherches supplémentaires seront nécessaires pour étudier/confirmer les scores seuils proposés pour la DOS dans différent pays. Celles-ci pourront par exemple inclure des entretiens semi-structurés utilisant les critères diagnostiques proposés par le consensus d'experts (Donini et al., 2022), en parallèle de la passation de la DOS.

La TOS, développée plus récemment, présente quant à elle l'avantage d'évaluer de manière distincte l'orthorexie saine (HeOr ; dimension adaptative de l'orthorexie, non associée ou associée inversement à la psychopathologie) et l'orthorexie nerveuse (ON ; dimension associée positivement à la psychopathologie). De plus, elle a été traduite et validée dans de nombreuses langues (e.g., version allemande : Strahler et al. (2020), version arabe : Mhanna et al. (2021), versions anglaises : Chace et Kluck (2021) et Zickgraf et Barrada (2022)), et sa structure bidimensionnelle ainsi que ses bonnes qualités psychométriques ont été reproduites dans ses différentes adaptations. Disposer d'un outil de mesure tel que la TOS permet de commencer à étudier l'orthorexie saine et pathologique dans la population française, sans considérer toutes les préoccupations autour de l'alimentation saine comme pathologiques. Cela présente ainsi un intérêt au niveau du dépistage et de la prévention de l'ON et de ses complications ou conséquences négatives sur la santé physique et mentale des individus.

Concernant les perspectives, par rapport à la DOS, l'échantillon sur lequel la DOS a été validé était composé uniquement d'étudiants universitaires. Or les comportements alimentaires de cette population peuvent différer de ceux d'une autre population en raison de nombreux paramètres socio-culturels et socio-économiques. En effet, les étudiants universitaires n'ont pas nécessairement les mêmes connaissances concernant l'alimentation et la diététique, les mêmes revenus, la même accessibilité aux produits alimentaires, la même possibilité de cuisiner dans leur logement, le même temps à consacrer à leur alimentation qu'une population plus âgée et ayant de meilleurs revenus économiques. Des recherches supplémentaires (e.g., études comparatives culturelles) seront nécessaires pour valider la DOS dans d'autres populations. Le champ de recherche sur l'orthorexie étant relativement récent, il se pose également la question de savoir si ces deux outils de mesure, i.e. la DOS et la TOS, couvrent de façon exhaustive le construit orthorexie.

Le deuxième grand objectif de ce travail de thèse était d'améliorer la compréhension de l'orthorexie en investiguant notamment les profils de personnalité pathologique de jeunes

adultes présentant des comportements alimentaires orthorexiques pathologiques, la psychopathologie associée à ces différents profils de personnalité pathologique (étude 2, Lasson & Raynal, 2021), les liens qu'entretiennent les deux dimensions de l'orthorexie avec la symptomatologie obsessionnelle-compulsive et la symptomatologie des troubles du comportement alimentaire (étude 3, Lasson et al., 2023), ainsi que les processus psychopathologiques pouvant expliquer le développement et le maintien de l'ON (étude 4).

L'analyse de clusters nous a permis d'identifier quatre clusters dans le sous-échantillon de jeunes adultes présentant des comportements alimentaires orthorexiques pathologiques ($n = 106$) : 1— un cluster avec de faibles niveaux de traits de personnalité pathologique (34,9%) ; 2— un cluster avec des traits modérés de personnalité pathologique et un niveau faible de traits narcissiques (40,0%); 3— un cluster avec des niveaux faibles de traits de personnalité pathologique et un niveau modéré de traits narcissiques (26,4%); 4— un cluster avec des niveaux élevés de traits paranoïaques et narcissiques et des niveaux modérés de traits schizotypiques et borderlines (4,7%).

Les individus présentant de hauts niveaux de traits paranoïaques et narcissiques, ou des niveaux modérés de traits de personnalité pathologique et un niveau faible de traits narcissiques, semblaient présenter un fonctionnement psychologique moins bon, avec une prédominance de symptômes de TOC, de dépression, d'anxiété généralisée, et de phobie sociale. Les jeunes adultes avec ces profils de personnalité représentent presque la moitié de notre sous-échantillon de jeunes adultes ayant des comportements alimentaires orthorexiques pathologiques (44,7%). Nos résultats suggèrent donc que le TOC, la dépression, le trouble d'anxiété généralisée, et la phobie sociale sont des comorbidités fréquentes de l'ON. Ces résultats fournissent également des preuves empiriques supplémentaires à la liste de facteurs de risque établie par le consensus d'experts sur l'ON (Donini et al., 2022) qui incluait la présence ou les antécédents de troubles mentaux tels que les TOC, la dépression, et l'anxiété (généralisée ou spécifique). Il pourrait être intéressant de reproduire cette étude en incluant cette fois les troubles de la personnalité que nous n'avons pas investigués dans ce travail de thèse (i.e., les troubles de la personnalité schizoïde, anti-sociale, histrionique, évitante, et dépendante). Il serait également intéressant de reproduire cette étude en utilisant un outil de mesure d'orthorexie distinguant l'ON de l'HeOr comme la TOS afin d'observer si les profils de personnalité diffèrent selon les niveaux d'ON et d'HeOr.

Concernant les processus psychopathologiques pouvant être impliqués dans l'ON, nos résultats suggèrent que bien que les différentes dimensions du perfectionnisme et l'intolérance à l'incertitude pourraient être associées à l'ON, seuls les deux types de ruminations mentales (i.e., ressassement et réflexion) liées à l'alimentation, au poids, et à l'apparence physique, ainsi que les standards personnels seraient prédicteurs d'ON, jouant un rôle important dans le développement et le maintien de l'ON. Comme l'a montré la littérature scientifique, les ruminations mentales liées à l'alimentation, au poids, et à l'apparence physique ainsi que les standards personnels sont donc des processus psychopathologiques à la fois impliqués dans le développement et le maintien des TCA mais également dans l'ON. Dans une perspective d'approche processuelle transdiagnostique, ces processus psychopathologiques peuvent donc participer activement à expliquer la comorbidité entre les TCA et l'ON, le risque de passage de l'un à l'autre, et/ou le risque de rechute d'un TCA.

Les résultats de notre troisième étude montrent que la symptomatologie obsessionnelle-compulsive est positivement associée à l'ON, ce qui suggère que l'ON et les TOC pourraient avoir des manifestations communes. Selon la littérature, les symptômes qui se chevauchent pourraient être des obsessions, des préoccupations spécifiquement orientées vers l'alimentation saine, un temps considérable consacré aux obsessions et aux préoccupations (planification, achat, préparation), et une rigidité importante concernant certaines règles alimentaires strictes auto-imposées entraînant un sentiment de culpabilité si elles ne sont pas respectées (Donini et al., 2022). Cependant, les résultats de notre troisième étude montrent également que l'ON semble plus fortement associée à la symptomatologie des TCA. Parmi les symptômes qui peuvent se chevaucher entre les TCA et l'ON on peut retrouver, par exemple, les préoccupations et restrictions alimentaires, l'évitement d'aliments, le besoin de contrôle, la culpabilité concernant la transgression des règles alimentaires auto-imposées, un insight limité, des conséquences négatives au niveau social et au niveau la santé (Goutaudier & Rousseau, 2019; Koven & Abry, 2015). Nos résultats apportent une preuve empirique supplémentaire au critère diagnostique du consensus d'experts qui considère l'ON comme un trouble appartenant à la catégorie diagnostique des TCA, tout en mentionnant cependant que des caractéristiques obsessionnelles-compulsives soient également présentes dans l'ON (Donini et al., 2022; Zagaria et al., 2022). Les résultats de notre quatrième et dernière étude montrent une absence d'association ou une faible association de l'HeOr avec les processus psychopathologiques, alors que l'ON était plus fortement associée aux processus psychopathologiques. Nos résultats viennent donc appuyer l'intérêt de la conception bidimensionnelle de l'orthorexie composée

d'une dimension adaptative et d'une dimension pathologique, et l'importance pour les futures recherches d'évaluer celles-ci de manière distincte. Un engagement envers une alimentation saine n'est donc pas nécessairement pathologique. En effet, une personne peut avoir un score d'HeOr élevé, sans expérimenter de détresse ou que cela n'interfère avec sa vie ou son fonctionnement psycho-social. Cela indique que l'intérêt pour une alimentation saine et le fait de considérer ce mode de vie comme une partie de son identité n'est pas nécessairement associé à la psychopathologie. Cela confirme également que, comme indiqué dans d'autres études (e.g., Barrada & Roncero, 2018), l'ON et l'HeOr ne représentent pas un continuum, allant de l'absence d'intérêt pour une alimentation saine à un impact négatif important de l'écart par rapport à ses propres normes en matière d'alimentation saine, avec un intérêt optimal comme point médian, mais représentent bien deux facteurs qui peuvent et doivent être dissociés. Ce qui est pathologique réside dans le sentiment de culpabilité et l'autopunition faisant suite aux transgressions des règles alimentaires strictes auto-imposées. Mais aussi dans l'isolement social causé par la difficulté à participer à certaines activités sociales ne permettant pas aux individus ayant des comportements orthorexiques pathologiques de suivre leurs règles alimentaires strictes auto-imposées ou par l'évitement de situations où il leur faut manger avec des personnes ne partageant pas leur vision de l'alimentation saine. Et enfin, dans les inquiétudes ou préoccupations excessives liées au fait de manger des aliments qu'ils considèrent comme mauvais pour leur santé, ainsi que la détresse et les problèmes de concentration qui découlent de ces préoccupations.

Les résultats de notre dernière étude permettent de définir les caractéristiques psychologiques des individus souffrant d'ON. Ces derniers peuvent être caractérisés comme des personnes se fixant de très hauts standards personnels, présentant une tolérance faible face à l'incertitude, ce qui pourrait engendrer une détresse importante lorsque les règles alimentaires strictes qu'ils se sont fixées sont remises en question ou perturbées par certaines situations (e.g., invitation, produit non disponible, impossibilité de vérifier la composition de certains aliments). Ces individus peuvent également faire l'expérience de doutes et de craintes persistantes quant à leurs choix et comportements alimentaires. Cela peut potentiellement être la cause ou la conséquence d'un cycle de ruminations mentales liées à leur alimentation, à leur poids corporel, et à leur apparence physique, ainsi que d'une préoccupation excessive concernant l'amélioration de leur régime alimentaire, ou de l'adhésion à des règles alimentaires strictes.

Ce travail de thèse ouvre de nouvelles perspectives de recherche sur l'orthorexie. Depuis quelques années, les concepts de santé, d'alimentation saine et de bien-être ont gagné en

popularité dans nos sociétés occidentales. Cependant, nous ne connaissons pas les représentations sociales associées à ces différents concepts de santé alors que celles-ci peuvent avoir un impact important sur les comportements de santé (i.e., alimentation, sport, etc.) et amener les individus à développer des comportements orthorexiques qu'ils soient sains ou pathologiques. Il serait alors intéressant de mener une étude qualitative afin d'explorer les représentations sociales des concepts de santé, d'alimentation saine, et de bien-être dans la population générale, et d'identifier les représentations qui sont associées à l'orthorexie saine et pathologique, ainsi que leur impact sur les comportements de santé. Il serait également intéressant de tester la totalité du modèle de la détermination des troubles psychologiques de Kinderman et Tai (2007) afin d'identifier les facteurs biologiques (e.g., IMC, âge, genre, niveau socio-éducatif), sociaux (e.g., influence des pairs, de la famille, et des médias) et circonstanciels (e.g., antécédents de régimes, vécu d'un événement traumatique) pouvant agir, comme causes distales, aux côtés des ruminations mentales et des standards personnels dans l'ON. Des études longitudinales nous semblent également nécessaires afin d'explorer le développement et l'évolution de l'orthorexie notamment au travers de facteurs tels que, par exemple, les modèles parentaux ou encore l'exposition à certains types de contenus sur les réseaux sociaux. En effet, la majeure partie des études sur l'orthorexie sont de nature transversale, corrélationnelle et observationnelle, ce qui limite les connaissances sur les liens de cause à effets pouvant exister entre les différentes variables étudiées et l'orthorexie. Un exemple d'étude expérimentale et longitudinale à mener consisterait à étudier l'effet d'induction répétée de stratégies cognitives en réponse au stress telles que les ruminations mentales, la réévaluation positive, l'acceptation, et l'auto-distanciation, sur les comportements alimentaires et sur l'orthorexie. Les effets iatrogènes des prises en charges nutritionnelles, des campagnes de prévention du gouvernement en ce qui concerne l'alimentation, des systèmes d'étiquetage nutritionnel (e.g., Nutriscore), ou encore des applications de smartphones de scan de produits (e.g., Yuka) sont également des éléments qu'il nous semble important d'étudier.

A l'instar de la prise en charge thérapeutique des TCA, l'implication d'une équipe pluridisciplinaire composée au minimum d'un médecin généraliste, d'un diététicien et/ou d'un médecin nutritionniste, et d'un psychologue et/ou d'un psychiatre semble essentielle dans la prise en charge de l'ON. Afin d'optimiser l'efficacité de la prise en charge thérapeutique, un bilan médical est à recommander avec notamment l'évaluation de potentielles carences nutritionnelles, de perte de poids significative, ou d'autres complications physiques importantes liées à l'ON qui devront être prises en charge prioritairement avant tout travail

psychothérapeutique. Les différents résultats de cette thèse pourraient permettre de formuler certaines recommandations. En effet, il nous semble important d'établir un bilan psychologique comprenant l'évaluation du stade de motivation au changement, les motifs sous-tendant les choix alimentaires, une évaluation de la personnalité, ainsi que la présence de troubles psychologiques comorbides avant le début de la prise en charge psychothérapeutique. Ces éléments peuvent avoir une importance sur l'orientation et l'efficacité de la prise en charge. Il sera en effet important d'assouplir le fonctionnement de la personnalité, notamment en présence de niveaux élevés de traits paranoïaques pouvant conduire à de la méfiance du patient vis-à-vis de l'accompagnement thérapeutique, pouvant mettre en échec le succès de la thérapie. Un des axes majeurs dans la prise en charge de l'ON est d'aider le patient à développer une vision plus globale et réaliste de la santé, de l'alimentation, de la nutrition et de prendre conscience des risques liés au fait de se fixer des règles alimentaires trop strictes dans l'objectif d'améliorer sa santé. Cela peut passer par de l'éducation thérapeutique sur la santé, l'alimentation, la nutrition, l'orthorexie, et les risques liés à l'ON. Un autre axe majeur dans la prise en charge thérapeutique de l'ON consiste à aider le patient à assouplir ses règles alimentaires strictes, à augmenter la liste des aliments autorisés et à réduire celle des aliments interdits de manière significative. Cela peut notamment passer par de l'exposition hiérarchique graduelle, assistée par le psychologue et le nutritionniste dans un premier temps, puis réalisé à domicile par le patient dans un second temps afin de généraliser le comportement. La restructuration cognitive et/ou la thérapie cognitive basée sur la pleine conscience est également à recommander pour diminuer les préoccupations et les ruminations mentales liées à l'alimentation, au poids, et à l'apparence physique, qui jouent un rôle dans le développement et le maintien de l'ON. L'auto-observation des prises alimentaires peut également être proposé par le nutritionniste et le psychologue afin d'identifier et de travailler sur les contextes, les pensées, les émotions susceptibles de déclencher des comportements alimentaires orthorexiques pathologiques.

BIBLIOGRAPHIE

Alvarenga, M. S., Martins, M. C. T., Sato, K. S. C. J., Vargas, S. V. A., Philippi, S. T., & Scagliusi, F. B. (2012). Orthorexia nervosa behavior in a sample of Brazilian dietitians assessed by the Portuguese version of ORTO-15. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 17(1), e29–e35. <https://doi.org/10.1007/BF03325325>

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. <https://doi.org/10.1176/appi.books.9780890425596.744053>

Ames, D. R., Rose, P., & Anderson, C. P. (2006). The NPI-16 as a short measure of narcissism. *Journal of Research in Personality*, 40(4), 440–450. <https://doi.org/10.1016/j.jrp.2005.03.002>

Arthurs, E., Steele, R. J., Hudson, M., Baron, M., & Thombs, B. D. (2012). Are Scores on English and French Versions of the PHQ-9 Comparable? An Assessment of Differential Item Functioning. *PLoS ONE*, 7(12). <https://doi.org/10.1371/journal.pone.0052028>

Arusçoğlu, G., Kabakçı, E., Köksal, G., & Merdol, T. K. (2008). [Orthorexia nervosa and adaptation of ORTO-11 into Turkish]. *Türk Psikiyatri Dergisi = Turkish Journal of Psychiatry*, 19(3), 283–291.

Asil, E., & Sürücüoğlu, M. S. (2015). Orthorexia Nervosa in Turkish Dietitians. *Ecology of Food and Nutrition*, 54(4), 303–313. <https://doi.org/10.1080/03670244.2014.987920>

Asparouhov, T., & Muthén, B. (2009). Exploratory Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 16(3), 397–438. <https://doi.org/10.1080/10705510903008204>

Atchison, A. E., & Zickgraf, H. F. (2022). Orthorexia nervosa and eating disorder behaviors: A systematic review of the literature. *Appetite*, 177, 106134. <https://doi.org/10.1016/j.appet.2022.106134>

Babeau, C., Le Chevanton, T., Julien-Sweerts, S., Brochenin, A., Donini, L. M., & Fouques, D. (2019). Structural validation of the ORTO-12-FR questionnaire among a French sample as a first attempt to assess orthorexia nervosa in France. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-019-00835-0>

Baeyens, C. (2016). Chapitre 5. D'une approche symptomatique à une approche transdiagnostique: Le cas des pensées répétitives négatives: In *L'approche transdiagnostique en psychopathologie* (pp. 101–124). Dunod.

<https://doi.org/10.3917/dunod.mones.2016.01.0101>

Bağcı Bosi, A. T., Çamur, D., & Güler, Ç. (2007). Prevalence of orthorexia nervosa in resident medical doctors in the faculty of medicine (Ankara, Turkey). *Appetite*, 49(3), 661–666. <https://doi.org/10.1016/j.appet.2007.04.007>

Barnes, M. A., & Caltabiano, M. L. (2017). The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 22(1), 177–184. <https://doi.org/10.1007/s40519-016-0280-x>

Barrada, J. R., & Roncero, M. (2018). Bidimensional Structure of the Orthorexia: Development and Initial Validation of a New Instrument. *Anales de Psicología*, 34(2), 283. <https://doi.org/10.6018/analesps.34.2.299671>

Bartel, S. J., Sherry, S. B., Farthing, G. R., & Stewart, S. H. (2020). Classification of Orthorexia Nervosa: Further evidence for placement within the eating disorders spectrum. *Eating Behaviors*, 38, 101406. <https://doi.org/10.1016/j.eatbeh.2020.101406>

Barthels, F., Barrada, J. R., & Roncero, M. (2019). Orthorexia nervosa and healthy orthorexia as new eating styles. *PLOS ONE*, 14(7), e0219609. <https://doi.org/10.1371/journal.pone.0219609>

Barthels, F., Meyer, F., Huber, T., & Pietrowsky, R. (2017). Orthorexic eating behaviour as a coping strategy in patients with anorexia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 22(2), 269–276. <https://doi.org/10.1007/s40519-016-0329-x>

Barthels, F., Meyer, F., & Pietrowsky, R. (2015a). Die Düsseldorfer Orthorexie Skala—Konstruktion und Evaluation eines Fragebogens zur Erfassung orthorektischen Ernährungsverhaltens. *Zeitschrift für Klinische Psychologie und Psychotherapie*, 44(2), 97–105. <https://doi.org/10.1026/1616-3443/a000310>

Barthels, F., Meyer, F., & Pietrowsky, R. (2015b). Orthorexic eating behavior. A new type of disordered eating. *Ernährungs Umschau*, 62(10), Article 62(10).
<https://doi.org/10.4455/eu.2015.029>

Barthels, F., & Pietrowsky, R. (2012). Orthorektisches Ernährungsverhalten – Nosologie und Prävalenz. *PPmP - Psychotherapie · Psychosomatik · Medizinische Psychologie*, 62(12), 445–449. <https://doi.org/10.1055/s-0032-1312630>

Barthels, F., Poerschke, S., Müller, R., & Pietrowsky, R. (2019). *Orthorexic eating behavior in vegans is linked to health, not to animal welfare* (pp. 1–4) [Report]. Springer.
<https://link.springer.com/article/10.1007/s40519-019-00679-8>

Bauer, S. M., Fusté, A., Andrés, A., & Saldaña, C. (2019). The Barcelona Orthorexia Scale (BOS): Development process using the Delphi method. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 24(2), Article 2. <https://doi.org/10.1007/s40519-018-0556-4>

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107(2), Article 2.

Bhattacharya, A., Cooper, M., McAdams, C., Peebles, R., & Timko, C. A. (2022). Cultural shifts in the symptoms of Anorexia Nervosa: The case of Orthorexia Nervosa. *Appetite*, 170, 105869. <https://doi.org/10.1016/j.appet.2021.105869>

Bo, S., Zoccali, R., Ponzo, V., Soldati, L., De Carli, L., Benso, A., Fea, E., Rainoldi, A., Durazzo, M., Fassino, S., & Abbate-Daga, G. (2014). University courses, eating problems and muscle dysmorphia: Are there any associations? *Journal of Translational Medicine*, 12(1).
<https://doi.org/10.1186/s12967-014-0221-2>

Boswell, J. F., Thompson-Hollands, J., Farchione, T. J., & Barlow, D. H. (2013). Intolerance of Uncertainty: A Common Factor in the Treatment of Emotional Disorders: Intolerance of Uncertainty. *Journal of Clinical Psychology*, 69(6), 630–645.
<https://doi.org/10.1002/jclp.21965>

Bouvard, M. (2002). *Questionnaires et échelles d'évaluation de la personnalité* (2^o éd. rev. et augm.). Masson.

Bratman, S. (2017). Orthorexia vs. Theories of healthy eating. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 22(3), 381–385.
<https://doi.org/10.1007/s40519-017-0417-6>

Bratman, S. (1997). Health Food Junkie. *Yoga Journal*, 42-50.

Bratman, S., & Knight, D. (2001). *Health Food Junkies: Orthorexia Nervosa: Overcoming the Obsession with Healthful Eating* (1 edition). Broadway.

Braun, S., Kempenaers, C., Linkowski, P., & Loas, G. (2016). French Adaptation of the Narcissistic Personality Inventory in a Belgian French-Speaking Sample. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.01980>

Brislin, R. W. (1970). Back-Translation for Cross-Cultural Research. *Journal of Cross-Cultural Psychology*, 1(3), Article 3. <https://doi.org/10.1177/135910457000100301>

Brown, M., Robinson, L., Campione, G. C., Wuensch, K., Hildebrandt, T., & Micali, N. (2017). Intolerance of Uncertainty in Eating Disorders: A Systematic Review and Meta-Analysis: Intolerance of Uncertainty in Eating Disorders. *European Eating Disorders Review*, 25(5), 329–343. <https://doi.org/10.1002/erv.2523>

Browne, M. W., & Cudeck, R. (1992). Alternative Ways of Assessing Model Fit. *Sociological Methods & Research*, 21(2), 230–258.
<https://doi.org/10.1177/0049124192021002005>

Brytek-Matera, A. (2012). Orthorexia nervosa—An eating disorder, obsessive-compulsive disorder or disturbed eating habit? *Archives of Psychiatry and Psychotherapy*, 1(1), Article 1.

Brytek-Matera, A. (2021). The Polish version of the Düsseldorf Orthorexia Scale (PL-DOS) and its comparison with the English version of the DOS (E-DOS). *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 26(4), 1223–1232.
<https://doi.org/10.1007/s40519-020-01025-z>

Brytek-Matera, A., Krupa, M., Poggiogalle, E., & Donini, L. M. (2014). Adaptation of the ORTHO-15 test to Polish women and men. *Eating and Weight Disorders: EWD*, 19(1), 69–76. <https://doi.org/10.1007/s40519-014-0100-0>

Brytek-Matera, A., Plasonja, N., & Décamps, G. (2020). Assessing Orthorexia Nervosa: Validation of the Polish Version of the Eating Habits Questionnaire in a General Population Sample. *Nutrients*, 12(12), 3820. <https://doi.org/10.3390/nu12123820>

Brytek-Matera, A., Rogoza, R., Gramaglia, C., & Zeppego, P. (2015). Predictors of orthorexic behaviours in patients with eating disorders: A preliminary study. *BMC Psychiatry*, 15(1), 252. <https://doi.org/10.1186/s12888-015-0628-1>

Buhr, K., & Dugas, M. J. (2009). The role of fear of anxiety and intolerance of uncertainty in worry: An experimental manipulation. *Behaviour Research and Therapy*, 47(3), 215–223. <https://doi.org/10.1016/j.brat.2008.12.004>

Carballeira, Y., Dumont, P., Borgacci, S., Rentsch, D., Tonnac, N. de, Archinard, M., & Andreoli, A. (2007). Criterion validity of the French version of Patient Health Questionnaire (PHQ) in a hospital department of internal medicine. *Psychology and Psychotherapy: Theory, Research and Practice*, 80(1), 69–77. <https://doi.org/10.1348/147608306X103641>

Carrard, I., Lien Rebetez, M. M., Mobbs, O., & Van der Linden, M. (2015). Factor structure of a French version of the eating disorder examination-questionnaire among women with and without binge eating disorder symptoms. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 20(1), 137–144. <https://doi.org/10.1007/s40519-014-0148-x>

Cena, H., Barthels, F., Cuzzolaro, M., Bratman, S., Brytek-Matera, A., Dunn, T., Varga, M., Missbach, B., & Donini, L. M. (2018). Definition and diagnostic criteria for orthorexia nervosa: A narrative review of the literature. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1–38.

Cerolini, S., Vacca, M., Zagaria, A., Donini, L. M., Barbaranelli, C., & Lombardo, C. (2022). Italian adaptation of the Düsseldorf Orthorexia Scale (I-DOS): Psychometric properties and prevalence of orthorexia nervosa among an Italian sample. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 27(4), 1405–1413. <https://doi.org/10.1007/s40519-021-01278-2>

Chabrol, H., Rousseau, A., Callahan, S., & Hyler, S. E. (2007). Frequency and structure of DSM-IV personality disorder traits in college students. *Personality and Individual Differences*, 43(7), 1767–1776. <https://doi.org/10.1016/j.paid.2007.05.015>

Chabrol, H., Valls, M., Leeuwen, N. van, & Bui, E. (2012). Callous-unemotional and borderline traits in nonclinical adolescents: Personality profiles and relations to antisocial behaviors. *Personality and Individual Differences*, 53(8), 969–973.
<https://doi.org/10.1016/j.paid.2012.07.017>

Chace, S., & Kluck, A. S. (2021). Validation of the Teruel Orthorexia Scale and relationship to health anxiety in a U.S. sample. *Eating and Weight Disorders: EWD*.
<https://doi.org/10.1007/s40519-021-01272-8>

Chard, C. A., Hilzendegen, C., Barthels, F., & Stroebele-Benschop, N. (2019). Psychometric evaluation of the English version of the Düsseldorf Orthorexie Scale (DOS) and the prevalence of orthorexia nervosa among a U.S. student sample. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 24(2), 275–281.
<https://doi.org/10.1007/s40519-018-0570-6>

Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A Psychobiological Model of Temperament and Character. *Archives of General Psychiatry*, 50(12), 975–990.
<https://doi.org/10.1001/archpsyc.1993.01820240059008>

Connor, K. M., Kobak, K. A., Churchill, L. E., Katzelnick, D., & Davidson, J. R. (2001). Mini-SPIN: A brief screening assessment for generalized social anxiety disorder. *Depression and Anxiety*, 14(2), 137–140.

Conrad, R., Schilling, G., Bausch, C., Nadstawek, J., Wartenberg, H. C., Wegener, I., Geiser, F., Imbierowicz, K., & Liedtke, R. (2007). Temperament and character personality profiles and personality disorders in chronic pain patients: *Pain*, 133(1), 197–209.
<https://doi.org/10.1016/j.pain.2007.07.024>

Cowdrey, F. A., & Park, R. J. (2011). Assessing rumination in eating disorders: Principal component analysis of a minimally modified ruminative response scale. *Eating Behaviors*, 12(4), 321–324. <https://doi.org/10.1016/j.eatbeh.2011.08.001>

da Silva, R. W., Cruz Marmol, C. H., Nogueira Neves, A., Marôco, J., & Bonini Campos, J. A. D. (2021). A Portuguese Adaptation of the Teruel Orthorexia Scale and a Test of Its Utility with Brazilian Young Adults. *Perceptual and Motor Skills*, 128(5), 2052–2074.
<https://doi.org/10.1177/00315125211029240>

Dajon, M., Delpech, L., & Sudres, J.-L. (2020). Validation de l'Échelle Française d'Orthorexie. *L'Évolution Psychiatrique*. <https://doi.org/10.1016/j.evopsy.2020.09.001>

Damian, L. E., Stoeber, J., Negru-Subtirica, O., & Băban, A. (2017). On the Development of Perfectionism: The Longitudinal Role of Academic Achievement and Academic Efficacy. *Journal of Personality*, 85(4), Article 4. <https://doi.org/10.1111/jopy.12261>

Davidson, C. A., Hoffman, L., & Spaulding, W. D. (2016). Schizotypal personality questionnaire – brief revised (updated): An update of norms, factor structure, and item content in a large non-clinical young adult sample. *Psychiatry Research*, 238, 345–355. <https://doi.org/10.1016/j.psychres.2016.01.053>

Depa, J., Barrada, J., & Roncero, M. (2019). Are the Motives for Food Choices Different in Orthorexia Nervosa and Healthy Orthorexia? *Nutrients*, 11(3), 697. <https://doi.org/10.3390/nu11030697>

Depa, J., Schweizer, J., Bekers, S.-K., Hilzendegen, C., & Stroebele-Benschop, N. (2017). Prevalence and predictors of orthorexia nervosa among German students using the 21-item-DOS. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 22(1), Article 1. <https://doi.org/10.1007/s40519-016-0334-0>

Derogatis, L. R. (1979). Symptom Checklist-90-Revised (SCL-90-R). *Lyndhurst, NJ: NCS Pearson*.

Dittfeld, A., Gwizdek, K., Jagielski, P., Brzęk, J., & Ziora, K. (2017). A Study on the relationship between orthorexia and vegetarianism using the BOT (Bratman Test for Orthorexia). *Psychiatria Polska*, 51(6), 1133–1144. <https://doi.org/10.12740/PP/75739>

Donini, L. M., Barrada, J. R., Barthels, F., Dunn, T. M., Babeau, C., Brytek-Matera, A., Cena, H., Cerolini, S., Cho, H.-H., Coimbra, M., Cuzzolaro, M., Ferreira, C., Galfano, V., Grammatikopoulou, M. G., Hallit, S., Håman, L., Hay, P., Jimbo, M., Lasson, C., ... Lombardo, C. (2022). A consensus document on definition and diagnostic criteria for orthorexia nervosa. *Eating and Weight Disorders: EWD*, 27(8), 3695–3711. <https://doi.org/10.1007/s40519-022-01512-5>

Donini, L. M., Marsili, D., Graziani, M. P., Imbriale, M., & Cannella, C. (2004).

Orthorexia nervosa: A preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 9(2), 151–157. <https://doi.org/10.1007/BF03325060>

Donini, L. M., Marsili, D., Graziani, M. P., Imbriale, M., & Cannella, C. (2005). Orthorexia nervosa: Validation of a diagnosis questionnaire. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 10(2). <https://doi.org/10.1007/BF03327537>

Douilliez, C., Rivière, J., & Rousseau, A. (2016). Rumination related to weight, shape and eating: French validation of Ruminative Response Scale for Eating Disorders. *Poster Presentation at the 8th World Congress of Behavioural and Cognitive Therapies, June 2016, Melbourne (Australia)*.

Dunn, O. J., & Clark, V. (1969). Correlation Coefficients Measured on the Same Individuals. *Journal of the American Statistical Association*, 64(325), 366–377. <https://doi.org/10.1080/01621459.1969.10500981>

Dunn, T. M., & Bratman, S. (2016). On orthorexia nervosa: A review of the literature and proposed diagnostic criteria. *Eating Behaviors*, 21, 11–17. <https://doi.org/10.1016/j.eatbeh.2015.12.006>

Dunn, T. M., Gibbs, J., Whitney, N., & Starosta, A. (2017a). Prevalence of orthorexia nervosa is less than 1 %: Data from a US sample. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 22(1), 185–192. <https://doi.org/10.1007/s40519-016-0258-8>

Epskamp, S. (2015). semPlot: Unified visualizations of structural equation models. *Structural Equation Modeling*, 22(3), Article 3. <https://doi.org/10.1080/10705511.2014.937847>

Eriksson, L., Baigi, A., Marklund, B., & Lindgren, E. C. (2008). Social physique anxiety and sociocultural attitudes toward appearance impact on orthorexia test in fitness participants. *Scandinavian Journal of Medicine & Science in Sports*, 18(3), 389–394. <https://doi.org/10.1111/j.1600-0838.2007.00723.x>

Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, 16(4), 363–370.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A “transdiagnostic” theory and treatment. *Behaviour Research and Therapy*, 41(5), Article 5.

Falgares, G., Costanzo, G., Manna, G., Marchetti, D., Barrada, J. R., Roncero, M., Verrocchio, M. C., & Ingolia, S. (2023). Healthy orthorexia vs. orthorexia nervosa: Italian validation of the Teruel Orthorexia Scale (TOS). *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 28(1), 42. <https://doi.org/10.1007/s40519-023-01568-x>

Farstad, S. M., McGeown, L. M., & Von Ranson, K. M. (2016). Eating disorders and personality, 2004–2016: A systematic review and meta-analysis. *Clinical Psychology Review*, 46, 91–105. <https://doi.org/10.1016/j.cpr.2016.04.005>

Ferchiou, A., Todorov, L., Lajnef, M., Baudin, G., Pignon, B., Richard, J.-R., Leboyer, M., Szöke, A., & Schürhoff, F. (2017a). Analyse de la structure factorielle de la version brève du questionnaire de personnalité schizotypique (SPQ-B) – format Likert – en population générale en France. *L'Encéphale*, 43(6), 558–563. <https://doi.org/10.1016/j.encep.2016.05.011>

Fidan, T., Ertekin, V., Işıkay, S., & Kırpınar, I. (2010). Prevalence of orthorexia among medical students in Erzurum, Turkey. *Comprehensive Psychiatry*, 51(1), 49–54. <https://doi.org/10.1016/j.comppsy.2009.03.001>

Fink, P., Ewald, H., Jensen, J., Sørensen, L., Engberg, M., Holm, M., & Munk-Jørgensen, P. (1999). Screening for somatization and hypochondriasis in primary care and neurological in-patients: A seven-item scale for hypochondriasis and somatization. *Journal of Psychosomatic Research*, 46(3), 261–273. [https://doi.org/10.1016/S0022-3999\(98\)00092-0](https://doi.org/10.1016/S0022-3999(98)00092-0)

Finney, S. J., & DiStefano, C. (2013). Nonnormal and categorical data in structural equation modeling. In *Structural equation modeling: A second course, 2nd ed* (pp. 439–492). IAP Information Age Publishing.

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: Development and validation of a short version. *Psychological Assessment*, 14(4), 485–496.

Fonseca-Pedrero, E., Paino, M., Lemos-Giráldez, S., & Muñiz, J. (2013). Maladaptive personality traits in adolescence: Psychometric properties of the Personality Diagnostic

Questionnaire-4+. *International Journal of Clinical and Health Psychology*, 13(3), 207–215.
[https://doi.org/10.1016/S1697-2600\(13\)70025-5](https://doi.org/10.1016/S1697-2600(13)70025-5)

Fortin, F., Coutu-Wakulczyk, G., Université de Montréal, & Faculté des sciences infirmières. (1985). *Validation et normalisation d'une mesure de santé mentale: Le SCL-90-R : rapport final*. Université de Montréal, Faculté des sciences infirmières.

Frank, G. K. W., Roblek, T., Shott, M. E., Jappe, L. M., Rollin, M. D. H., Hagman, J. O., & Pryor, T. (2012). Heightened fear of uncertainty in anorexia and bulimia nervosa. *International Journal of Eating Disorders*, 45(2), 227–232. <https://doi.org/10.1002/eat.20929>

Freeston, M. H., Rhéaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? *Personality and Individual Differences*, 17(6), 791–802.
[https://doi.org/10.1016/0191-8869\(94\)90048-5](https://doi.org/10.1016/0191-8869(94)90048-5)

Fried, E. I., & Nesse, R. M. (2015). Depression sum-scores don't add up: Why analyzing specific depression symptoms is essential. *BMC Medicine*, 13(1), 72.
<https://doi.org/10.1186/s12916-015-0325-4>

Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research*, 14(5), 449–468.
<https://doi.org/10.1007/BF01172967>

Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. *Psychological Medicine*, 12(4), 871–878.
<https://doi.org/10.1017/S0033291700049163>

Giles, S., Toohey, M., Hughes, E. K., Fuller-Tyszkiewicz, M., & Krug, I. (2021). Do orthorexia and intolerance of uncertainty mediate the relationship between autism spectrum traits and disordered eating symptoms? *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 26(7), 2309–2316. <https://doi.org/10.1007/s40519-020-01094-0>

Gkiouras, K., Grammatikopoulou, M. G., Tsaliki, T., Ntwali, L., Nigdelis, M. P., Gerontidis, A., Taousani, E., Tzimos, C., Rogoza, R., Bogdanos, D. P., Donini, L. M., & Goulis, D. G. (2022). Orthorexia nervosa: Replication and validation of the ORTO questionnaires translated into Greek in a survey of 848 Greek individuals. *Hormones (Athens, Greece)*, 21(2), 251–260. <https://doi.org/10.1007/s42000-022-00351-4>

Gleaves, D. H., Graham, E. C., & Ambwani, S. (2013b). Measuring “orthorexia”: Development of the Eating Habits Questionnaire. *The International Journal of Educational and Psychological Assessment*, 12(2), 1–18.

Godefroy, V., Trinchera, L., & Dorard, G. (2020). Optimizing the empirical assessment of orthorexia nervosa through EHQ and clarifying its relationship with BMI. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-020-00909-4>

Goldberg, L. R. (1981). Language and individual differences: The search for universals in personality lexicons. *Review of Personality and Social Psychology*, 2(1), 141–165.

Goutaudier, N., & Rousseau, A. (2019). L’orthorexie: Une nouvelle forme de trouble des conduites alimentaires ? *La Presse Médicale*, 48(10), 1065–1071. <https://doi.org/10.1016/j.lpm.2019.07.005>

Gramaglia, C., Brytek-Matera, A., Rogoza, R., & Zeppegno, P. (2017). Orthorexia and anorexia nervosa: Two distinct phenomena? A cross-cultural comparison of orthorexic behaviours in clinical and non-clinical samples. *BMC Psychiatry*, 17(1), Article 1. <https://doi.org/10.1186/s12888-017-1241-2>

Gramaglia, C., Gambaro, E., Delicato, C., Marchetti, M., Sarchiapone, M., Ferrante, D., Roncero, M., Perpiñá, C., Brytek-Matera, A., Wojtyna, E., & Zeppegno, P. (2019). Orthorexia nervosa, eating patterns and personality traits: A cross-cultural comparison of Italian, Polish and Spanish university students. *BMC Psychiatry*, 19(1), 235. <https://doi.org/10.1186/s12888-019-2208-2>

Grammatikopoulou, M. G., Gkiouras, K., Marakis, G., Sifakaki, M., Petropoulou, A., Donini, L. M., Lindqvist, H. M., & Bogdanos, D. P. (2023). Mind the Gap: Tools for the Diagnosis and Assessment of Orthorexia Nervosa Based on the Recent Consensus Definition. Reply to Meule, A. Comment on “Sifakaki et al. Orthorexia Nervosa Practices in Rheumatoid Arthritis: The DORA Study. *Nutrients* 2023, 15, 713.” *Nutrients*, 15(8), 1985. <https://doi.org/10.3390/nu15081985>

Grammatikopoulou, M. G., Gkiouras, K., Markaki, A., Theodoridis, X., Tsakiri, V., Mavridis, P., Dardavessis, T., & Chourdakis, M. (2018). Food addiction, orthorexia, and food-related stress among dietetics students. *Eating and Weight Disorders - Studies on Anorexia,*

Bulimia and Obesity, 23(4), 459–467. <https://doi.org/10.1007/s40519-018-0514-1>

Grime, M. M., & Wright, G. (2016). Delphi Method. In N. Balakrishnan, T. Colton, B. Everitt, W. Piegorisch, F. Ruggeri, & J. L. Teugels (Eds.), *Wiley StatsRef: Statistics Reference Online* (1st ed., pp. 1–6). Wiley. <https://doi.org/10.1002/9781118445112.stat07879>

Ha, J. H., Kim, E. J., Abbey, S. E., & Kim, T.-S. (2007). Relationship between personality disorder symptoms and temperament in the young male general population of South Korea. *Psychiatry and Clinical Neurosciences*, 61(1), 59–66. <https://doi.org/10.1111/j.1440-1819.2007.01611.x>

Haddad, C., Hallit, R., Akel, M., Honein, K., Akiki, M., Kheir, N., Obeid, S., & Hallit, S. (2020). Validation of the Arabic version of the ORTO-15 questionnaire in a sample of the Lebanese population. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 25(4), 951–960. <https://doi.org/10.1007/s40519-019-00710-y>

Halim, Z. M., Dickinson, K. M., Kemps, E., & Prichard, I. (2020). Orthorexia nervosa: Examining the Eating Habits Questionnaire’s reliability and validity, and its links to dietary adequacy among adult women. *Public Health Nutrition*, 23(10), 1684–1692. <https://doi.org/10.1017/S1368980019004282>

Hallit, S., Barrada, J. R., Salameh, P., Sacre, H., Roncero, M., & Obeid, S. (2021). The relation of orthorexia with lifestyle habits: Arabic versions of the Eating Habits Questionnaire and the Dusseldorf Orthorexia Scale. *Journal of Eating Disorders*, 9(1), 102. <https://doi.org/10.1186/s40337-021-00455-z>

Håman, L., Barker-Ruchti, N., Patriksson, G., & Lindgren, E.-C. (2015). Orthorexia nervosa: An integrative literature review of a lifestyle syndrome. *International Journal of Qualitative Studies on Health and Well-Being*, 10(1), 26799. <https://doi.org/10.3402/qhw.v10.26799>

Harvey, A. G., Watkins, E., Mansell, W., & Shafran, R. (2004). *Cognitive behavioural processes across psychological disorders: A transdiagnostic approach to research and treatment*. Oxford University Press.

He, J., Ma, H., Barthels, F., & Fan, X. (2019). Psychometric properties of the Chinese version of the Düsseldorf Orthorexia Scale: Prevalence and demographic correlates of

orthorexia nervosa among Chinese university students. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 24(3), 453–463. <https://doi.org/10.1007/s40519-019-00656-1>

Heiss, S., Coffino, J. A., & Hormes, J. M. (2019). What does the ORTO-15 measure? Assessing the construct validity of a common orthorexia nervosa questionnaire in a meat avoiding sample. *Appetite*, 135, 93–99. <https://doi.org/10.1016/j.appet.2018.12.042>

Herranz Valera, J., Acuña Ruiz, P., Romero Valdespino, B., & Visioli, F. (2014). Prevalence of orthorexia nervosa among ashtanga yoga practitioners: A pilot study. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 19(4), Article 4. <https://doi.org/10.1007/s40519-014-0131-6>

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), Article 1. <https://doi.org/10.1080/10705519909540118>

Hunter, J. D., & Crudo, D. F. (2018). Unintended Consequences of Restrictive Diets: Two Case Reports and a Review of Orthorexia. *Clinical Pediatrics*, 57(14), Article 14. <https://doi.org/10.1177/0009922818795905>

Hyler, S. E., Rieder, R. O., Williams, J. B. W., Spitzer, R. L., Hendler, J., & Lyons, M. (1988). The Personality Diagnostic Questionnaire: Development and Preliminary Results. *Journal of Personality Disorders*, 2(3), 229–237. <https://doi.org/10.1521/pedi.1988.2.3.229>

Kendler, K. S., Zachar, P., & Craver, C. (2011). What kinds of things are psychiatric disorders? *Psychological Medicine*, 41(6), 1143–1150. <https://doi.org/10.1017/S0033291710001844>

Kinderman, P. (2005). A Psychological Model of Mental Disorder. *Harvard Review of Psychiatry*, 13(4), 206–217. <https://doi.org/10.1080/10673220500243349>

Kinderman, P. (2009). Understanding and Addressing Psychological and Social Problems: The Mediating Psychological Processes Model. *International Journal of Social Psychiatry*, 55(5), 464–470. <https://doi.org/10.1177/0020764008097757>

Kinderman, P., & Tai, S. (2007). Empirically Grounded Clinical Interventions Clinical

Implications of a Psychological Model of Mental Disorder. *Behavioural and Cognitive Psychotherapy*, 35(01), 1. <https://doi.org/10.1017/S1352465806003274>

Kinzl, J. F., Hauer, K., Traweger, C., & Kiefer, I. (2006). Orthorexia Nervosa in Dieticians. *Psychotherapy and Psychosomatics*, 75(6), 395–396.
<https://doi.org/10.1159/000095447>

Kiss-Leizer, M., & Rigó, A. (2019). People behind unhealthy obsession to healthy food: The personality profile of tendency to orthorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 24(1), 29–35. <https://doi.org/10.1007/s40519-018-0527-9>

Koven, N. S., & Abry, A. W. (2015). The clinical basis of orthorexia nervosa: Emerging perspectives. *Neuropsychiatric Disease and Treatment*, 11, 385–394.
<https://doi.org/10.2147/NDT.S61665>

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals*, 32(9), Article 9. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>

Kroenke, K., Spitzer, R. L., Williams, J. B. W., & Löwe, B. (2010). The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: A systematic review. *General Hospital Psychiatry*, 32(4), 345–359.
<https://doi.org/10.1016/j.genhosppsych.2010.03.006>

Lasson, C., Barthels, F., & Raynal, P. (2021). Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-021-01123-6>

Lasson, C., & Raynal, P. (2021). Personality profiles in young adults with orthorexic eating behaviors. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-021-01124-5>

Lasson, C., Rousseau, A., Vicente, S., Goutaudier, N., Romo, L., Roncero, M., & Barrada, J. R. (2023). Orthorexic eating behaviors are not all pathological: A French validation of the Teruel Orthorexia Scale (TOS). *Journal of Eating Disorders*, 11(1), 65.

<https://doi.org/10.1186/s40337-023-00764-5>

Lee, S., Ng, K. L., Ma, Y. L., Tsang, A., & Kwok, K. P. S. (2011). A general population study of the Chinese Whiteley-7 Index in Hong Kong. *Journal of Psychosomatic Research*, 71(6), 387–391. <https://doi.org/10.1016/j.jpsychores.2011.05.013>

Leichner, P., Steiger, H., Puentes-Neuman, G., Perreault, M., & Gottheil, N. (1994). Validation d'une échelle d'attitudes alimentaires auprès d'une population québécoise francophone. *The Canadian Journal of Psychiatry*, 39(1), 49–54. <https://doi.org/10.1177/070674379403900110>

Lenzenweger, M. F., Lane, M. C., Loranger, A. W., & Kessler, R. C. (2007). DSM-IV Personality Disorders in the National Comorbidity Survey Replication. *Biological Psychiatry*, 62(6), 553–564. <https://doi.org/10.1016/j.biopsych.2006.09.019>

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, 48(3), Article 3. <https://doi.org/10.3758/s13428-015-0619-7>

Li, W., Tan, S., Ouyang, R.-Q., Cui, Y., Ma, J., Cheng, C., Mu, Y., Zhang, S., Zheng, L., Xiong, P., Ni, W., Li, L., Fan, L., Luo, Y., Yu, Y., Wang, Z., Ding, F., Pan, Q., Jiang, A., ... Zeng, F. (2022). Translation and validation of the Chinese version of the orthorexia nervosa assessment questionnaires among college students. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 27(8), 3389–3398. <https://doi.org/10.1007/s40519-022-01469-5>

Limburg, K., Watson, H. J., Hagger, M. S., & Egan, S. J. (2017). The relationship between perfectionism and psychopathology: A meta-analysis. *Journal of Clinical Psychology*, 73, 1301–1326. <https://doi.org/10.1002/jclp.22435>

Lopes, R., Melo, R., & Dias Pereira, B. (2020). Orthorexia nervosa and comorbid depression successfully treated with mirtazapine: A case report. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 25(1), 163–167. <https://doi.org/10.1007/s40519-018-0539-5>

Luck-Sikorski, C., Jung, F., Schlosser, K., & Riedel-Heller, S. G. (2019). Is orthorexic behavior common in the general public? A large representative study in Germany. *Eating and*

Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 24(2), 267–273.

Mansell, W., Harvey, A., Watkins, E. R., & Shafran, R. (2008). Cognitive behavioral processes across psychological disorders: A review of the utility and validity of the transdiagnostic approach. *International Journal of Cognitive Therapy*, 1, 181–191. <https://doi.org/10.1680/ijct.2008.1.3.181>

Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In Search of Golden Rules: Comment on Hypothesis-Testing Approaches to Setting Cutoff Values for Fit Indexes and Dangers in Overgeneralizing Hu and Bentler's (1999) Findings. *Structural Equation Modeling: A Multidisciplinary Journal*, 11(3), 320–341. https://doi.org/10.1207/s15328007sem1103_2

Marsh, H. W., Lüdtke, O., Muthén, B., Asparouhov, T., Morin, A. J. S., Trautwein, U., & Nagengast, B. (2010). A new look at the big five factor structure through exploratory structural equation modeling. *Psychological Assessment*, 22(3), 471–491. <https://doi.org/10.1037/a0019227>

Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory Structural Equation Modeling: An Integration of the Best Features of Exploratory and Confirmatory Factor Analysis. *Annual Review of Clinical Psychology*, 10(1), 85–110. <https://doi.org/10.1146/annurev-clinpsy-032813-153700>

McComb, S. E., & Mills, J. S. (2019). Orthorexia nervosa: A review of psychosocial risk factors. *Appetite*, 140, 50–75. <https://doi.org/10.1016/j.appet.2019.05.005>

McDonald, R. P. (1999). *Test theory: A unified treatment* (pp. xi, 485). Lawrence Erlbaum Associates Publishers.

McGregor, R. (2017). *Orthorexia: When Healthy Eating Goes Bad*. Watkins Media Limited.

McRae, R. R., & Costa, P. T. (1991). The NEO Personality Inventory: Using the Five-Factor Model in Counseling. *Journal of Counseling & Development*, 69(4), 367–372. <https://doi.org/10.1002/j.1556-6676.1991.tb01524.x>

Meule, A., Holzapfel, C., Brandl, B., Greetfeld, M., Hessler-Kaufmann, J. B., Skurk, T., Quadflieg, N., Schlegl, S., Hauner, H., & Voderholzer, U. (2020). Measuring orthorexia

nervosa: A comparison of four self-report questionnaires. *Appetite*, 146, 104512. <https://doi.org/10.1016/j.appet.2019.104512>

Meule, A., & Voderholzer, U. (2021). Orthorexia Nervosa—It Is Time to Think About Abandoning the Concept of a Distinct Diagnosis. *Frontiers in Psychiatry*, 12, 640401. <https://doi.org/10.3389/fpsyt.2021.640401>

Mhanna, M., Azzi, R., Hallit, S., Obeid, S., & Soufia, M. (2021). Validation of the Arabic version of the Teruel Orthorexia Scale (TOS) among Lebanese adolescents. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-021-01200-w>

Michalak, J., Hölz, A., & Teismann, T. (2011). Rumination as a predictor of relapse in mindfulness-based cognitive therapy for depression: Rumination as a predictor of relapse. *Psychology and Psychotherapy: Theory, Research and Practice*, 84(2), 230–236. <https://doi.org/10.1348/147608310X520166>

Micoulaud-Franchi, J.-A., Lagarde, S., Barkate, G., Dufournet, B., Besancon, C., Trébuchon-Da Fonseca, A., Gavaret, M., Bartolomei, F., Bonini, F., & McGonigal, A. (2016). Rapid detection of generalized anxiety disorder and major depression in epilepsy: Validation of the GAD-7 as a complementary tool to the NDDI-E in a French sample. *Epilepsy & Behavior: E&B*, 57(Pt A), 211–216. <https://doi.org/10.1016/j.yebeh.2016.02.015>

Missbach, B., & Barthels, F. (2017). Orthorexia Nervosa: Moving forward in the field. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 22(1), 1–1. <https://doi.org/10.1007/s40519-017-0365-1>

Missbach, B., Hinterbuchinger, B., Dreiseitl, V., Zellhofer, S., Kurz, C., & König, J. (2015). When Eating Right, Is Measured Wrong! A Validation and Critical Examination of the ORTO-15 Questionnaire in German. *PLOS ONE*, 10(8), e0135772. <https://doi.org/10.1371/journal.pone.0135772>

Molina Alén, E. (2006). Perspectiva antropológica de un caso de ortorexia nerviosa. *Cultura de los Cuidados Revista de Enfermería y Humanidades*, 20, Article 20. <https://doi.org/10.14198/cuid.2006.20.15>

Monestès, J.-L., & Baeyens, C. (2016). Introduction. In *L'approche transdiagnostique*

en psychopathologie (pp. 1–7). Dunod. <https://doi.org/10.3917/dunod.mones.2016.01.0003>

Moroze, R. M., Dunn, T. M., Craig Holland, J., Yager, J., & Weintraub, P. (2015). Microthinking About Micronutrients: A Case of Transition From Obsessions About Healthy Eating to Near-Fatal “Orthorexia Nervosa” and Proposed Diagnostic Criteria. *Psychosomatics*, 56(4), 397–403. <https://doi.org/10.1016/j.psych.2014.03.003>

Nevin, S. M., & Vartanian, L. R. (2017). The stigma of clean dieting and orthorexia nervosa. *Journal of Eating Disorders*, 5(1). <https://doi.org/10.1186/s40337-017-0168-9>

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100, 569–582. <https://doi.org/10.1037/0021-843X.100.4.569>

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*, 61(1), 115–121. <https://doi.org/10.1037/0022-3514.61.1.115>

Nolen-Hoeksema, S., Stice, E., Wade, E., & Bohon, C. (2007). Reciprocal relations between rumination and bulimic, substance abuse, and depressive symptoms in female adolescents. *Journal of Abnormal Psychology*, 116(1), 198–207. <https://doi.org/10.1037/0021-843X.116.1.198>

Nolen-Hoeksema, S., & Watkins, E. R. (2011). A Heuristic for Developing Transdiagnostic Models of Psychopathology: Explaining Multifinality and Divergent Trajectories. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, 6(6), 589–609. <https://doi.org/10.1177/1745691611419672>

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science*, 3(5), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>

Norring, C. E. A., & Sohlberg, S. S. (1993). Outcome, recovery, relapse and mortality across six years in patients with clinical eating disorders. *Acta Psychiatrica Scandinavica*, 87(6), 437–444. <https://doi.org/10.1111/j.1600-0447.1993.tb03401.x>

Novara, C., Pardini, S., Pastore, M., & Mulatti, C. (2017). Ortoressia Nervosa: Un'indagine del costrutto e delle caratteristiche psicometriche della versione italiana dell'Eating Habits Questionnaire- 21(EHQ-21). [Orthorexia Nervosa: An investigation of the construct and psychometric properties of the Italian version of the Eating Habits Questionnaire- 21 (EHQ-21).]. *Psicoterapia Cognitiva e Comportamentale*, 23, 291–316.

Oberle, C. D., De Nadai, A. S., & Madrid, A. L. (2020). Orthorexia Nervosa Inventory (ONI): Development and validation of a new measure of orthorexic symptomatology. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*.
<https://doi.org/10.1007/s40519-020-00896-6>

Oberle, C. D., Klare, D. L., & Patyk, K. C. (2019). Health beliefs, behaviors, and symptoms associated with orthorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 24(3), 495–506. <https://doi.org/10.1007/s40519-019-00657-0>

Oberle, C. D., Samaghabadi, R. O., & Hughes, E. M. (2017a). Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*, 108, 303–310. <https://doi.org/10.1016/j.appet.2016.10.021>

Oberle, C. D., Samaghabadi, R. O., & Hughes, E. M. (2017b). Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*, 108, 303–310. <https://doi.org/10.1016/j.appet.2016.10.021>

Parra-Fernández, M. L., Onieva-Zafra, M. D., Fernández-Muñoz, J. J., & Fernández-Martínez, E. (2019). Adaptation and validation of the Spanish version of the DOS questionnaire for the detection of orthorexic nervosa behavior. *PLOS ONE*, 14(5), e0216583. <https://doi.org/10.1371/journal.pone.0216583>

Parra-Fernández, M. L., Onieva-Zafra, M. D., Fernández-Muñoz, J. J., Głębocka, A., Fernández-Martínez, E., & Brytek-Matera, A. (2021). The Spanish Version of the Eating Habits Questionnaire (EHQ-ES) and Its Links to Symptoms and Concerns Characteristic of Eating Disorders among Young Adults. *Nutrients*, 13(6), 1993. <https://doi.org/10.3390/nu13061993>

Parra-Fernandez, M. L., Rodríguez-Cano, T., Onieva-Zafra, M. D., Perez-Haro, M. J., Casero-Alonso, V., Muñoz Camargo, J. C., & Notario-Pacheco, B. (2018). Adaptation and validation of the Spanish version of the ORTO-15 questionnaire for the diagnosis of orthorexia nervosa. *PLOS ONE*, 13(1), e0190722. <https://doi.org/10.1371/journal.pone.0190722>

Parra-Fernández, M.-L., Rodríguez-Cano, T., Onieva-Zafra, M.-D., Perez-Haro, M. J., Casero-Alonso, V., Fernández-Martínez, E., & Notario-Pacheco, B. (2018). Prevalence of orthorexia nervosa in university students and its relationship with psychopathological aspects of eating behaviour disorders. *BMC Psychiatry*, 18(1), Article 1. <https://doi.org/10.1186/s12888-018-1943-0>

Philippot, P. (2016). Chapitre 2. Démêler l'écheveau des processus psychologiques en psychopathologie. In *L'approche transdiagnostique en psychopathologie* (pp. 33–60). Dunod; Cairn.info. <https://doi.org/10.3917/dunod.mones.2016.01.0033>

Plasonja, N., & Décamps, G. (2021). Validation française de l'échelle de mesure de l'orthorexie ORTO-15 et étude des liens avec les troubles des conduites alimentaires et l'image du corps. *Psychologie Française*, S0033298421000170. <https://doi.org/10.1016/j.psfr.2021.02.002>

Pontes, J. B., Montagner, M. I., & Montagner, M. Â. (2014). ORTOREXIA NERVOSA: ADAPTAÇÃO CULTURAL DO ORTO-15. *DEMETRA: Alimentação, Nutrição & Saúde*, 9(2). <https://doi.org/10.12957/demetra.2014.8576>

Radomsky, A. S., Ashbaugh, A. R., Saxe, M. L., Ouimet, A. J., Golden, E. R., Lavoie, S. L., & O'Connor, K. P. (2006). Psychometric properties of the French and English versions of the Social Phobia Inventory. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement*, 38(4), 354–360. <https://doi.org/10.1037/cjbs2006021>

Raine, A., & Benishay, D. (1995). The SPQ-B: A brief screening instrument for schizotypal personality disorder. *Journal of Personality Disorders*, 9(4), 346–355. <https://doi.org/10.1521/pedi.1995.9.4.346>

Rawal, A., Park, R. J., & Williams, J. M. G. (2010). Rumination, experiential avoidance, and dysfunctional thinking in eating disorders. *Behaviour Research and Therapy*, 48(9), 851–859. <https://doi.org/10.1016/j.brat.2010.05.009>

Regier, D. A., Narrow, W. E., Clarke, D. E., Kraemer, H. C., Kuramoto, S. J., Kuhl, E. A., & Kupfer, D. J. (2013). DSM-5 Field Trials in the United States and Canada, Part II: Test-Retest Reliability of Selected Categorical Diagnoses. *American Journal of Psychiatry*, 170(1), 59–70. <https://doi.org/10.1176/appi.ajp.2012.12070999>

Reilly, E. E., Perry, T. R., Brown, T. A., Wierenga, C. E., & Kaye, W. H. (2021). Intolerance of Uncertainty and Eating Disorder Symptoms Over the Course of Intensive Treatment. *Behavior Therapy*, 52(3), 698–708. <https://doi.org/10.1016/j.beth.2020.09.002>

Reynolds, R. (2018b). Is the prevalence of orthorexia nervosa in an Australian university population 6.5%? *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 23(4), 453–458. <https://doi.org/10.1007/s40519-018-0535-9>

Rogowska, A. M., Kwaśnicka, A., & Ochnik, D. (2021a). Development and Validation of the Test of Orthorexia Nervosa (TON-17). *Journal of Clinical Medicine*, 10(8), 1637. <https://doi.org/10.3390/jcm10081637>

Rogowska, A. M., Kwaśnicka, A., & Ochnik, D. (2021b). Validation and Polish Adaptation of the Authorized Bratman Orthorexia Self-Test (ABOST): Comparison of Dichotomous and Continuous Likert-Type Response Scales. *Psychology Research and Behavior Management, Volume 14*, 921–931. <https://doi.org/10.2147/PRBM.S308356>

Rogoza, R., & Donini, L. M. (2020). Introducing ORTO-R: A revision of ORTO-15: Based on the re-assessment of original data. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-020-00924-5>

Rogoza, R., Hallit, S., Soufia, M., Barthels, F., & Obeid, S. (2021). Validation of the Arabic version of the Dusseldorf Orthorexia Scale (DOS) among Lebanese adolescents. *Journal of Eating Disorders*, 9(1), 130. <https://doi.org/10.1186/s40337-021-00488-4>

Roncero, M., Barrada, J. R., García-Soriano, G., & Guillén, V. (2021). Personality Profile in Orthorexia Nervosa and Healthy Orthorexia. *Frontiers in Psychology*, 12, 710604. <https://doi.org/10.3389/fpsyg.2021.710604>

Roncero, M., Barrada, J. R., & Perpiñá, C. (2017). Measuring Orthorexia Nervosa: Psychometric Limitations of the ORTO-15. *The Spanish Journal of Psychology*, 20, E41. <https://doi.org/10.1017/sjp.2017.36>

Rosenberg, M. (1989). *Society and the adolescent self-image*, Rev. Ed (pp. xxxii, 347). Wesleyan University Press.

Ross Arguedas, A. A. (2020). “Can naughty be healthy?”: Healthism and its discontents

in news coverage of orthorexia nervosa. *Social Science & Medicine*, 246, 112784. <https://doi.org/10.1016/j.socscimed.2020.112784>

Rosseel, Y. (2012). **lavaan**: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, 48(2), Article 2. <https://doi.org/10.18637/jss.v048.i02>

Rudolph, S. (2018). The connection between exercise addiction and orthorexia nervosa in German fitness sports. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 23(5), Article 5. <https://doi.org/10.1007/s40519-017-0437-2>

Ryman, F. V. M., Cesuroglu, T., Bood, Z. M., & Syurina, E. V. (2019). Orthorexia Nervosa: Disorder or Not? Opinions of Dutch Health Professionals. *Frontiers in Psychology*, 10, 555. <https://doi.org/10.3389/fpsyg.2019.00555>

Sánchez-Carracedo, D., Barrada, J. R., López-Guimerà, G., Fauquet, J., Almenara, C. A., & Trepát, E. (2012). Analysis of the factor structure of the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-3) in Spanish secondary-school students through exploratory structural equation modeling. *Body Image*, 9(1), 163–171. <https://doi.org/10.1016/j.bodyim.2011.10.002>

Sassaroli, S., Lauro, L., Ruggiero, G., Vinai, P., & Frost, R. (2008). Perfectionism in depression, obsessive-compulsive disorder and eating disorders. *Behaviour Research and Therapy*, 46, 757–765. <https://doi.org/10.1016/j.brat.2008.02.007>

Segura-Garcia, C., Ramacciotti, C., Rania, M., Aloï, M., Caroleo, M., Bruni, A., Gazzarrini, D., Sinopoli, F., & De Fazio, P. (2015). The prevalence of orthorexia nervosa among eating disorder patients after treatment. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 20(2), Article 2. <https://doi.org/10.1007/s40519-014-0171-y>

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7. *Archives of Internal Medicine*, 166(10), 1092. <https://doi.org/10.1001/archinte.166.10.1092>

Steenkamp, J.-B. E. M., & Maydeu-Olivares, A. (2023). Unrestricted factor analysis: A powerful alternative to confirmatory factor analysis. *Journal of the Academy of Marketing Science*, 51(1), 86–113. <https://doi.org/10.1007/s11747-022-00888-1>

Stochel, M. Ł., Kozik, M. J., Zejda, J. E., Hyrnik, J., Jelonek, I., & Siwiec, A. (2015). Validation of ORTO-15 Questionnaire in the group of urban youth aged 15-21. *Psychiatria Polska*, 49(1), 119–134. <https://doi.org/10.12740/PP/25962>

Stoeber, J., Madigan, D. J., & Gonidis, L. (2020). Perfectionism is adaptive and maladaptive, but what's the combined effect? *Personality and Individual Differences*, 161, 109846. <https://doi.org/10.1016/j.paid.2020.109846>

Stoeber, J., & Otto, K. (2006). Positive Conceptions of Perfectionism: Approaches, Evidence, Challenges. *Personality and Social Psychology Review*, 10(4), 295–319. https://doi.org/10.1207/s15327957pspr1004_2

Strahler, J. (2020). The Dark Side of Healthy Eating: Links between Orthorexic Eating and Mental Health. *Nutrients*, 12(12), 3662. <https://doi.org/10.3390/nu12123662>

Strahler, J. (2021). Trait mindfulness differentiates the interest in healthy diet from orthorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 26(3), 993–998. <https://doi.org/10.1007/s40519-020-00927-2>

Strahler, J., Haddad, C., Salameh, P., Sacre, H., Obeid, S., & Hallit, S. (2020). Cross-cultural differences in orthorexic eating behaviors: Associations with personality traits. *Nutrition*, 77, 110811. <https://doi.org/10.1016/j.nut.2020.110811>

Supriyanto, I., & Warsini, S. (2020). Validity And reliability testing of Indonesian version of Orto-15: An instrument for orthorexia nervosa assessment. *Philippine Journal of Nursing*, 29–33.

Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics* (Pearson new international edition, sixth edition). Pearson.

Thibault, I., Pauzé, R., Lavoie, E., Pesant, C., Beaugerard, C., Caron, L., Fortier, M., & Mercier, M. (2017). Étude de cas d'une jeune orthorexique. *Revue québécoise de psychologie*, 37(1), Article 1. <https://doi.org/10.7202/1040102ar>

Tremelling, K., Sandon, L., Vega, G. L., & McAdams, C. J. (2017). Orthorexia Nervosa and Eating Disorder Symptoms in Registered Dietitian Nutritionists in the United States. *Journal of the Academy of Nutrition and Dietetics*, 117(10), 1612–1617.

<https://doi.org/10.1016/j.jand.2017.05.001>

Valente, M., Cesuroglu, T., Labrie, N., & Syurina, E. V. (2022). “When Are We Going to Hold Orthorexia to the Same Standard as Anorexia and Bulimia?” Exploring the Medicalization Process of Orthorexia Nervosa on Twitter. *Health Communication*, 37(7), 872–879. <https://doi.org/10.1080/10410236.2021.1875558>

Valera, J. H., Acuña Ruiz, P., Romero Valdespino, B., & Visioli, F. (2014). Prevalence of orthorexia nervosa among ashtanga yoga practitioners: A pilot study. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 19(4), Article 4. <https://doi.org/10.1007/s40519-014-0131-6>

Vallieres, E. F., & Vallerand, R. J. (1990). Traduction Et Validation Canadienne-Française De L'échelle De L'estime De Soi De Rosenberg*. *International Journal of Psychology*, 25(2), 305–316. <https://doi.org/10.1080/00207599008247865>

Van der Linden, M. (2016). Chapitre 1. S'affranchir du DSM ou d'une vision essentialiste des problèmes psychologiques. In *L'approche transdiagnostique en psychopathologie* (pp. 9–32). Dunod; Cairn.info. <https://doi.org/10.3917/dunod.mones.2016.01.0009>

Vandereycken, W. (2011). Media Hype, Diagnostic Fad or Genuine Disorder? Professionals' Opinions About Night Eating Syndrome, Orthorexia, Muscle Dysmorphia, and Emetophobia. *Eating Disorders*, 19(2), 145–155. <https://doi.org/10.1080/10640266.2011.551634>

Varga, M., Thege, B. K., Dukay-Szabó, S., Túry, F., & van Furth, E. F. (2014). When eating healthy is not healthy: Orthorexia nervosa and its measurement with the ORTO-15 in Hungary. *BMC Psychiatry*, 14(1), Article 1. <https://doi.org/10.1186/1471-244X-14-59>

Viladrich, C., Angulo-Brunet, A., & Doval, E. (2017). Un viaje alrededor de alfa y omega para estimar la fiabilidad de consistencia interna. *Anales de Psicología*, 33(3), 755. <https://doi.org/10.6018/analesps.33.3.268401>

von Rosenstiel, I., Stam, J., & Schats, W. (2012). Safety issues and orthorexia in paediatrics. *BMC Complementary and Alternative Medicine*, 12(1), Article 1. <https://doi.org/10.1186/1472-6882-12-S1-P224>

Watkins, E. R. (2009). Depressive Rumination: Investigating Mechanisms to Improve Cognitive Behavioural Treatments. *Cognitive Behaviour Therapy*, 38(sup1), 8–14. <https://doi.org/10.1080/16506070902980695>

World Health Organization. (2016b). *HEARTS Technical package for cardiovascular disease management in primary health care*. Geneva, Switzerland. http://www.who.int/cardiovascular_diseases/heart/en/

Xia, Y., & Yang, Y. (2019). RMSEA, CFI, and TLI in structural equation modeling with ordered categorical data: The story they tell depends on the estimation methods. *Behavior Research Methods*, 51(1), 409–428. <https://doi.org/10.3758/s13428-018-1055-2>

Yakın, E., Raynal, P., & Chabrol, H. (2020). Distinguishing orthorexic behaviors from eating disordered and obsessive–compulsive behaviors: A typological study. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-020-01037-9>

Zagaria, A., Vacca, M., Cerolini, S., Ballesio, A., & Lombardo, C. (2022). Associations between orthorexia, disordered eating, and obsessive-compulsive symptoms: A systematic review and meta-analysis. *The International Journal of Eating Disorders*, 55(3), 295–312. <https://doi.org/10.1002/eat.23654>

Zermatten, A., Van der Linden, M., Jermain, F., & Ceschi, G. (2006). Validation of a French version of the Obsessive-Compulsive Inventory-Revised in a non-clinical sample. *European Review of Applied Psychology / Revue Européenne de Psychologie Appliquée*, 56(3), 151–155. <https://doi.org/10.1016/j.erap.2005.07.003>

Zickgraf, H. F., & Barrada, J. R. (2022). Orthorexia nervosa vs. healthy orthorexia: Relationships with disordered eating, eating behavior, and healthy lifestyle choices. *Eating and Weight Disorders: EWD*, 27(4), 1313–1325. <https://doi.org/10.1007/s40519-021-01263-9>

Zickgraf, H. F., Ellis, J. M., & Essayli, J. H. (2019). Disentangling orthorexia nervosa from healthy eating and other eating disorder symptoms: Relationships with clinical impairment, comorbidity, and self-reported food choices. *Appetite*, 134, 40–49. <https://doi.org/10.1016/j.appet.2018.12.006>

ANNEXES

Index des annexes

Annexe 1 : Düsseldorf Orthorexia Skala (DOS, version francophone de Lasson et al., 2021).....	157
Annexe 2 : Eating Habits Questionnaire (EHQ, version francophone non validée)	159
Annexe 3 : Eating Attitudes Test-26 (EAT-26, version francophone de Leichner et al., 1994)	161
Annexe 4 : Generalized Anxiety Disorder-7 (GAD-7, version francophone de Micoulaud-Franchi et al., 2016).....	163
Annexe 5 : Patient Health Questionnaire-9 (PHQ-9, version francophone de Carballeira et al., 2007).....	164
Annexe 6: Obsessive Compulsive Inventory-Revised (OCI-R, version francophone de Zermatten et al., 2006).....	165
Annexe 7 : Schizotypal Personality Questionnaire - Brief (SPQ-B, version francophone de Ferchiou et al., 2017).....	167
Annexe 8 : Personality Diagnostic Questionnaire-4 – Sous échelle Borderline (PDQ-4, version francophone de Bouvard, 2002).....	169
Annexe 9 : Symptoms Check List-90R - Sous échelle Paranoid (items 1-6 ; SCL90-R, version francophone de Fortin et al., 1985) et attention check question (item 7)	171
Annexe 10 : Personality Diagnostic Questionnaire-4 – Sous échelle Obsessionnelle Compulsive (PDQ-4, version francophone de Bouvard, 2002).....	172
Annexe 11 : Narcissistic Personality Inventory (NPI-16, version francophone de Braun et al., 2016).....	173
Annexe 12 : Rosenberg Self Esteem Scale (Version francophone de Vallières et Vallerand, 1990).....	175
Annexe 13 : WHITELEY-7 (items 1-7, version francophone non validée) et attention check question (item 8).....	176
Annexe 14 : Mini-Social Phobia Inventory (Mini-SPIN, version francophone de Radomsky et al., 2006).....	177

Annexe 15 : Teruel Orthorexia Scale (TOS, version francophone de Lasson et al., 2023)	178
Annexe 16 : Eating Disorders Examination-Questionnaire (EDE-Q, version francophone de Carrard et al., 2015)	180
Annexe 17 : Ruminative Response Scale for Eating Disorders (RRS-ED, version francophone de Douilliez et al., 2016)	185
Annexe 18 : Frost Multidimensionnal Perfectionism Scale (FMPS, version francophone de Bouvard et al., 2000)	187
Annexe 19 : Intolerance of Uncertainty Scale (IUS, version francophone de Freeston et al., 1994)	191
Annexe 20 : Article Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students (Lasson et al., 2021)	194
Annexe 21 : Article Personality profiles in young adults with orthorexic eating behaviors (Lasson & Raynal, 2021)	202
Annexe 22 : Article Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS) (Lasson et al., 2023)	212

Annexe 1 : Düsseldorf Orthorexia Skala (DOS, version francophone de Lasson et al., 2021)

Validation française de la « Düsseldorf Orthorexia Skala »

Nous vous proposons une série d'affirmations. Lisez, s'il vous plait, chaque affirmation et indiquez à quel point chacune est vraie pour vous en cochant la case appropriée. Il est important de remplir entièrement ce questionnaire, même si plusieurs questions paraissent très éloignées de vos préoccupations ou si vous trouvez que plusieurs d'entre elles se ressemblent.

1. Manger de la nourriture bonne pour la santé est plus important pour moi que le plaisir.
☐ Pas du tout
☐ Plutôt non
☐ Plutôt oui
☐ Tout à fait

2. J'ai établi des règles alimentaires auxquelles j'adhère.
☐ Pas du tout
☐ Plutôt non
☐ Plutôt oui
☐ Tout à fait

3. Je peux apprécier la nourriture seulement si elle est considérée comme bonne pour la santé.
☐ Pas du tout
☐ Plutôt non
☐ Plutôt oui
☐ Tout à fait

4. J'évite d'aller manger chez des amis lorsqu'ils ne veillent pas à avoir une alimentation saine.
☐ Pas du tout
☐ Plutôt non
☐ Plutôt oui
☐ Tout à fait

5. Je trouve positif de faire plus attention que les autres à avoir une alimentation saine.
☐ Pas du tout
☐ Plutôt non
☐ Plutôt oui
☐ Tout à fait

6. Lorsque je mange quelque chose qui n'est pas bon pour la santé, je m'en veux.
☐ Pas du tout
☐ Plutôt non

- ☐ Plutôt oui
 - ☐ Tout à fait
7. J'ai l'impression d'être exclu(e) par mes amis et mes collègues à cause de mon régime alimentaire strict.
- ☐ Pas du tout
 - ☐ Plutôt non
 - ☐ Plutôt oui
 - ☐ Tout à fait
8. Mes pensées sont centrées en permanence sur l'alimentation saine et j'organise ma journée en fonction de cela.
- ☐ Pas du tout
 - ☐ Plutôt non
 - ☐ Plutôt oui
 - ☐ Tout à fait
9. Il m'est difficile de transgresser mes règles alimentaires.
- ☐ Pas du tout
 - ☐ Plutôt non
 - ☐ Plutôt oui
 - ☐ Tout à fait
10. Je me sens déprimé(e) lorsque je mange quelque chose de mauvais pour la santé.
- ☐ Pas du tout
 - ☐ Plutôt non
 - ☐ Plutôt oui
 - ☐ Tout à fait

Calcul des scores

Echelle de réponses : Pas du tout = 1, plutôt non = 2, plutôt oui = 3, tout à fait = 4.

Plus le score est élevé, plus le niveau de comportement alimentaire orthorexique est élevé.

Un score ≥ 30 est considéré indiquer la présence d'Orthorexie Nerveuse, et un score ≥ 25 et ≤ 29 suggère un risque d'ON (Barthels et al., 2015; Chard et al., 2019; Lasson et al., 2021).

Annexe 2 : Eating Habits Questionnaire (EHQ, version francophone non validée)

Consigne : Nous vous proposons une série d'affirmations. Lisez, s'il vous plait, chaque affirmation et indiquez à quel point chacune est vraie pour vous en cochant la colonne appropriée.

	Tout à fait faux	Un peu vrai	Principalement vrai	Tout à fait vrai
1. Je décline les invitations qui impliquent de manger de la nourriture qui n'est pas bonne pour la santé.				
2. Mon alimentation saine est une source de stress importante dans mes relations.				
3. J'ai fait des efforts pour manger plus sainement au cours du temps.				
4. Mon régime alimentaire affecte le type d'emploi que je pourrais accepter.				
5. J'ai des difficultés à trouver des restaurants qui servent les aliments que je mange.				
6. Je suis de façon rigoureuse un régime alimentaire bon pour la santé.				
7. Mon régime alimentaire est meilleur que celui des autres personnes.				
8. Je me sens en contrôle quand je mange sainement.				
9. Je suis plus informé(e) que les autres concernant l'alimentation saine.				

10. Je passe plus de trois heures par jour à penser à de la nourriture saine.				
11. Peu d'aliments sont suffisamment bons pour ma santé pour que je les mange.				
12. Je suis un régime alimentaire avec de nombreuses règles.				
13. Mes habitudes alimentaires sont supérieures à celles des autres.				
14. Manger comme je le fais m'apporte de la satisfaction.				
15. Je ne mange que ce que mon régime alimentaire autorise.				
16. Je me sens bien quand je mange des aliments bons pour la santé.				
17. Au cours de l'année écoulée, des ami-e-s ou des membres de ma famille m'ont dit que j'étais trop préoccupé(e) par le fait de manger sainement.				
18. Je suis distrait(e) par des pensées sur le fait de manger sainement.				
19. Je prépare la nourriture de la façon la plus saine possible.				
20. Je sors moins depuis que j'ai commencé à manger sainement.				
21. La façon dont est préparée ma nourriture est importante dans mon régime alimentaire.				

Annexe 3 : Eating Attitudes Test-26 (EAT-26, version francophone de Leichner et al., 1994)

Consigne : Nous vous proposons une série d'affirmations. Lisez, s'il vous plait, chaque affirmation et indiquez à quel point chacune est vraie pour vous en cochant la colonne appropriée :

	Toujours	Très souvent	Souvent	Parfois	Rarement	Jamais
1. Je suis terrifié(e) à l'idée d'être trop gros(se).						
2. J'évite de manger quand j'ai faim.						
3. Je suis préoccupé(e) par la nourriture.						
4. J'ai fait des excès alimentaires au cours desquels je pensais ne pas pouvoir m'arrêter.						
5. Je coupe ma nourriture en petits morceaux.						
6. Je suis conscient(e) du contenu calorique de la nourriture que je mange.						
7. J'évite particulièrement les aliments tels le sucre, le pain ou les pommes de terre.						
8. J'ai l'impression que les autres préféreraient que je mange davantage.						
9. Je déteste avoir mangé.						
10. Je me sens terriblement coupable après avoir mangé.						
11. Je suis préoccupé(e) par le désir d'être plus mince.						

12. Je me pèse plusieurs fois par jour.						
13. Je pense que je suis en train de brûler des calories quand je fais des exercices.						
14. Les autres pensent que je suis trop mince.						
15. Je suis préoccupé(e) par l'idée d'être grassouillet(te).						
16. Je prends plus de temps que les autres à manger mes repas.						
17. J'évite de manger de la nourriture qui contient du sucre.						
18. Je mange des aliments diététiques.						
19. J'ai l'impression que la nourriture contrôle ma vie.						
20. Je suis discipliné(e) devant la nourriture.						
21. J'ai l'impression que les autres me poussent à manger.						
22. Je consacre trop de temps et pense trop à la nourriture.						
23. Je ne me sens pas à l'aise après avoir mangé des sucreries.						
24. J'aime que mon estomac soit vide.						
25. Je déteste essayer de la nouvelle nourriture riche en calories.						
26. J'ai envie de vomir après les repas.						

Annexe 4 : Generalized Anxiety Disorder-7 (GAD-7, version francophone de Micoulaud-Franchi et al., 2016)

Consigne : Au cours des 2 dernières semaines, selon quelle fréquence avez-vous été gêné(e) par les problèmes suivants ?

	Jamais	Plusieurs jours	Plus de la moitié du temps	Presque tous les jours
1. Un sentiment de nervosité, d'anxiété ou de tension.				
2. Une incapacité à arrêter de s'inquiéter ou à contrôler ses inquiétudes.				
3. Une inquiétude excessive à propos de tout et de rien.				
4. Des difficultés à se détendre.				
5. Une agitation telle qu'il est difficile à tenir en place, de rester tranquille.				
6. Une tendance à être facilement contrarié(e) ou irritable.				
7. Un sentiment de peur comme si quelque chose de terrible risquait de se produire.				

Annexe 5 : Patient Health Questionnaire-9 (PHQ-9, version francophone de Carballeira et al., 2007)

Consigne : Au cours des 2 dernières semaines, selon quelle fréquence avez-vous été gêné(e) par les problèmes suivants ?

	Jamais	Plusieurs jours	Plus de la moitié du temps	Presque tous les jours
1. Peu d'intérêt ou de plaisir à faire les choses.				
2. Être triste, déprimé(e) ou désespéré(e).				
3. Difficultés à s'endormir ou à rester endormi(e), ou dormir trop.				
4. Se sentir fatigué(e) ou manquer d'énergie.				
5. Avoir peu d'appétit ou manger trop.				
6. Avoir une mauvaise opinion de soi-même, ou avoir le sentiment d'être nul(le), ou d'avoir déçu sa famille ou s'être déçu(e) soi-même.				
7. Avoir du mal à se concentrer, par exemple, pour lire le journal ou regarder la télévision.				
8. Bouger ou parler si lentement que les autres auraient pu le remarquer. Ou au contraire, être si agité(e) que vous avez eu du mal à tenir en place par rapport à d'habitude.				
9. Penser qu'il vaudrait mieux mourir ou envisager de vous faire du mal d'une manière ou d'une autre.				

Annexe 6: Obsessive Compulsive Inventory-Revised (OCI-R, version francophone de Zermatten et al., 2006)

Consigne : Les énoncés suivants se rapportent à des expériences que de nombreuses personnes vivent dans leur quotidien. Cochez, pour chaque énoncé, la colonne qui décrit le mieux à quel point l'expérience vous a peiné ou dérangé durant le mois dernier.

	Pas du tout	Peu	Moyennement	Beaucoup	Extrêmement
1. J'ai conservé tellement de choses qu'elles bloquent le passage.					
2. Je vérifie les choses plus souvent que nécessaire.					
3. Je suis contrarié si les objets ne sont pas rangés correctement.					
4. Je me sens obligé de compter pendant que je fais des choses.					
5. J'éprouve de la difficulté à toucher un objet quand je sais qu'il a été touché par des étrangers ou par certaines personnes.					
6. J'éprouve de la difficulté à contrôler mes propres pensées.					
7. J'accumule des choses dont je n'ai pas besoin.					
8. Je vérifie de manière répétée les portes, les fenêtres, les tiroirs, etc.					
9. Je suis contrarié si les autres changent la manière dont j'ai rangé les choses.					
10. Je sens que je dois répéter certains chiffres.					

11. Je dois parfois me laver ou me nettoyer, simplement parce que je me sens contaminé.					
12. Je suis contrarié par des pensées déplaisantes qui me viennent à l'esprit contre ma volonté.					
13. J'évite de jeter les choses parce que je crains d'en avoir besoin plus tard.					
14. Je vérifie de manière répétée les robinets de gaz et d'eau ainsi que les interrupteurs après les avoir éteints.					
15. J'ai besoin que les choses soient rangées dans un ordre particulier.					
16. Je sens qu'il y a de bons et de mauvais chiffres.					
17. Je me lave les mains plus souvent et plus longtemps que nécessaire.					
18. J'ai fréquemment des pensées malsaines et j'ai de la difficulté à m'en débarrasser.					

Annexe 7 : Schizotypal Personality Questionnaire - Brief (SPQ-B, version francophone de Ferchiou et al., 2017)

Consigne: *Veillez indiquer pour chacune d'elles si elle vous correspond ou pas. Nous avons bien conscience que certaines réponses peuvent varier en fonction du contexte (par exemple si vous êtes en famille, avec des amis ou au travail) ; dans ce cas, il faut se représenter une situation « moyenne » en se posant la question : « Au fond, est-ce que, en général, je pense plutôt comme ceci ou comme cela ? ».*

	Non	Oui
1. Les gens me trouvent parfois lointain ou distant.		
2. Il m'est déjà arrivé d'avoir la sensation de sentir une force ou une présence auprès de moi, alors même que j'étais tout seul à ce moment-là.		
3. Les gens font parfois des commentaires sur mes comportements ou certaines de mes manières qu'ils trouvent inhabituelles.		
4. Je suis parfois convaincu(e) que d'autres personnes seraient capables de dire ce que je suis en train de penser.		
5. J'ai déjà remarqué que certains objets ou certaines situations apparemment sans importance peuvent être des sortes de messages si l'on arrive à les décrypter.		
6. Certaines personnes pensent que je suis quelqu'un de très bizarre.		
7. Je sens que je dois rester sur mes gardes même avec mes amis.		
8. Certains me trouvent parfois vague ou peu clair lors des conversations.		
9. Je relève souvent des remarques dépréciatives ou des menaces cachées dans ce que les gens disent ou font.		
10. Lorsque je fais mes courses, j'ai le sentiment que les gens me remarquent.		
11. Je me sens très mal à l'aise dans les situations où je suis en présence de gens que je ne connais pas.		

12. J'ai déjà eu des expériences particulières en rapport avec l'astrologie, la divination, le contact avec d'autres êtres, les perceptions extra-sensorielles, ou tout simplement j'ai le sentiment d'avoir un sixième sens.		
13. Il m'arrive d'utiliser les mots de travers.		
14. Je pense qu'il vaut mieux que les gens n'en sachent pas trop sur moi.		
15. J'ai tendance à me tenir en retrait dans les situations sociales.		
16. Il m'arrive d'être subitement distrait par des sons lointains auxquels je n'accorde normalement aucune attention.		
17. Je dois souvent rester vigilant pour que les gens n'abusent pas de ma confiance ou de ma bonne volonté.		
18. J'ai le sentiment qu'il ne m'est pas possible d'être proche des gens.		
19. Je suis quelqu'un d'original ou d'assez spécial ; en tout cas assez différent des autres.		
20. Je trouve qu'il est difficile de communiquer clairement aux autres ce que j'ai envie de leur dire.		
21. Je me sens très mal à l'aise quand je parle à des gens que je ne connais pas bien.		
22. J'ai tendance à garder mes sentiments pour moi.		

Annexe 8 : Personality Diagnostic Questionnaire-4 – Sous échelle Borderline (PDQ-4, version francophone de Bouvard, 2002)

Consigne : *Veillez répondre "Vrai" quand l'énoncé est généralement vrai pour vous, ou "Faux" quand l'énoncé est généralement faux pour vous. Même si vous n'êtes pas tout à fait certain(e) de votre réponse. Il n'y a pas de réponses justes ou fausses.*

	Faux	Vrai
1. Je ferais n'importe quoi pour éviter que ceux qui me sont chers me quittent.		
2. J'aime ou je déteste quelqu'un, il n'y a pas de juste milieu pour moi.		
3. Je me demande souvent qui je suis réellement.		
4. Je fais, de manière impulsive, des choses (comme celles indiquées ci-dessous) qui pourraient me créer des problèmes :		
5. Dépenser plus d'argent que j'en ai.		
6. Avoir des rapports sexuels avec des gens que je ne connais à peine.		
7. Boire trop.		
8. Prendre des drogues.		
9. Manger de façon boulimique.		
10. Conduire imprudemment.		
11. J'ai essayé de me blesser ou de me tuer.		
12. Je suis très "soupe au lait" (susceptible).		
13. Il me semble que ma vie est sans intérêt et n'a aucun sens.		
14. J'ai de la peine à contrôler ma colère ou mes sautes d'humeur.		

15. Quand je suis stressé(e), il m'arrive de devenir "parano" ou même de perdre conscience.		
---	--	--

Annexe 9 : Symptoms Check List-90R - Sous échelle Paranoid (items 1-6 ; SCL90-R, version francophone de Fortin et al., 1985) et attention check question (item 7)

Consigne : Vous trouverez ci-dessous une liste de phrases décrivant des situations que l'on peut éprouver. Pour chacune de ces phrases, veuillez cocher la meilleure description de ce qui vous a ennuyé ou préoccupé au cours de la semaine qui vient de s'écouler. Merci de répondre à toutes les questions, ne passez pas trop de temps à répondre, c'est votre première impression qui est importante.

	Oui, extrêmement	Oui, beaucoup	Oui, moyennement	Oui, un peu	Non, pas du tout
1. J'ai le sentiment que les autres sont responsables de la plupart de mes troubles.					
2. J'ai l'impression qu'on ne peut avoir confiance dans la plupart des gens.					
3. J'ai l'impression d'être observé(e) par les autres et qu'on parle de moi.					
4. J'ai des idées ou des croyances que les autres ne partagent pas.					
5. J'ai l'impression que les autres n'apprécient pas à sa juste valeur ce que je fais.					
6. Je pense que les gens profiteraient de moi si je les laissais faire.					
7. Si vous répondez attentivement à cette enquête, merci de sélectionner la réponse "Oui, extrêmement"					

Annexe 10 : Personality Diagnostic Questionnaire-4 – Sous échelle Obsessionnelle Compulsive (PDQ-4, version francophone de Bouvard, 2002)

Consigne: Veuillez répondre "Vrai" quand l'énoncé est généralement vrai pour vous, ou "Faux" quand l'énoncé est généralement faux pour vous. Même si vous n'êtes pas tout à fait certain(e) de votre réponse. Il n'y a pas de réponses justes ou fausses.

	Faux	Vrai
1. Je me perds souvent dans les détails et n'ai plus de vision d'ensemble.		
2. Je perds du temps à m'efforcer de tout faire parfaitement.		
3. Je place mon travail avant la famille, les amis ou les loisirs.		
4. J'ai un sens moral plus élevé que les autres gens.		
5. J'ai accumulé énormément de choses dont je n'ai pas besoin mais que je suis incapable de jeter.		
6. Si les autres sont incapables de faire les choses correctement, je préfère les faire moi-même.		
7. J'estime être économe, mais les autres me trouvent pingre.		
8. Les gens se plaignent que je sois aussi têtu(e) qu'une mule.		

Annexe 11 : Narcissistic Personality Inventory (NPI-16, version francophone de Braun et al., 2016)

Consigne : *Pour chaque question, deux propositions vous sont proposées. Veuillez choisir celle des deux qui vous correspond le mieux.*

1. Je suis parfois embarrassé(e) lorsque les gens me font des compliments.
Je sais que je suis bon parce que tout le monde me le dit.
2. Je préfère me fondre dans la foule.
J'aime être le centre de l'attention.
3. Je ne suis ni meilleur(e) ni pire que les autres.
Je suis une personne hors du commun.
4. J'aime avoir de l'autorité sur les autres personnes.
Ça ne me gêne pas d'obéir aux ordres.
5. Je trouve facile de manipuler les gens.
Je n'aime pas quand je me surprends à manipuler les autres.
6. Je suis intransigeant(e) quant au respect qui m'est dû.
On me témoigne habituellement le respect que je mérite.
7. J'essaye de ne pas me faire valoir aux yeux d'autrui.
Je sais me mettre en avantage si j'en ai l'opportunité.
8. Je sais toujours ce que je suis en train de faire.
Parfois, je ne suis pas sûr(e) de ce que je fais.
9. Parfois, je raconte de bonnes histoires.
Tout le monde aime bien écouter mes histoires.
10. J'attends beaucoup des autres.
J'aime faire des choses pour les autres personnes.
11. J'apprécie réellement être le centre de l'attention.
Cela me met mal à l'aise d'être le centre de l'attention.
12. Être reconnu(e) en tant qu'autorité ne signifie pas grand-chose pour moi.
Les gens semblent toujours reconnaître mon autorité.
13. Je serai une personne formidable.
J'espère que je vais être couronné(e) de succès.
14. Parfois, les gens croient ce que je leur raconte.
Je peux faire croire n'importe quoi à n'importe qui.
15. J'ai plus de capacités que les autres personnes.
Je peux apprendre beaucoup des autres personnes.

16. Je suis plus comme tout le monde.
Je suis une personne extraordinaire.

Annexe 12 : Rosenberg Self Esteem Scale (Version francophone de Vallières et Vallerand, 1990)

Consigne : Nous vous proposons une série d'affirmations. Lisez, s'il vous plait, chaque affirmation et indiquez à quel point chacune est vraie pour vous :

	Tout à fait en désaccord	Plutôt en désaccord	Plutôt en accord	Tout à fait en accord
1. Je pense que je suis une personne de valeur, au moins égale à n'importe qui d'autre.				
2. Je pense que je possède un certain nombre de belles qualités.				
3. Tout bien considéré, je suis porté à me considérer comme un raté.				
4. Je suis capable de faire les choses aussi bien que la majorité des gens.				
5. Je sens peu de raisons d'être fier de moi.				
6. J'ai une attitude positive vis-à-vis moi-même.				
7. Dans l'ensemble, je suis satisfait de moi.				
8. J'aimerais avoir plus de respect pour moi-même.				
9. Parfois je me sens vraiment inutile.				
10. Il m'arrive de penser que je suis un bon à rien.				

Annexe 13 : WHITELEY-7 (items 1-7, version francophone non validée) et attention check question (item 8)

Consigne : Nous vous proposons une série d'affirmations. Lisez, s'il vous plait, chaque affirmation et indiquez à quel point chacune est vraie pour vous en cochant la colonne appropriée :

	Tout à fait faux	Moyennement faux	Moyennement vrai	Tout à fait vrai
1. Pensez-vous qu'il y a quelque chose qui ne va vraiment pas avec votre corps ?				
2. Est-ce que vous vous faites beaucoup de souci à propos de votre santé ?				
3. Est-il difficile pour vous de croire le médecin quand il vous dit qu'il n'y a pas de raison de s'inquiéter ?				
4. Êtes-vous souvent inquiet(ète) de la possibilité d'avoir une maladie grave ?				
5. Êtes-vous dérangé(e) par de nombreuses douleurs plus ou moins intenses ?				
6. Si vous entendez parler d'une maladie (par exemple à la télévision, à la radio ou par une de vos connaissances), êtes-vous inquiet(ète) à l'idée de l'attraper ?				
7. Trouvez-vous que vous êtes préoccupé(e) par beaucoup de symptômes différents ?				
8. Si vous êtes attentif dans le remplissage de ce questionnaire, veuillez cocher la réponse "Tout à fait faux"				

Annexe 14 : Mini-Social Phobia Inventory (Mini-SPIN, version francophone de Radomsky et al., 2006)

	Pas du tout	Un petit peu	Un peu	Beaucoup	Extrêmement
1. La peur de l'embarras me fait éviter de faire des choses ou de parler aux gens.					
2. J'évite les activités dans lesquelles je suis le centre d'attention.					
3. Être gêné ou avoir l'air stupide fait partie de mes pires craintes.					

Annexe 15 : Teruel Orthorexia Scale (TOS, version francophone de Lasson et al., 2023)

Validation française de la « Teruel Orthorexia Scale »

Les questions suivantes concernent les idées et les attitudes que vous avez vis-à-vis de l'alimentation. Plus précisément, nous souhaiterions savoir dans quelle mesure il est important pour vous de suivre une alimentation saine ou de consommer des aliments, par exemple, sans gras, sans sel, sans conservateurs, sans additifs ou toute substance que vous considérez comme nocive ou toxique comme les pesticides.

	Pas du tout d' accord	Plutôt pas d' accord	Plutôt d' accord	Tout à fait d' accord
1. Je me sens bien quand je mange des aliments sains				
2. Je passe beaucoup de temps à acheter, à planifier et/ou à préparer la nourriture pour que mon alimentation soit la plus saine possible				
3. Je considère que ma façon de manger est plus saine que celle de la plupart des gens				
4. Je me sens coupable lorsque je mange de la nourriture que je considère comme mauvaise pour la santé				
5. Ma préoccupation à manger sainement a eu un impact négatif sur mes relations sociales				
6. Mon intérêt pour une alimentation saine définit ma manière d'être, de comprendre le monde				
7. Je préfère manger une nourriture saine et peu savoureuse qu'une nourriture savoureuse mais mauvaise pour la santé				
8. Je consomme principalement des aliments que je considère sains				

9. Je suis préoccupé(e) par l'éventualité de manger des aliments mauvais pour la santé				
10. Cela ne me dérange pas de dépenser plus d'argent pour un aliment si je le considère plus sain				
11. Je me sens bouleversé(e) ou triste si je mange des aliments que je considère mauvais pour la santé				
12. Je préfère manger peu, mais de la nourriture saine, que d'être rassasié(e) avec de la nourriture mauvaise pour la santé				
13. J'évite de manger avec des personnes qui ne partagent pas mes idées sur une alimentation saine				
14. S'il m'arrive de manger quelque chose que je considère comme mauvais pour la santé, je me punis pour cela				
15. Des pensées concernant une alimentation saine m'empêchent de me concentrer sur d'autres tâches				

Calcul des scores

Échelle de réponse : Pas du tout d'accord = 0, pas d'accord = 1, plutôt d'accord = 2, tout à fait d'accord = 3.

TOS – Orthorexie saine = TOS1 + TOS2 + TOS3 + TOS6 + TOS7 + TOS8 + TOS10 + TOS12.

TOS – Orthorexie nerveuse = TOS4 + TOS5 + TOS9 + TOS11 + TOS13 + TOS14 + TOS15.

Annexe 16 : Eating Disorders Examination-Questionnaire (EDE-Q, version francophone de Carrard et al., 2015)

Consigne : Les questions suivantes concernent seulement les quatre dernières semaines (28 jours). Veuillez lire chaque question attentivement. Veuillez répondre à toutes les questions. Merci.

Questions 1 à 12 : Veuillez entourer le chiffre approprié à droite. Rappelez-vous que les questions se réfèrent seulement aux quatre dernières semaines (28 jours).

Pendant combien de jours durant les 28 jours passés...	Aucun jour	1-5 jours	6-12 jours	13-15 jours	16-22 jours	23-27 jours	Chaque jour
1. Avez-vous intentionnellement essayé de limiter la quantité de nourriture que vous mangez pour influencer votre silhouette ou votre poids (que vous ayez réussi ou non)?	0	1	2	3	4	5	6
2. Avez-vous déjà passé de longues périodes (8 heures de veille ou plus) sans rien manger du tout dans le but d'influencer votre silhouette ou votre poids?	0	1	2	3	4	5	6
3. Avez-vous essayé d'exclure de votre alimentation des aliments que vous aimez dans le but d'influencer votre silhouette ou votre poids (que vous ayez réussi ou non)?	0	1	2	3	4	5	6
4. Avez-vous essayé de suivre des règles précises concernant votre alimentation (par exemple, une limitation de calories) dans le but d'influencer votre silhouette ou votre poids (que vous ayez réussi ou non)?	0	1	2	3	4	5	6

5. Avez-vous eu fermement envie d'avoir l'estomac vide dans le but d'influencer 0123456 votre silhouette ou votre poids?	0	1	2	3	4	5	6
6. Avez-vous eu fermement envie d'avoir un ventre complètement plat?	0	1	2	3	4	5	6
7. Est-ce que le fait de penser à la nourriture, au fait de manger ou aux calories vous a beaucoup gêné-e pour vous concentrer sur les choses qui vous intéressent (par exemple, travailler, suivre une conversation, ou lire)?	0	1	2	3	4	5	6
8. Est-ce que le fait de penser à votre silhouette ou à votre poids vous a beaucoup gêné-e pour vous concentrer sur les choses qui vous intéressent (par exemple, travailler, suivre une conversation, ou lire)?	0	1	2	3	4	5	6
9. Avez-vous clairement eu peur de perdre le contrôle sur votre alimentation?	0	1	2	3	4	5	6
10. Avez-vous clairement eu peur d'une possible prise de poids?	0	1	2	3	4	5	6
11. Vous êtes-vous senti-e gros-se?	0	1	2	3	4	5	6
12. Avez-vous eu une forte envie de perdre du poids?	0	1	2	3	4	5	6

Questions 13-18 : Veuillez compléter l'espace pointillé à droite avec les chiffres appropriés. Rappelez-vous que les questions se réfèrent seulement aux quatre dernières semaines (28 jours).

Durant les quatre semaines passées (28 jours) ...	
13. Durant les 28 derniers jours, combien de fois avez-vous mangé ce que d'autres personnes considéreraient comme une quantité anormalement grande de nourriture (étant donné les circonstances)?	
14. Lors de ces épisodes, combien de fois avez-vous eu le sentiment de perdre le contrôle sur votre comportement alimentaire (au moment où vous mangiez)?	
15. Durant les 28 derniers jours, pendant combien de JOURS ont eu lieu ces épisodes d'excès de nourriture (c.-à-d., vous avez mangé une quantité anormalement grande de nourriture et vous avez eu le sentiment de perdre le contrôle à ce moment)?	
16. Durant les 28 derniers jours, combien de fois vous êtes-vous fait-e vomir comme moyen de contrôler votre silhouette ou votre poids?	
17. Durant les 28 derniers jours, combien de fois avez-vous pris des laxatifs comme moyen de contrôler votre silhouette ou votre poids?	
18. Durant les 28 derniers jours, combien de fois avez-vous fait de l'exercice sans pouvoir vous en empêcher, de façon irrésistible, pour contrôler votre poids, votre silhouette ou votre quantité de graisse, ou pour brûler des calories?	

Questions 19 à 21 : Veuillez entourer le chiffre approprié. Nous vous prions de noter que pour ces questions le terme « crises de boulimie » signifie manger une quantité de nourriture que les autres considéreraient comme anormalement grande pour les circonstances, accompagné d'un sentiment d'avoir perdu le contrôle sur le comportement alimentaire.

19. Durant les 28 derniers jours, pendant combien de jours avez-vous mangé en secret (c.-à-d., en cachette) ? ... Ne comptez pas les épisodes de crises de boulimie	Aucun jour	1-5 jours	6-12 jours	13-15 jours	16-22 jours	23-27 jours	Chaque jour
	0	1	2	3	4	5	6
20. Combien de fois vous êtes- vous senti-e coupable de manger (avez-vous ressenti avoir fait quelque chose de mal) en raison des conséquences de ces prises d'aliments sur votre silhouette ou votre poids?	Aucune fois	Quelques fois	Moins de la moitié	La moitié des fois	Plus de la moitié	La plupart du temps	Chaque fois
	0	1	2	3	4	5	6

...Ne comptez pas les épisodes de crises de boulimie							
21. Durant les 28 derniers jours, est-ce que l'idée que d'autres personnes pourraient vous voir manger vous a inquiété-e?	Pas du tout		Légèrement		Modérément		Fortement
...Ne comptez pas les épisodes de crises de boulimie	0	1	2	3	4	5	6

Questions 22 à 28 : Veuillez entourer le chiffre approprié à droite. Rappelez-vous que les questions se réfèrent seulement aux quatre dernières semaines (28 jours).

Durant les 28 jours passés...	Pas du tout		Légèrement		Modérément		Fortement
22. Est-ce que votre poids a influencé l'idée (jugement) que vous avez de vous-même en tant que personne?	0	1	2	3	4	5	6
23. Est-ce que votre silhouette a influencé l'opinion (jugement) que vous avez de vous-même en tant que personne?	0	1	2	3	4	5	6
24. A quel point cela vous aurait-il contrarié-e si on vous avait demandé de vous peser une fois par semaine (pas plus ou moins souvent) pendant quatre semaines?	0	1	2	3	4	5	6
25. A quel point avez-vous été insatisfait-e de votre poids?	0	1	2	3	4	5	6
26. A quel point avez-vous été insatisfait-e de votre silhouette?	0	1	2	3	4	5	6
27. A quel point étiez-vous mal à l'aise à la vue de votre corps (par ex., voir votre silhouette dans le miroir, dans le reflet d'une vitrine de magasin, en train de vous déshabiller ou de prendre un bain ou une douche)?	0	1	2	3	4	5	6

28. A quel point étiez-vous mal à l'aise du fait que les autres voient votre silhouette ou vos formes (par ex., dans des vestiaires communs, quand vous nagez, ou portez des habits serrés)?	0	1	2	3	4	5	6
--	---	---	---	---	---	---	---

Annexe 17 : Ruminative Response Scale for Eating Disorders (RRS-ED, version francophone de Douilliez et al., 2016)

Consigne : *Veillez lire chacun des énoncés ci-dessous et indiquer à quelle fréquence vous pensez ou faites ce qui est mentionné lorsque vous vous préoccupez de contrôler votre alimentation, votre poids et/ou votre silhouette. Indiquez ce que vous faites habituellement et non ce que vous pensez que vous devriez faire.*

	Presque jamais	Parfois	Souvent	Presque toujours
1. Je pense « Pourquoi est-ce que je réagis toujours de cette manière par rapport à la nourriture ? ».				
2. Je m'isole pour réfléchir à pourquoi j'essaie de contrôler mon alimentation, mon poids et/ou ma silhouette.				
3. J'écris ce que je pense à propos de mon alimentation, poids et/ou silhouette et je l'analyse.				
4. Je pense à un repas récent en souhaitant que ça se soit mieux passé.				
5. Je pense « Pourquoi ai-je de telles difficultés à contrôler mon alimentation, mon poids et/ou ma silhouette ? ».				
6. Je pense « Pourquoi ne puis-je pas mieux gérer mon alimentation ? ».				
7. J'analyse ma personnalité pour comprendre pourquoi je dois essayer de contrôler mon alimentation, mon poids et/ou ma silhouette.				

8. Je vais quelque part seul(e) pour réfléchir à mes sentiments à propos de mon alimentation, mon poids et/ou ma silhouette.				
9. Je pense « Pourquoi ai-je de telles difficultés avec mon alimentation, mon poids et/ou ma silhouette ? ».				

Annexe 18 : Frost Multidimensionnal Perfectionism Scale (FMPS, version francophone de Bouvard et al., 2000)

	Fortement en désaccord	Plutôt en désaccord	Neutre	Plutôt en accord	Fortement en accord
1. Mes parents ont établi des standards très élevés pour moi					
2. L'organisation est vraiment importante pour moi					
3. Étant enfant, j'étais punie lorsque je faisais des choses qui n'étaient pas parfaites					
4. Si je n'établis pas les plus hauts standards pour moi-même, je vais probablement finir par devenir une personne de seconde catégorie					
5. Mes parents n'ont jamais essayé de comprendre mes erreurs					
6. C'est important pour moi d'être tout à fait compétente dans tout ce que je fais					
7. Je suis une personne soignée					
8. J'essaie d'être une personne organisée					
9. Si j'échoue au travail ou à l'école, je considère que je ne vauds rien en tant que personne					
10. Je devrais être contrariée si je fais une erreur					

11. Mes parents voulaient que je sois la meilleure dans tout					
12. Je me fixe des buts plus élevés que la plupart des gens					
13. Si quelqu'un réalise une tâche au travail ou à l'école mieux que moi, alors j'ai le sentiment d'avoir échoué la tâche totalement					
14. Si j'échoue partiellement, c'est aussi grave que de se sentir en échec complet					
15. Seule une performance exceptionnelle est assez bonne dans ma famille					
16. Je suis très forte pour concentrer tous mes efforts sur un but à atteindre					
17. Même lorsque je fais quelque chose très soigneusement, je sens souvent que ce n'est pas tout à fait correct					
18. Je déteste ne pas être la meilleure					
19. J'ai des objectifs extrêmement élevés					
20. Mes parents s'attendaient « à l'excellence » de ma part					
21. Les gens auront probablement une moins bonne opinion de moi si je fais une erreur					
22. Je ne me suis jamais senti capable d'atteindre les attentes de mes parents					

23. Si je ne fais pas aussi bien que les autres personnes, cela veut dire que je suis un être humain inférieur					
24. Les autres personnes semblent accepter des standards plus bas pour eux-mêmes que je ne le fais					
25. Si je ne réussis pas bien tout le temps, les gens ne me respecteront pas					
26. Mes parents ont toujours eu des attentes plus élevées pour mon avenir que moi-même					
27. J'essaie d'être une personne soignée					
28. J'ai habituellement des doutes à propos des choses simples que je fais tous les jours					
29. Être soigné(e) est vraiment important pour moi					
30. Je m'attends à une performance plus élevée dans mes tâches quotidiennes comparativement à la plupart des gens.					
31. Je suis une personne organisée					
32. J'ai tendance à prendre du retard dans mon travail parce que je répète les choses à maintes reprises					
33. Cela me prend beaucoup de temps pour faire quelque chose correctement					
34. Moins je fais d'erreurs, plus les gens vont m'aimer					

35. Je ne me suis jamais sentie capable d'atteindre les standards de mes parents					
---	--	--	--	--	--

Annexe 19 : Intolerance of Uncertainty Scale (IUS, version francophone de Freeston et al., 1994)

Consigne : Voici une série d'énoncés qui représentent la manière dont les gens peuvent réagir à l'incertitude dans la vie. Cochez la case qui décrit le mieux ce qui vous correspond pour chacun des énoncés.

	Pas du tout correspondant	Un peu correspondant	Assez correspondant	Très correspondant	Tout à fait correspondant
1. L'incertitude m'empêche de prendre position.					
2. Être incertain(e) veut dire qu'on est une personne désorganisée.					
3. L'incertitude rend la vie intolérable.					
4. C'est injuste de ne pas avoir de garanties dans la vie.					
5. Je ne peux pas avoir l'esprit tranquille tant que je ne sais pas ce qui va arriver le lendemain.					
6. L'incertitude me rend mal à l'aise, anxieux (se) ou stressé(e).					
7. Les imprévus me dérangent énormément.					
8. Ça me frustre de ne pas avoir toute l'information dont j'ai besoin.					
9. L'incertitude m'empêche de profiter pleinement de la vie.					

10. On devrait tout prévenir pour éviter les surprises.					
11. Un léger imprévu peut tout gâcher, même la meilleure des planifications.					
12. Lorsque c'est le temps d'agir, l'incertitude me paralyse.					
13. Être incertain(e) veut dire que je ne suis pas à la hauteur.					
14. Lorsque je suis incertain(e), je ne peux pas aller de l'avant.					
15. Lorsque je suis incertain(e), je ne peux pas bien fonctionner.					
16. Contrairement à moi, les autres semblent toujours savoir où ils vont dans la vie.					
17. L'incertitude me rend vulnérable, malheureux (se) ou triste.					
18. Je veux toujours savoir ce que l'avenir me réserve.					
19. Je déteste être pris(e) au dépourvu.					
20. Le moindre doute peut m'empêcher d'agir.					
21. Je devrais être capable de tout organiser à l'avance.					
22. Être incertain(e), ça veut dire que je manque de confiance.					

23. Je trouve injuste que d'autres personnes semblent certaines face à leur avenir.					
24. L'incertitude m'empêche de bien dormir.					
25. Je dois me retirer de toute situation incertaine.					
26. Les ambiguïtés de la vie me stressent.					
27. Je ne tolère pas d'être indécis(e) au sujet de mon avenir.					

Annexe 20 : Article Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students (Lasson et al., 2021)

Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity
<https://doi.org/10.1007/s40519-021-01123-6>

ORIGINAL ARTICLE



Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students

Clotilde Lasson¹ · Friederike Barthels² · Patrick Raynal¹

Received: 30 September 2019 / Accepted: 20 January 2021

© The Author(s), under exclusive licence to Springer Nature Switzerland AG part of Springer Nature 2021

Abstract

Purpose This study aimed at obtaining a French version of the DOS (F-DOS) and evaluating its psychometric properties in a sample of university students, then assessing the prevalence of orthorexic eating behavior among the participants.

Methods The F-DOS was obtained using back translation, and then administered to 3235 university students (10.32% men, 89.67% women) with a mean age of 21.13 (SD = 2.23). The Eating Habits Questionnaire and Eating Attitudes Test were used to assess convergent and divergent validities, respectively. Confirmatory factor analysis was performed to explore the factor structure.

Results Ordinal ω of F-DOS was 0.87, indicating very good internal consistency. F-DOS and EHQ total scores were strongly correlated ($r_s = 0.74$, $p < 0.001$), indicating very good construct validity. Factor analysis revealed a well-fitted one-factor model. Regarding Orthorexia Nervosa (ON) prevalence, according to DOS cut-off score, 3.28% of participants could be considered having ON, while an additional 11.31% could be at risk of developing ON.

Conclusions The F-DOS appears to be a valid and reliable instrument to assess orthorexic eating behavior. ON prevalence in college students appeared similar to Germany and lower than in the US.

Level of evidence Descriptive (cross-sectional) study, Level V.

Keywords Orthorexic behaviors · Eating disorders · Anorexia nervosa

Introduction

Orthorexia Nervosa (ON) is defined as an excessive preoccupation with healthy food, characterized by the adherence to strict dietary rules that might lead individuals to cut out some food or food categories of their diet, because they are considered not pure or bad for their health [1]. In a study in Belgium and the Netherlands, 66.7% of healthcare professionals reported to have observed this potential disorder in their own practice, and 68.5% expressed that the diagnosis of ON should deserve more attention [2]. To date, despite

proposals of diagnostic criteria (i.e., obsessional preoccupation with eating “healthy food”, impairment of physical health, and impairment of social, academic or vocational functioning [3]), research has not yet allowed the categorization of ON as a separate mental disorder in classifications [4]. This is partly due to an overlap of certain ON features with Anorexia Nervosa (AN), but also with other eating disorders or obsessive-compulsive disorder [5, 6]. However, on a theoretical level, ON and AN can be distinguished from each other on several aspects. For example, individuals with ON are essentially focused on food quality and its impact on health, while, in AN, the obsession is exclusively oriented on food quantity and fear of obesity [7]. In addition, it has been suggested that ON could also serve as a healthier alternative or as a coping strategy for individuals suffering from AN, allowing them to eat more while maintaining control over food [8]. Regarding weight matters, it is unclear how far weight loss is intended in ON [9, 10] and there is a lack of a clear link between ON symptomatology and body mass index (BMI). Indeed, most studies found no significant

✉ Clotilde Lasson
clotilde.lasson@univ-tlse2.fr

¹ Laboratoire Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de La Santé, Université Toulouse-Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France

² Heinrich-Heine-University Düsseldorf, Universitätsstraße 1, 40225 Düsseldorf, Germany

relationship between ON and BMI, while others reported an increased ON symptomatology linked to greater BMI [11].

Besides weight loss, other negative effects of ON encompass different aspects, including nutritional deficiencies [9, 12], hypoestrogenism [13], depression [14], social isolation [1, 5] or stigmatization by others [15]. In community or student samples, positive correlations were found between ON symptomatology and depression symptoms, negative affects, or suicidal ideations [11, 16]. In addition, negative correlations were reported between ON and well-being, self-esteem, and ability to relax [17]. Moreover, children living with orthorexic parents can be exposed to harmful effects of malnutrition [18, 19].

ON prevalence in community or student samples was estimated between 6.9% [20] and 70% using ORTO-15 [9, 21], a widely used self-report questionnaire created to assess ON symptomatology [22]. Regarding gender, a large meta-analytic work compiling 67 publications showed that tendencies toward orthorexic behaviors were comparable between genders, but pathological healthy eating appeared to be more pronounced in women [23].

To date, the high prevalence rates of ON reported in some studies are thought to be due to psychometric limitations of ORTO-15. Indeed, ORTO-15 might also detect a construct other than pathological eating beliefs and behaviors [24], as it includes items seemingly unspecific to ON, e.g., "At present, are you alone when having meals?" [22]. It thus seems important to replicate those prevalence studies with more reliable measurement tools. Another instrument for assessing ON is the Eating Habits Questionnaire (EHQ) [16], but it has been criticized for not taking into account negative emotionality or other dimensions of ON [7, 25]. The EHQ was nonetheless used in this current study, because it has better psychometric properties than the ORTO-15 and seems, therefore, to be more appropriate to assess convergent validity. The Teruel Orthorexia Scale is a novel and promising tool as it attempts to distinguish ON from healthy orthorexia (interest in healthy eating) [25]. It remains to be validated in different languages.

One validated and reliable instrument that was recently published is the Düsseldorf Orthorexia Skala (DOS) [17]. The DOS has been used in various samples in Germany, e.g., [8, 17, 26–28]. It was also translated in English [29], Chinese [30], and Spanish [31], showing good psychometric properties in original or translated versions.

The aim of this study was to adapt the DOS into French and examine its psychometric properties (internal consistency, factor structure, and convergent and divergent validities) using a university student sample. To assess the convergent and divergent validities of the translated DOS, participants also completed the EHQ and the Eating Attitudes Test evaluating eating disorders [32]. In addition, to address the links between ON and psychopathology, a

correlational analysis was performed between ON symptomatology and markers of functioning and mental health status in students (i.e., results of the last semester, levels of anxiety, depression, and obsessional–compulsive symptoms).

Methods

Participants and procedure

The data were collected through an online survey that was distributed to students from different universities in France. The link was shared on social networks in groups specifically dedicated to students. To be eligible for participation, participants had to be university students and older than 18. Informed consent was obtained online before completing the survey and no compensation was offered to participate in the study. The study protocol was approved by the local ethics committee (Comité d'Ethique de la Recherche de Toulouse University).

This study's participants were 3235 college students (10.32% men, 89.67% women), aged between 18 and 29 years (mean age = 21.13, SD = 2.23). Based on self-reported height and weight, calculated BMI ranged from 13.67 to 59.12 (mean = 22.04, SD = 4.06) kg/m². Other characteristics of participants are shown in Table 1. The majority of participants had a normal weight (68.9%) and did not follow a particular diet (79.3%), while 9.6% considered themselves as vegetarian, 3.9% flexitarian (i.e., a person with a primarily vegetarian diet with the occasional inclusion of meat or fish), and 2.9% vegan. Regarding fields of study, 40.9% of participants were in human sciences, 9.9%

Table 1 Participants' demographics and dietary style characteristics (*N* = 3235)

Age, years, mean (SD)	21.13 (2.23)
Gender, <i>n</i> (%)	
Men	334 (10.3)
Women	2901 (89.7)
Body mass index (kg/m ²), <i>n</i> (%)	
Underweight (BMI < 18)	446 (13.8)
Normal weight (BMI 18–24.99)	2228 (68.9)
Overweight (BMI 25–29.99)	412 (12.7)
Obese (BMI > 30)	137 (4.2)
Dietary style, <i>n</i> (%)	
Vegetarian	310 (9.6)
Vegan	94 (2.9)
Flexitarian (low in meat)	126 (3.9)
Low in sugar	32 (1.0)
Low in fat	25 (0.8)
Other (gluten-free, ketogenic, etc.)	81 (2.5)
No specific dietary style	2567 (79.3)

in law, 9.7% in literature and foreign language, 8.9% in sciences or engineering, 6.3% in history, geography, or political sciences, 5.2% in economics, 4.5% in medical/paramedical courses, 2.9% in art or design, 2.9% in art history or archeology, 2.6% in educational sciences, 2.2% in communication and information, and 4% in other fields.

Measures

Sociodemographic information was obtained including age, gender, height, weight, field of study, current year of study (first year's bachelor, second year's bachelor, etc.), and result of the last semester of participant's major course. Personal dietary style (vegetarian, vegan, etc.) was also assessed.

The Düsseldorf Orthorexia Skala (DOS)

The DOS is a self-report questionnaire measuring orthorexic behaviors using 10 items, each rated on a 4-point Likert scale (from 1 = "this does not apply to me" to 4 = "this applies to me") [17]. Higher scores suggest the presence of more pronounced orthorexic behaviors. A score ≥ 30 is considered as a cut-off to indicate the presence of ON, and a score ≥ 25 and ≤ 29 suggests a risk of ON [17, 33]. The DOS has shown high internal consistency, with Cronbach's α ranging from 0.8 to 0.88 [8, 17, 26–31]. In this current

study, the DOS was translated from German to French using a back translation procedure [34], i.e., the original version was translated into French and then back into German by two different translators. Differences were then discussed in a research meeting to decide the best translation for each item. The final version of the French version of the DOS (F-DOS) is presented in Table 2. For reviewing purpose, the corresponding items of the English version (E-DOS) [29] are also presented in Table 2.

The Eating Habits Questionnaire (EHQ)

The EHQ assesses cognitions, behaviors, and feelings related to an extreme focus on healthy eating [16]. Participants filled in the 21-item version [11]. Each item is rated on a 4-point scale (from 1 = "false, not at all true" to 4 = "very true"). The EHQ is composed of 3 subscales: (1) problems associated with healthy eating (e.g., "I spend more than 3 h a day thinking about healthy food"); (2) knowledge of healthy eating (e.g., "I know more about healthy eating than do other people"); (3) feeling positively about healthy eating (e.g., "I feel in control when I eat healthily"). As no ON measurement tool existed in French at the time the current study began, the EHQ was translated by the authors for the purposes of the study and used as the gold standard for the assessment of convergent validity. Since the study was conducted, the

Table 2 Mean, SD, and item selectivity

Item	Mean (SD)	Item selectivity
1. Manger de la nourriture bonne pour la santé est plus important pour moi que le plaisir <i>1. Eating healthy food is more important to me than indulgence/enjoying the food</i>	2.46 (0.73)	0.58
2. J'ai établi des règles alimentaires auxquelles j'adhère <i>2. I have certain nutrition rules that I adhere to</i>	2.55 (0.98)	0.64
3. Je peux apprécier la nourriture seulement si elle est considérée comme bonne pour la santé <i>3. I can only enjoy eating foods considered healthy</i>	1.65 (0.73)	0.60
4. J'évite d'aller manger chez des amis lorsqu'ils ne veillent pas à avoir une alimentation saine <i>4. I try to avoid getting invited over to friends for dinner if I know that they do not pay attention to healthy nutrition</i>	1.35 (0.65)	0.62
5. Je trouve positif de faire plus attention que les autres à avoir une alimentation saine <i>5. I like that I pay more attention to healthy nutrition than other people</i>	2.65 (0.90)	0.55
6. Lorsque je mange quelque chose qui n'est pas bon pour la santé, je m'en veux <i>6. If I eat something I consider unhealthy, I feel really bad</i>	2.31 (0.93)	0.64
7. J'ai l'impression d'être exclu(e) par mes amis et mes collègues à cause de mon régime alimentaire strict <i>7. I have the feeling of being excluded by my friends and colleagues due to my strict nutrition rules</i>	1.27 (0.59)	0.52
8. Mes pensées sont centrées en permanence sur l'alimentation saine et j'organise ma journée en fonction de cela <i>8. My thoughts constantly revolve around healthy nutrition and I organize my day around it</i>	1.43 (0.72)	0.67
9. Il m'est difficile de transgresser mes règles alimentaires <i>9. I find it difficult to go against my personal dietary rules</i>	1.76 (0.92)	0.65
10. Je me sens déprimé(e) lorsque je mange quelque chose de mauvais pour la santé <i>10. I feel upset after eating unhealthy foods</i>	1.77 (0.90)	0.66

The corresponding items of E-DOS are shown in italics

EHQ has been validated in French [35]. The EHQ demonstrated good internal consistency with a Cronbach's $\alpha=0.90$ in the English version [16] and an Ordinal $\omega=0.92$ in the current study.

The Eating Attitudes Test-26 (EAT-26)

EAT-26 is a standard assessment tool to measure pathological characteristics associated with anorexic and bulimic eating behavior [32]. It is composed of 26 items and 3 subscales (Dieting, Bulimia and food preoccupation, and Oral control). An example item is "I avoid eating when I am hungry". The French adaptation [36] was used. The internal consistency of the French version was demonstrated with a Cronbach's $\alpha=0.86$ [36] and an Ordinal $\omega=0.94$ in the present study.

Psychopathology measures

Anxiety and depression symptoms were assessed using the Generalized Anxiety Disorder-7 and the Patient Health Questionnaire-9, respectively [37, 38]. Levels of obsessive-compulsive symptoms were evaluated with the Obsessive Compulsive Inventory-Revised [39]. For these 3 scales, high scores suggest more pronounced symptoms. For the present study, the French versions [40–42] of these questionnaires were used. Good internal consistency of the French versions was demonstrated with Cronbach's of 0.90, 0.90, and 0.86, respectively, in the previous studies [40–42] and Ordinal ω of 0.92, 0.89, and 0.90, respectively, in the current study.

Data analysis

RStudio (Version 1.2.5033) for Macintosh was used for the analysis. Prior to statistical analysis, the assumption of normality was checked using an examination of skewness and kurtosis cues, as well as Shapiro–Wilk and Levene tests for normality and homoscedasticity. Due to significant deviation from normality in all the measures used in this study (Shapiro–Wilk <0.001), we chose to implement nonparametric statistics. A Confirmatory Factor Analysis (CFA) based on the single-factor model of DOS was performed using the Lavaan and SemPlot packages from RStudio [43, 44]. Given the DOS 4-point Likert scale, we considered the data as categorical and we used the Weighted Least Squares with Mean and Variance (WLSMV) estimation method for the CFA [45]. F-DOS missing values (0.49%) were handled using listwise deletion before computing CFA, which is an acceptable procedure in regards with Tabachnick and Fidell's recommendations [46] that removing missing data was acceptable when 5% or less of participants have missing data. To evaluate model fit we relied on the following recommendations: values of Comparative Fit Index (CFI)

and Tucker Lewis Index (TLI) greater than about 0.9 or greater indicate good fit of the model [47], values of Root Mean Square Error of Approximation (RMSEA) about 0.08 or less suggest a reasonable model-data fit [48], and values of Root Mean Square Residual (RMSR) equal or less than 0.08 indicate a well-fitting model [49]. Reliability analysis was assessed using calculation of Ordinal ω [50, 51]. To analyze convergent validity, Spearman's Rho correlations were examined between F-DOS and EHQ. To test divergent validity, these coefficients were examined between F-DOS and EAT-26.

Results

Confirmatory factor analysis (CFA)

A CFA was performed based on the single-factor model of DOS. The computation of the fit indices showed that the model had a good fit: $\chi^2(35)=703.979$, $p<0.001$; CFI=0.941; TLI=0.924; RMSEA=0.077; SRMR=0.065. The graphical representation of the CFA with standardized factor loadings is represented in Fig. 1.

Validity and reliability of F-DOS

The Ordinal ω value of the F-DOS was 0.87, showing strong internal consistency. For each F-DOS item, mean, SD, and item selectivity are presented in Table 2.

The total scores of the F-DOS and the EHQ were significantly correlated ($r_s=0.74$, $p<0.001$), suggesting good construct validity. Significant correlation coefficients were also found with the three subscales of the EHQ (knowledge: $r_s=0.65$; problems: $r_s=0.69$; feelings: $r_s=0.62$, $p<0.001$ for all).



Fig. 1 Path diagram of the tested F-DOS with standardized factor loadings

Regarding divergent validity, the relationship of each F-DOS item with the EAT-26 total or subscale scores revealed that coefficient correlations were in the 0.05–0.45 range. The correlation coefficient of F-DOS and EAT-26 total scores was 0.39 ($p < 0.001$).

Prevalence and psychopathology of ON

The mean total score of F-DOS for the sample was 19.2 (range 10–39; $SD = 4.95$). To assess the validity of the cut-offs previously reported, we applied the same method used in the original study [17]. In this method, the 95th percentile corresponds to 29 and a score equal or above 30 was suggested on the basis of this 95th percentile as a preliminary cut-off value for the presence of orthorexia [17]. A score between 25 and 29 was suggested as an “at risk” preliminary cut-off based on the 90th percentile [30, 33, 52]. With this method, in our sample, the 95th percentile corresponds to 28, suggesting a score equal or above 29 as a cut-off value for the presence of orthorexia, and the 90th percentile corresponds to 25, suggesting a score between 26 and 28 as an “at risk” cut-off. Considering that 29 is very close to 30, that 26 is very close to 25, and that in every other article validating the DOS in different languages [29, 30, 52], the preliminary recommended cut-offs of 30 and 25 were used, we chose to also use the cut-offs of 30 and 25. On this basis, 3.28% of participants could be considered having ON, while an additional 11.31% could be at risk of developing ON. No risk of ON was observed in 85.41% of the sample. No statistically significant relationships between the F-DOS categories and gender (Cramer's $V = 0.013$, $p = 0.766$) or between the F-DOS and BMI categories ($r_s = 0.01$, $p = 0.39$) were observed. However, a positive significant correlation, yet very small, was observed between BMI and the F-DOS total score ($r_s = 0.04$, $p < 0.01$). Participants who indicated following a certain diet (vegetarian, vegan, flexitarian, etc.) were more likely to display ON or be at risk of developing ON (certain diet: ON: 8.4%, risk of ON: 27.7%; no certain diet: ON: 1.9%, risk of ON: 7.1%, Cramer's $V = 0.311$, $p < 0.001$). Considering only vegetarians or vegans ($n = 404$), they were more likely to have ON (6.19% vs. 1.95%) or to be at risk of developing ON (29.95% vs. 7.05%) compared with students who did not follow a particular diet (Cramer's $V = 0.281$, $p < 0.001$). Similarly, looking only at flexitarians ($n = 126$), they were more likely to have ON (4.76% vs. 1.95%) or to be at risk of developing ON (23.81% vs. 7.05%) compared with participants who did not follow a specific diet (Cramer's $V = 0.14$, $p < 0.001$).

To address the links between ON and psychopathology, a correlational analysis was performed between the F-DOS total score, markers of functioning, and mental health status in students: results of the last semester, levels of anxiety, depression, and obsessional–compulsive symptoms. While

no significant correlations were revealed between F-DOS and symptomatology of anxiety ($r_s = -0.005$, $p = 0.76$), depression ($r_s = -0.008$, $p = 0.64$), and obsessive–compulsive disorder ($r_s = -0.022$, $p = 0.23$), a small positive correlation was revealed between F-DOS and results of the last semester ($r_s = 0.071$, $p < 0.001$).

Discussion

This study is the first to describe a French version of the DOS. The so-called F-DOS showed good validity and reliability. Its Ordinal ω value (0.87) indicated a good internal consistency, in the same range (0.8 to 0.88) as the Cronbach's α of other DOS versions in different languages [8, 17, 26–31]. In addition, the mean total score of F-DOS in this study ($M = 19.2$, $SD = 4.95$) was very close to that of the DOS obtained in young adults in Germany ($M = 17.75$, $SD = 5.44$) [17] or to that of the E-DOS in a US student sample with a women majority ($M = 20.02$, $SD = 5.95$) [29]. Likewise, the ranges of mean score per item were highly similar between DOS (1.23–2.43), E-DOS (1.42–2.59), and F-DOS (1.27–2.65), further strengthening the validity of F-DOS. Similarly, the range of item selectivity values was also very comparable between DOS (0.49–0.63), E-DOS (0.56–0.73), and F-DOS (0.52–0.67) [17, 29].

Regarding the factor analysis of the F-DOS, the single component model had a good fit. Regarding divergent validity, the correlational analysis of F-DOS and EAT-26 showed that these instruments evaluate distinct constructs, even though, as expected, some relations exist [8, 53]. Altogether, these analyses indicate that the F-DOS displays significant reliability and validity, as well as specificity for ON among eating disorders.

With 3.28% of participants scoring above the cut-off, the prevalence of ON may appear very low in this study, compared to reports of ON prevalence rates as high as 30–70% in community or student samples [9, 21]. However, these high rates are currently thought to reflect significant psychometric limitations when measuring ON with ORTO-15, rather than attesting a widespread prevalence of ON [7]. Indeed, when additional criteria were used to assess ON using ORTO-15, a prevalence rate below 1% was found in a US sample [54]. Moreover, using the DOS or its adaptations rather than ORTO-15, the ON prevalence rate in community or student samples varied from 1 to 6.9% in Germany [17, 27], and it was around 8% in samples of US or China university students composed with a majority of women [29, 30]. Therefore, the ON rate in French university students appeared to be within the range reported in comparable samples assessed using the DOS or one of its adaptations.

Regarding BMI, this study found a small positive correlation between BMI and ON symptomatology, which is

in line with recent reports showing positive links between ON and drive for thinness, a common underlying feature of AN [8, 17]. However, other reports showed no major relation between ON and BMI in students or community samples [25, 29, 30, 55]. Additional research is thus required to clarify this area.

Looking at the general psychopathology of the sample, the results did not reveal any correlation between F-DOS total score and levels of anxiety, depression, and obsessive-compulsive symptoms; accordingly, it cannot be assumed that general psychopathology increases with higher levels of orthorexic eating behavior measured by the F-DOS. A possible explanation might be that people with slightly elevated DOS levels, without displaying any pathological features, feel better when they eat healthier, and thus, they display lower levels of general psychopathology. It could be further assumed that insight into illness might not be given in ON [56]. Hence, some individuals with high levels of orthorexic eating behavior, supposedly displaying a pathological behavior, might not be willing to admit that their well-being is impaired. These two possible explanations might then lead to an unclear pattern of the relationship between general psychopathology and F-DOS total scores. Yet, the F-DOS score was positively correlated with academic results. A possible reason of this association could be perfectionism, a trait linked with orthorexic behaviors [7, 31, 57] but also with higher performance and academic achievement [58]. Also, regarding these aspects, more research is needed to further analyze how orthorexic eating behavior elicits psychological distress.

This study is not without some limitations. First, the BMI was calculated with self-reported weight and size. The results regarding BMI should thus be considered with caution. In addition, the use of self-report questionnaires could be viewed as a weakness in trustworthiness of results, and semi-structured interviews could have strengthened the findings. Second, due to the transversal design of this study, test-retest reliability was not examined.

In conclusion, this study suggests that the F-DOS is a psychometrically adequate instrument to measure ON symptomatology in French-speaking populations, thereby providing a reliable instrument to assess ON in individuals in these populations. This report also shows an ON prevalence of 3.28% in young adults, while an additional 11.31% could be at risk of developing ON. The existence of a reliable assessment tool is important for future research, notably for identifying ON risk factors and protective elements, as well as for developing potential interventions.

What is already known on this subject?

The aim of this study was to adapt the DOS into French and examine its psychometric properties.

What this study adds?

This study provides an instrument to measure ON symptomatology in French-speaking populations, allowing future research on risk and protective factors, and the development of potential interventions.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40519-021-01123-6>.

Acknowledgements We are grateful to Fanny Gemieux for help in data collection.

Author contributions CL and PR designed the study and wrote the protocol. CL, FB, and PR conducted literature searches, provided summaries of previous research, and participated in the writing of the Introduction and Discussion sections. PR wrote the first draft of the Abstract, Method, and Conclusion sections. CL conducted statistical analyses and wrote the Results section. All authors contributed to and have approved the final manuscript.

Funding No funding was provided for this study.

Data availability The authors do not have permission to share data.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the Comité d'Ethique de la Recherche de the University of Toulouse (Registration number 2019-123) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all the participants included in this study.

Consent for publication All participants were informed that results from this study were going to be published in scientific journals or congress. Consent was obtained from all the participants included in this study.

References

1. Bratman S, Knight D (2000) *Health food junkies: overcoming the obsession with healthful eating*. Broadway Books, New York
2. Vandereycken W (2011) Media hype, diagnostic fad or genuine disorder? professionals' opinions about night eating syndrome, orthorexia, muscle dysmorphia, and emetophobia. *Eat Disord* 19:145–155. <https://doi.org/10.1080/10640266.2011.551634>
3. Moroze RM, Dunn TM, Craig Holland J et al (2015) Microthinking about micronutrients: a case of transition from obsessions about healthy eating to near-fatal "orthorexia nervosa" and proposed diagnostic criteria. *Psychosomatics* 56:397–403. <https://doi.org/10.1016/j.psych.2014.03.003>

4. Barthels F, Meyer F, Pietrowsky R (2015) Orthorexic eating behavior. A new type of disordered eating. *Ernahrungs Umsch* 62:156–161. <https://doi.org/10.4455/eu.2015.029>
5. Brytek-Matera A (2012) Orthorexia nervosa—an eating disorder, obsessive-compulsive disorder or disturbed eating habit. *Arch Psychiatry Psychother* 1:55–60
6. Ryman FVM, Syurina E, Bood Z, Cesuroglu T (2019) Orthorexia Nervosa: disorder or not? Opinions of Dutch health professionals. *Front Psychol* 10:555. <https://doi.org/10.3389/fpsyg.2019.00555>
7. Koven NS, Abry AW (2015) The clinical basis of orthorexia nervosa: emerging perspectives. *Neuropsychiatr Dis Treat* 11:385–394. <https://doi.org/10.2147/NDT.S61665>
8. Barthels F, Meyer F, Huber T, Pietrowsky R (2017) Orthorexic eating behaviour as a coping strategy in patients with anorexia nervosa. *Eat Weight Disord-Stud Anorex Bulim Obes* 22:269–276. <https://doi.org/10.1007/s40519-016-0329-x>
9. Dunn TM, Bratman S (2016) On orthorexia nervosa: a review of the literature and proposed diagnostic criteria. *Eat Behav* 21:11–17. <https://doi.org/10.1016/j.eatbeh.2015.12.006>
10. Thibault I, Pauzé R, Lavoie E et al (2016) Étude de cas d'une jeune orthorexique. *Rev Québécoise Psychol* 37:27–38. <https://doi.org/10.7202/1040102ar>
11. Oberle CD, Samaghabadi RO, Hughes EM (2017) Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite* 108:303–310. <https://doi.org/10.1016/j.appet.2016.10.021>
12. Molina-Alén E (2006) Perspectiva antropológica de un caso de ortorexia nerviosa. In: *Cult Los Cuid Año X N° 20 2° Semest*, pp 109–116
13. McGregor R (2017) Orthorexia: when healthy eating goes bad. Watkins Media Limited, London
14. Lopes R, Melo R, Pereira BD (2018) Orthorexia nervosa and comorbid depression successfully treated with mirtazapine: a case report. *Eat Weight Disord-Stud Anorex Bulim Obes*. <https://doi.org/10.1007/s40519-018-0539-5>
15. Nevin SM, Vartanian LR (2017) The stigma of clean dieting and orthorexia nervosa. *J Eat Disord* 5:37. <https://doi.org/10.1186/s40337-017-0168-9>
16. Gleaves DH, Graham EC, Ambwani S (2013) Measuring 'orthorexia': development of the eating habits questionnaire. *Int J Educ Psychol Assess* 12:2
17. Barthels F, Meyer F, Pietrowsky R (2015) Die düsseldorfer orthorexie skala-konstruktion und evaluation eines fragebogens zur erfassung ortho-rektischen ernährungsverhaltens. *Z Für Klin Psychol Psychother* 2015:8
18. Hunter JD, Crudo DF (2018) Unintended consequences of restrictive diets: two case reports and a review of orthorexia. *Clin Pediatr (Phila)* 57:1693–1695. <https://doi.org/10.1177/0009922818795905>
19. von Rosenstiel I, Stam J, Schats W (2012) Safety issues and orthorexia in paediatrics. *BMC Complement Altern Med* 12:P224. <https://doi.org/10.1186/1472-6882-12-S1-P224>
20. Donini LM, Marsili D, Graziani MP et al (2004) Orthorexia nervosa: a preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eat Weight Disord Stud Anorex Bulim Obes* 9:151–157. <https://doi.org/10.1007/BF03325060>
21. Gramaglia C, Gambaro E, Delicato C et al (2019) Orthorexia nervosa, eating patterns and personality traits: a cross-cultural comparison of Italian, Polish and Spanish university students. *BMC Psychiatry* 19:235. <https://doi.org/10.1186/s12888-019-2208-2>
22. Donini LM, Marsili D, Graziani MP et al (2005) Orthorexia nervosa: validation of a diagnosis questionnaire. *Eat Weight Disord Stud Anorex Bulim Obes* 10:e28–e32. <https://doi.org/10.1007/BF03327537>
23. Strahler J (2019) Sex differences in orthorexic eating behaviors: a systematic review and meta-analytical integration. *Nutrition* 67–68:110534. <https://doi.org/10.1016/j.nut.2019.06.015>
24. Heiss S, Coffino JA, Hormes JM (2019) What does the ORTO-15 measure? Assessing the construct validity of a common orthorexia nervosa questionnaire in a meat avoiding sample. *Appetite* 135:93–99. <https://doi.org/10.1016/j.appet.2018.12.042>
25. Barrada JR, Roncero M (2018) Bidimensional structure of the orthorexia: development and initial validation of a new instrument. *An Psicol Psychol* 34:283–291
26. Depa J, Schweizer J, Bekers S-K et al (2017) Prevalence and predictors of orthorexia nervosa among German students using the 21-item-DOS. *Eat Weight Disord stud anorex bulim obes* 22:193–199. <https://doi.org/10.1007/s40519-016-0334-0>
27. luck-sikorski c, jung f, schlosser k, riedel-heller sg (2019) is orthorexic behavior common in the general public? a large representative study in germany. *eat weight disord-stud anorex bulim obes* 24:267–273
28. rudolph s (2018) the connection between exercise addiction and orthorexia nervosa in german fitness sports. *eat weight disord-stud anorex bulim obes* 23:581–586. <https://doi.org/10.1007/s40519-017-0437-2>
29. chard ca, hilzendegen c, barthels f, stroebele-benschop n (2019) psychometric evaluation of the english version of the düsseldorf orthorexie scale (dos) and the prevalence of orthorexia nervosa among a us student sample. *eat weight disord-stud anorex bulim obes* 24:275–281. <https://doi.org/10.1007/s40519-018-0570-6>
30. he j, ma h, barthels f, fan x (2019) psychometric properties of the chinese version of the düsseldorf orthorexia scale: prevalence and demographic correlates of orthorexia nervosa among Chinese university students. *Eat Weight Disord-Stud Anorex Bulim Obes* 24:453–463. <https://doi.org/10.1007/s40519-019-00656-1>
31. Parra-Fernández M-L, Rodríguez-Cano T, Onieva-Zafra M-D et al (2018) Prevalence of orthorexia nervosa in university students and its relationship with psychopathological aspects of eating behavior disorders. *BMC Psychiatry* 18:364. <https://doi.org/10.1186/s12888-018-1943-0>
32. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE (1982) The eating attitudes test—psychometric features and clinical correlates. *Psychol Med* 12:871–878
33. Chard CA, Hilzendegen C, Barthels F, Stroebele-Benschop N (2019) Psychometric evaluation of the English version of the Düsseldorf Orthorexie Scale (DOS) and the prevalence of orthorexia nervosa among a U.S. student sample. *Eat Weight Disord Stud Anorex Bulim Obes* 24:275–281. <https://doi.org/10.1007/s40519-018-0570-6>
34. Brislin RW (1970) Back-translation for cross-cultural research. *J Cross-Cult Psychol* 1:185–216. <https://doi.org/10.1177/135910457000100301>
35. Yakın E, Raynal P, Chabrol H (2020) Distinguishing orthorexic behaviors from eating disordered and obsessive—compulsive behaviors: a typological study. *Eat Weight Disord Stud Anorex Bulim Obes*. <https://doi.org/10.1007/s40519-020-01037-9>
36. Lechner P, Steiger H, Puentes-Neuman G et al (1994) Validation d'une échelle d'attitudes alimentaires auprès d'une population québécoise francophone, validation d'une échelle d'attitudes alimentaires auprès d'une population québécoise francophone. *Can J Psychiatry* 39:49–54. <https://doi.org/10.1177/070674379403900110>
37. Kroenke K, Spitzer RL (2002) The PHQ-9: a new depression diagnostic and severity measure. *Psychiatr Ann* 32:509–515. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>
38. Spitzer RL, Kroenke K, Williams JBW, Löwe B (2006) A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 166:1092. <https://doi.org/10.1001/archinte.166.10.1092>

39. Foa EB, Huppert JD, Leiberg S et al (2002) The obsessive-compulsive inventory: development and validation of a short version. *Psychol Assess* 14:485–496
40. Micoulaud-Franchi J-A, Lagarde S, Barkate G et al (2016) Rapid detection of generalized anxiety disorder and major depression in epilepsy: validation of the GAD-7 as a complementary tool to the NDDI-E in a French sample. *Epilepsy Behav* 57:211–216. <https://doi.org/10.1016/j.yebeh.2016.02.015>
41. Carballeira Y, Dumont P, Borgacci S et al (2007) Criterion validity of the French version of Patient Health Questionnaire (PHQ) in a hospital department of internal medicine. *Psychol Psychother Theory Res Pract* 80:69–77. <https://doi.org/10.1348/147608306X103641>
42. Zermatten A, Van der Linden M, Jermann F, Ceschi G (2006) Validation of a French version of the Obsessive-Compulsive Inventory-Revised in a non-clinical sample. *Eur Rev Appl Psychol Rev Eur Psychol Appliquée* 56:151–155. <https://doi.org/10.1016/j.erap.2005.07.003>
43. Rosseel Y (2012) lavaan: an R package for structural equation modeling. *J Stat Softw*. <https://doi.org/10.18637/jss.v048.i02>
44. Epskamp S (2015) semPlot: unified visualizations of structural equation models. *Struct Equ Model* 22:474–483. <https://doi.org/10.1080/10705511.2014.937847>
45. Li C-H (2016) Confirmatory factor analysis with ordinal data: comparing robust maximum likelihood and diagonally weighted least squares. *Behav Res Methods* 48:936–949. <https://doi.org/10.3758/s13428-015-0619-7>
46. Tabachnick BG, Fidell LS (2014) Using multivariate statistics, Pearson new international edition, 6th edn. Pearson, Harlow
47. Bentler PM (1990) Comparative fit indexes in structural models. *Psychol Bull* 107:238–246
48. Browne MW, Cudeck R (1992) Alternative ways of assessing model fit. *Sociol Methods Res* 21:230–258. <https://doi.org/10.1177/0049124192021002005>
49. Hu L, Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model* 6:1–55. <https://doi.org/10.1080/10705519909540118>
50. McDonald RP (1999) Test theory: a unified treatment. Lawrence Erlbaum Associates Publishers, Mahwah
51. Viladrich C, Angulo-Brunet A, Doval E (2017) Un viaje alrededor de alfa y omega para estimar la fiabilidad de consistencia interna. *An Psicol* 33:755. <https://doi.org/10.6018/analesps.33.3.268401>
52. Parra-Fernández ML, Onieva-Zafra MD, Fernández-Muñoz JJ, Fernández-Martínez E (2019) Adaptation and validation of the Spanish version of the DOS questionnaire for the detection of orthorexic nervosa behavior. *PLoS ONE* 14:e0216583. <https://doi.org/10.1371/journal.pone.0216583>
53. Zickgraf HF, Ellis JM, Essayli JH (2019) Disentangling orthorexia nervosa from healthy eating and other eating disorder symptoms: relationships with clinical impairment, comorbidity, and self-reported food choices. *Appetite* 134:40–49. <https://doi.org/10.1016/j.appet.2018.12.006>
54. Dunn TM, Gibbs J, Whitney N, Starosta A (2017) Prevalence of orthorexia nervosa is less than 1%: data from a US sample. *Eat Weight Disord-Stud Anorex Bulim Obes* 22:185–192. <https://doi.org/10.1007/s40519-016-0258-8>
55. Varga M, Thege BK, Dukay-Szabó S et al (2014) When eating healthy is not healthy: orthorexia nervosa and its measurement with the ORTO-15 in Hungary. *BMC Psychiatry* 14:59. <https://doi.org/10.1186/1471-244X-14-59>
56. Bratman MDS, Knight D (2001) Health food junkies: orthorexia nervosa: overcoming the obsession with healthful eating, 1st edn. Broadway, New York
57. Barnes MA, Caltabiano ML (2017) The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. *Eat Weight Disord Stud Anorex Bulim Obes* 22:177–184. <https://doi.org/10.1007/s40519-016-0280-x>
58. Damian LE, Stoeber J, Negru-Subtirica O, Băban A (2017) On the development of perfectionism: the longitudinal role of academic achievement and academic efficacy. *J Pers* 85:565–577. <https://doi.org/10.1111/jopy.12261>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Annexe 21 : Article Personality profiles in young adults with orthorexic eating behaviors (Lasson & Raynal, 2021)

Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity
<https://doi.org/10.1007/s40519-021-01124-5>

ORIGINAL ARTICLE



Personality profiles in young adults with orthorexic eating behaviors

Clotilde Lasson¹ · Patrick Raynal¹

Received: 10 August 2020 / Accepted: 20 January 2021

© The Author(s), under exclusive licence to Springer Nature Switzerland AG part of Springer Nature 2021

Abstract

Purpose Orthorexia nervosa (ON), defined as an excessive preoccupation with healthy eating, has gained more interest in the literature over these past few years. However, little is known about its risk and protective factors, in particular with regards to personality.

Methods A total of 3235 college students (10.32% men, 89.67% women) with a mean age of 21.13 (SD = 2.23) answered self-administered questionnaires assessing ON, psychopathological symptoms, and personality disorders including schizotypal, borderline, paranoid, obsessive–compulsive, and narcissistic personality. A subsample of 106 participants (91.51% women, mean age = 20.91, SD = 2.31) was selected based on the DOS cutoff score, and was then considered as the “orthorexic subsample”.

Results Hierarchical cluster analysis was performed in the orthorexic subsample and led to the identification of four groups: 1—a cluster with a low level of traits (L); 2—a cluster with moderate traits and low narcissistic traits (MD); 3—a cluster with a low level of traits and moderate narcissistic traits (MN); 4—a cluster with high paranoid and narcissistic traits (PN) and a moderate level of schizotypal and borderline traits. Levels of anxiety, obsessional–compulsive, and depressive symptoms were higher in the PN and MD clusters than in the L and MN clusters. Social phobia was higher and self-esteem lower in the MD cluster and hypochondriasis was higher in the PN and MN clusters.

Conclusions This study suggests that ON can be associated with different personality profiles, some of them displaying significant psychopathological levels. It also emphasizes the importance of taking into account personality disorder traits of young adults with orthorexic eating behaviors.

Level of evidence Descriptive (cross-sectional) study, Level V.

Keywords Orthorexia nervosa · Personality disorder traits · Cluster classification · Young adults · Healthy eating

Introduction

Orthorexia nervosa (ON) is defined as an excessive preoccupation with healthy food, characterized by the adherence to strict dietary rules that might lead individuals to cut out some food or food categories of their diet because they are considered not pure or bad for their health [1]. In a study asking healthcare practitioners [2], 66.7% of participants reported to have observed this potential disorder in their own practice, and 68.5% expressed that the diagnosis of

ON should deserve more attention. To date, despite proposals of diagnostic criteria (i.e., obsessional preoccupation with eating “healthy food”, impairment of physical health, and impairment of social, academic or vocational functioning [3]), ON is not yet indexed into mental disease classifications. Indeed, research has not yet allowed to reach a consensus on how to categorize it. While some studies suggested that ON could be a distinct disorder than those already present in the DSM-5 [4, 5], other studies suggested that ON belongs to the eating disorder spectrum, considering that ON is close to anorexia nervosa, bulimia nervosa, avoidant/restrictive food intake disorder, obsessive–compulsive and related disorders or even anxiety disorders [6–8]. Another study [9] suggested that ON could also serve as a healthier alternative or as a coping strategy for individuals suffering from anorexia nervosa, allowing them to eat more while maintaining control over food.

✉ Clotilde Lasson
clotilde.lasson@univ-tlse2.fr

¹ Laboratoire CERPPS (Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de La Santé), Université Toulouse Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France

Published online: 23 February 2021

Springer

Content courtesy of Springer Nature, terms of use apply. Rights reserved.

Paradoxically, this obsession with health might lead to negative consequences such as nutritional deficiencies, unintended weight loss, and malnutrition [10, 11]. From a psychological point of view, a feeling of moral superiority to others not sharing their way of eating, a loss of interest in work and interpersonal relationships as well as a social isolation might also result from ON [1, 6]. In community or student samples, positive correlations were found between ON, depression, negative affects and suicidal ideations [12, 13].

The prevalence of ON in the general population remains a matter of debate. Indeed, a majority of studies reporting ON prevalence in different populations relied on the ORTO-15 [14], a self-report questionnaire created to assess ON symptomatology. However this scale has been questioned, notably due to psychometric limitations and the omission of ON characteristics, thereby overestimating the prevalence of ON [13, 15–17]. In these latter studies, prevalence was estimated at 6.9% in the general population [14] and from 12.8 to 86% in specific populations such as healthcare professionals, students in the health field, or yoga practitioners (e.g., [10, 18–23]). However, when using the Düsseldorf Orthorexia Skala or its adaptations rather than ORTO-15, the ON prevalence rate in community or student samples varied from 1 to 6.9% in Germany [24, 25], and it was around 8% in the samples of US or China university students [26, 27], which is much lower than the above estimates.

There have been only few studies on risk and protective factors in ON, in particular with regards to personality. These studies only focused on dimensional models of personality or separate personality traits, with Gleaves et al.'s one [12] based on the Big-Five model, Gramaglia et al. and Kiss-Leizer and Rigó's ones [28, 29] based on the temperament and character personality dimensions, and Oberle et al.'s one [13] based on narcissism and perfectionism. Results of these studies suggested that ON could be linked to neuroticism (i.e., propensity to experience negative affects), perfectionism, narcissism (i.e., pervasive pattern of grandiosity, need for admiration and lack of empathy), self-directedness (i.e., ability to regulate behavior to achieve goals), transcendence (associated with spiritual experiences and transpersonal identification), low and medium persistence (i.e., capacity of perseverance in spite of fatigue and frustration), and harm avoidance characterized by excessive worrying, pessimism, and shyness [12, 13, 28, 29]. However, other models such as, for instance, categorical models (i.e., DSM, ICD approaches) assess more pathological aspects of personality. Based on the DSM personality categorical model, strong axis I disorders comorbidity has been reported in individuals with personality disorders [30] which makes this personality approach important to take into account when exploring possible risk and protective factors of ON.

To the best of our knowledge, this study is the first to explore possible links between orthorexic eating behaviors and personality traits based on the DSM categorical model of personality, including schizotypal, borderline, paranoid, obsessive–compulsive as well as narcissistic personality disorder traits. We hypothesized that at least some of these personality traits will be associated with orthorexic eating behaviors. The aim of our study was thus to establish a typology of young adults with orthorexic eating behaviors based on personality disorder traits.

Method

Participants and procedure

Participants were recruited via an advertisement posted on college students groups referenced on Facebook. Potential participants were provided with the link to an online questionnaire taking place on the LimeSurvey platform. Participants were told that if they agreed to take part in the study, they would be asked to answer questionnaires about their eating habits and personality traits. To be eligible for the participation, the participants had to be university students and 18 years or older. Two control questions (e.g., “Please tick the “yes, extremely” if you are careful in completing this questionnaire”) were added at half and three quarter of the questionnaire as inattention checks using the method described in [31]. A total of 157 participants were excluded from the final analyses based on these checks. The study protocol was approved by the local ethics committee (Comité d’Ethique de la Recherche of Toulouse University). Participants involved in this study did not receive any compensation. The questionnaires were anonymous.

Data were collected from 3235 college students (10.32% men, 89.67% women) aged between 18 and 29 years, with a mean age of 21.13 years ($SD = 2.23$). This sample was used in a former study [32]. From this whole sample, based on the DOS cutoff (score of 30 or above, i.e., DOS cutoff score proposed by Barthels et al. [24]), a subsample of 106 participants was selected and considered as the “orthorexic subsample”. It was composed of 91.51% of women and 8.49% of men, aged between 18 and 28, with a mean age of 20.91 ($SD = 2.31$) and a mean BMI of 20.74 ($SD = 3.49$). The majority of them had a normal weight (66.60%) and half of them followed a particular diet (52.83%) while 16.0% described their diet as vegetarian, 12.3% low in fat, 7.5% vegan, 5.7% flexitarian (i.e., a person with a primarily vegetarian diet with the occasional inclusion of meat or fish), and 4.7% low in sugar. Regarding fields of study, 32.1% of participants were in human sciences, 15.1% in law, 15.1% in literature and foreign language, 7.5% in history, geography or political sciences, 6.6% in sciences or engineering, 6.6%

in medical/paramedical courses, 4.7% in communication and information, 3.8% in economics, and 8.5% in other fields.

Measures

Personal information

Personal information was collected by asking participants their age, gender, height, weight, current level of study, field of study, presence or absence of a specific diet, and motives for following such a diet.

Orthorexia nervosa

Orthorexic eating behaviors was assessed using the French version of the Düsseldorfer Orthorexia Skala (DOS; [24, 32]), a unidimensional self-report questionnaire. The DOS includes 10 items scored on a four-point Likert-scale (1 = *This does not apply to me*, 4 = *This applies to me*). An example item is "If I eat something I consider unhealthy, I feel really bad". Higher scores indicate higher level of orthorexic behavior. Cronbach's α of the original version was 0.84 [24], Ordinal ω of the French version was 0.87 in a former study using the same sample [32] and Cronbach's α was 0.81 in this study.

Eating behavior

Symptoms of eating disorders were assessed using the Eating Attitudes Test-26 (EAT-26; [33, 34]), a 26-item self-report questionnaire composed of three subscales: (1) dieting (13 items, e.g., "I avoid foods with sugar in them"), (2) bulimia and food preoccupation (6 items, e.g., "I have the impulse to vomit after meals"), and (3) oral control (7 items, e.g., "I display self-control around food"). Items are scored on a six-point Likert-scale (1 = *Never*, 6 = *Always*). A score equal or above 20 indicates disordered eating attitudes and behaviors. The French version showed good internal consistency for each subscale as well as for the global score, Cronbach's α = 0.85, 0.62, 0.54, and 0.86, respectively [34].

Personality disorder traits

Schizotypal personality traits Schizotypal traits were measured using the Schizotypal Personality Questionnaire-Brief (SPQ-B; [35, 36]), a self-report questionnaire including 22 dichotomous items scored 0/1 (no/yes). An example of item is "People sometimes find me aloof and distant". Cronbach's α of the French version was 0.88 in a former study [35] and 0.83 in this study.

Obsessive-compulsive personality traits Obsessive-compulsive traits were measured using the eight relevant items of the Personality Diagnostic Questionnaire-4 (PDQ-4; [37, 38]). Items (e.g., "I waste time trying to make things too perfect.") were scored 0 (*false*) or 1 (*true*). Cronbach's α of the French version was 0.47 in a former study [39] and 0.43 in this study.

Borderline personality traits Borderline traits were assessed through the nine relevant items of the Personality Diagnostic Questionnaire-4 (PDQ-4; [37, 38]). Items (e.g., "I either love someone or hate them, with nothing in between.") were scored 0 (*false*) or 1 (*true*). Cronbach's α was 0.69 of the French version in a former study [40] and 0.65 in this study.

Paranoid personality traits Paranoid traits were measured using the six relevant items of the Symptoms Check List-90R (SCL-90R; [41, 42]). Items (e.g., "Feeling that you are watched or talked about by others") were scored on a five-point Likert scale (0 = *Not at all*, 4 = *Extremely*). Cronbach's α of the French version was 0.91 in a former study [42] and 0.75 in this study.

Narcissistic personality traits Narcissistic traits were assessed using the Narcissistic Personality Inventory-16 (NPI-16; [43, 44]), a self-report questionnaire including 16 items consisting of pairs of narcissistic and nonnarcissistic sentences (e.g., "I think I am a special person" vs. "I am not better or no worse than most people."). For each item, participants were asked to choose the sentence which fit them best. Narcissistic sentences were scored 1 and nonnarcissistic sentences were scored 0. Cronbach's α of the French version was 0.92 in a former study [44] and 0.62 in this study.

Psychopathological symptoms

Somatization and hypochondriasis symptoms Hypochondriasis and somatization were assessed using the WHITELEY-7 scale [45], a self-report questionnaire including seven items (e.g., "Is it hard for you to believe the doctor when he tells you there is nothing to worry about?"). Items were scored on a four-point Likert scale (1 = *Totally false*, 4 = *Totally true*). Cronbach's α of the original version was 0.73 in a former study [46] and 0.79 in this study.

Depressive symptoms Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9; [47, 48]), a self-report questionnaire including nine items (e.g., "Little interest or pleasure in doing things") in which participants are provided with a list of symptoms and are asked

how often they have been bothered by these symptoms over the past 2 weeks on a 4-point scale (0 = *Not at all*, 3 = *Nearly every day*). Higher scores indicate higher depressive symptomatology, with a score between 5 and 9 indicating mild depressive symptoms, between 10 and 14 mild, between 15 and 19 moderately severe and above 20 severe depression. Cronbach's α of the French version was 0.86 in a former study [49] and 0.85 in this study.

Anxious symptoms Anxious symptoms were assessed using the GAD-7 [50, 51], a self-report questionnaire including seven items (e.g., "Not being able to stop or control worrying") in which participants are provided with a list of symptoms and are asked how often they have been bothered by these symptoms over the past 2 weeks on a 4-point scale (0 = *Never*, 3 = *Almost everyday*). Higher scores indicate higher anxious symptomatology, with a score between 5 and 9 indicating mild, between 10 and 14 moderate, and above 15 severe anxiety. Cronbach's α of the French version was 0.9 in a former study [50] and 0.89 in this study.

Social phobia symptoms Social phobia symptoms were measured using the Mini-Social Phobia Inventory (Mini-SPIN; [52, 53]), a self-report questionnaire including three items. Each item (e.g., "I avoid activities in which I am the center of attention") is scored on a five-point Likert scale (0 = *Not at all*, 4 = *Extremely*). Scores equal or above 6 indicate possible problems with social phobia. Cronbach's α of the French version was 0.93 in a former study [53] and 0.78 in this study.

Obsessive-compulsive symptoms Obsessive-compulsive symptoms were assessed using the Obsessive Compulsive Inventory Revised (OCI-R; [54, 55]), a self-report scale including 18 items. Each item (e.g., "I get upset if others change the way I have arranged things") is scored on a five-point Likert scale (0 = *Not at all*, 4 = *Extremely*). Higher scores indicate higher obsessive-compulsive symptomatology, with a score equal or above 21 indicating the likely presence of obsessive-compulsive disorder. Cronbach's α of the French version was 0.86 in a former study [55] and 0.86 in this study.

Other psychological measures

Self esteem Self-esteem was measured using the Rosenberg Self Esteem Scale [56, 57], a unidimensional scale including ten items. Each item (e.g., "On the whole, I am satisfied with myself") is scored on a four-point Likert scale (1 = *Strongly agree*, 4 = *Strongly disagree*). Items 2, 5, 6, 8, and 9 are reverse scored. Higher scores indicate higher self-

esteem. Cronbach's α of the French version was between 0.83 and 0.90 in a former study [57] and 0.89 in this study.

Data analysis

A cluster analysis was performed in the orthorexic subsample in two steps to identify distinct profiles of participants based on their standardized total scores (z score) for the following personality traits: schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic. In the first step, a hierarchical cluster analysis was conducted (Ward's method with Euclidean distance), and the resulting dendrogram and agglomeration schedule were used to identify the number of clusters. As a second step, K-means clustering was used to assign each individual to the identified clusters. Cluster differences in level of orthorexic eating behaviors and psychopathological variables were tested using ANOVA and Tukey post-hoc tests. Statistical analyses were performed using IBM SPSS Statistics version 24.

Results

Descriptive statistics

As reported in a former study using the same sample [32], 3.28% of participants could be considered having ON. The F-DOS mean scores of the whole sample and the orthorexic subsample were 19.2 (SD = 4.95) and 32.62 (SD = 2.27), respectively. Scores on personality disorder traits and psychopathological variables, descriptive statistics of the whole sample and of the orthorexic subsample are shown in Table 1 (left part).

Cluster analysis

Considering the 106 participants of the orthorexic subsample, a cluster analysis was performed to identify the personality profiles of the participants, based on their scores in schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic traits. In the first step, a hierarchical cluster analysis was performed. The agglomeration schedule and dendrogram were then used to identify the number of clusters. The agglomeration schedule showed a sudden increase in linkage distance (nearly doubling from 24.7 to 48.1) when four clusters merged to three clusters. This indicated that the passage from four to three clusters would have more impact on cluster heterogeneity than the previous stages of the analysis. The dendrogram also clearly indicated a four-cluster solution (Fig. 1, four shaded areas). Therefore, the four-cluster solution was chosen.

In the second step, K-means clustering was used to assign individuals to each of the four clusters. A discriminant

Table 1 Descriptive statistics and typology of individuals with ON on five traits of personality disorders (cluster comparison using ANOVA and Tukey post hoc test) comparisons

	Whole sample (N = 3235)	Cronbach's alpha	Range	Orthorexic Subsample (N = 106)	Cluster M (SD)			F	η^2	Significant
					Low traits (L)	Moderately disturbed (MD)	Paranoid & narcissist. (PN)			
	M (SD)			M (SD)	n = 37 34.9%	n = 36 40.0%	n = 5 4.7%			n = 28 26.4%
Personality traits										
Schizotypal	9.01 (4.87)	0.83	0–22	8.23 (4.84)	6.27 (3.54)	11.94 (4.44)	13.40 (3.78)	5.11 (2.85)	25.08*	0.42 L, MN < MD, PN
Borderline	3.70 (2.14)	0.65	0–9	3.49 (1.96)	2.30 (1.22)	5.25 (1.70)	5.20 (1.79)	2.50 (1.07)	35.36*	0.51 L, MN < MD, PN
Paranoid	6.8 (4.68)	0.75	0–24	6.28 (4.45)	3.35 (2.61)	9.81 (3.78)	13.6 (3.21)	4.32 (2.39)	41.18*	0.55 L, MN < MD < PN
Obsessive–compulsive	3.89 (1.61)	0.43	0–8	3.92 (1.45)	2.68 (0.97)	4.94 (1.09)	4.20 (0.45)	4.18 (1.31)	26.93*	0.44 L < MN, MD, PN
Narcissistic	4.14 (2.59)	0.62	0–15	4.45 (2.85)	2.84 (1.67)	3.39 (1.55)	9.40 (2.70)	7.07 (2.62)	38.33*	0.53 L, MD < MN, PN
Eating behaviors										
Orthorexic behaviors	19.2 (4.95)	0.81	10–39	32.62 (2.27)	32.41 (2.36)	32.81 (2.31)	33.2 (2.17)	32.57 (2.18)	0.30	n.a
Eating disorder	10.92 (11.13)	0.89	0–77	35.92 (17.97)	35.51 (16.17)	37.56 (20.27)	40.80 (15.30)	33.46 (18.03)	0.40	n.a
BMI	22.04 (4.06)	n.a	13.7–59.1	20.74 (3.49)	21.43 (3.35)	20.42 (2.95)	17.32 (2.82)	20.82 (4.10)	2.26	n.a
Psychopathology										
Self-esteem	27.43 (6.08)	0.89	10–40	27.03 (6.2)	29.08 (4.30)	22.89 (5.38)	25.5 (10.63)	29.81 (6.08)	10.91*	0.25 MD < L, MN
Hypochondriasis	15.04 (4.78)	0.79	6–28	14.51 (4.92)	11.57 (3.57)	17 (4.70)	21 (8.16)	14.37 (3.70)	13.20*	0.29 L < MN, MD < PN
Obsess.–compuls. sympt.	17.3 (11.05)	0.86	0–69	16.29 (11.16)	9.69 (6.70)	25.26 (10.90)	23.00 (9.52)	12.42 (8.11)	20.78*	0.40 L, MN < MD, PN
Social anxiety	5.84 (3.38)	0.78	0–12	5.35 (3.48)	4.44 (2.97)	8.06 (2.83)	6.00 (2.94)	3.04 (2.68)	17.50*	0.32 L, MN < MD
Anxiety symptoms	7.06 (5.36)	0.89	0–21	6.37 (5.11)	3.58 (2.76)	9.85 (5.55)	11.00 (5.35)	5.00 (3.99)	19.18*	0.35 L, MN < MD, PN
Depression symptoms	9.86 (5.76)	0.85	0–27	8.97 (6.08)	5.36 (2.82)	13.00 (5.90)	17.5 (6.56)	7.44 (5.42)	15.02*	0.37 L, MN < MD, PN

n.a. not applicable

* $p < 0.05$

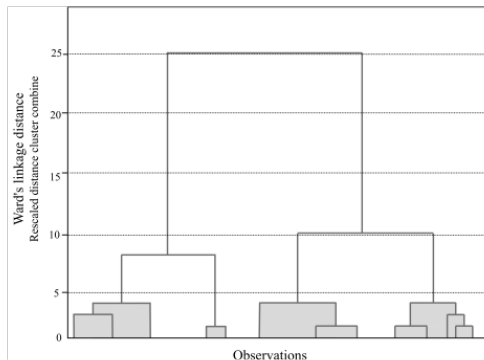


Fig. 1 Hierarchical clustering dendrogram

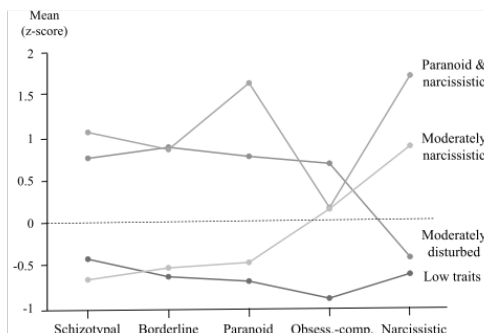


Fig. 2 Four-cluster solution based on the five personality disorder traits indicated on the x-axis

analysis showed clear differences between clusters (Wilks' $\lambda = 0.087$, $p < 0.001$) with 92.5% of cases correctly classified. Figure 2 represents the mean score of each trait for the four clusters. The first cluster, called "Low traits" (L, $n = 37$, 34.9%), was composed of participants with scores of the five personality traits lower than the sample mean. The second cluster, named "Moderately Disturbed" (MD, $n = 36$, 40.0%), aggregated persons with scores of schizotypal, borderline, paranoid, and obsessive-compulsive traits higher than the mean by at least one-half standard deviation (SD). Another cluster called "Paranoid and Narcissistic" (PN, $n = 5$, 4.7%) gathered students with paranoid and narcissistic scores higher than the mean by more than one and a half SD. The fourth cluster, labeled "Moderately Narcissistic" (MN, $n = 28$, 26.4%), was constituted of participants with a narcissistic trait score higher than the mean by nearly one SD value and with other scores lower than, or close to the mean.

These clusters were then compared to each other using ANOVA (Table 1, right part). Significant inter-cluster differences were found regarding all personality trait factors, which further validated the classification (with large effect sizes, η^2 0.42–0.55). No significant difference was observed between clusters in terms of orthorexic behaviors, eating disorder, and BMI. In contrast, when considering variables assessing psychopathology, the clusters showed a number of significant differences (with large effect sizes, η^2 0.25–0.40). Indeed, the MD and PN clusters displayed higher levels of anxiety, depression, and obsessional-compulsive symptoms when compared to the L and MN clusters. In addition, the MD cluster showed higher social phobia and lower self-esteem than the L and MN clusters. The clusters also differed significantly on the hypochondriasis score, with the PN cluster showing the highest score, the MD and MN clusters displaying intermediate scores.

Discussion

This study sought to establish a typology of young adults with orthorexic eating behaviors based on personality disorder traits. To our knowledge, this is the first study to explore possible links between orthorexic eating behaviors and personality traits related to personality disorders, as modeled by the DSM categorical approach.

In the current study, young adults with orthorexic eating behaviors met criteria for risk of eating disorders, having a mean score on the EAT-26 above the threshold (i.e., mean above 20), meaning a possible high level of concerns about dieting, body weight or problematic eating behavior. They also displayed scores above thresholds for the PHQ-9 (i.e., mean between 5 and 9), GAD-7 (i.e., mean between 5 and 9), and scored on the Mini-SPIN slightly below the threshold (i.e., mean slightly below 6), indicating possible moderate depression, general anxiety disorder and subclinical social phobia.

Cluster analysis led to the identification of four groups. The MD cluster was characterized by moderate levels of schizotypal, borderline, paranoid, and obsessive-compulsive traits, higher than the mean by at least one-half SD. The PN cluster, typified by high paranoid and narcissistic traits and moderate schizotypal and borderline traits, with paranoid and narcissistic traits being the highest component and the most differentiated from the other clusters, deviating from more than 1.5 S.D. The MN cluster was characterized by moderate narcissistic traits and low levels of schizotypal, borderline, paranoid, and obsessive-compulsive traits. Lastly, the L cluster showed levels below the mean of schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic traits. Regarding psychopathological symptomatology, a number of significant differences were shown between clusters with large effect sizes ($\eta^2 = 0.25$ –0.40). Indeed, the PN and MD clusters displayed higher scores on psychopathological symptomatology compared to L and MN

regarding general anxiety, depressive, and obsessive-compulsive symptoms. In addition, the MD cluster showed higher social phobia and lower self-esteem compared to MN and L clusters. The PN cluster showed higher scores on psychopathological symptomatology compared to MD with regards to hypochondriasis symptoms. The MN cluster also scored higher on hypochondriasis symptomatology compared to L cluster. In our study, the most striking differences between clusters were the prominence of obsessive-compulsive symptoms but also depressive, anxious, and social phobic symptoms, with scores twice higher in PN and MD clusters than in L and MN clusters. Furthermore, PN and MD scores on those variables were above threshold for those psychopathological variables, indicating moderate to severe depression and general anxiety, likely presence of obsessive-compulsive disorder and possible problems with social phobia. Considering that altogether PN and MD represent almost half of young adults in our orthorexic subsample, these results suggest that obsessive-compulsive disorder, depression, general anxiety, and social phobia are very frequent comorbidities in young adults with orthorexic eating behaviors. Given the ON characteristics and consequences that have been reported in the literature (e.g., guilty feelings after food rules transgression, excessive amount of time spent thinking about healthy food, social isolation, loss of interest in work and leisure activities, neuroticism; [1, 3, 6, 12, 13]), comorbidities between orthorexic eating behaviors and these disorders are not surprising. Results of our study then suggest that schizotypal, borderline, paranoid, obsessive-compulsive, and narcissistic traits might be relevant to the classification of ON and subclinical ON.

These results are consistent with the past studies showing the level of ON symptomatology to be positively correlated to harm avoidance, transcendence, and neuroticism, and negatively correlated to self-directedness [12, 28], personality dimensions which have been shown to be related to the ten DSM personality disorders [58, 59]. In addition, consistent with these results, strong DSM axis I disorder (e.g., eating, obsessive-compulsive, addictive, and anxious disorders) comorbidity in individuals with personality disorders has been demonstrated in the literature [30]. These findings also provide support to Apfeldorfer's statement which is, when ON becomes severe, individuals may turn to paranoia, becoming fervent followers of the conspiracy theory, showing suspiciousness towards food, the ones producing it, worrying that these ones intend to poison them by negligence, to make money or by pure malignity [60]. It also provides support to Bratman and Knight's statement describing ON as an obsession "with a sense of compulsions beginning to override free choice" in which individuals are spending a great amount of time thinking about food [1]. These results also bring additional support to Oberle et al. who found a positive correlation between ON and narcissism, and suggested that individuals with orthorexic eating behaviors "likely take pride in their

self-control, resisting temptation, and eating a near-perfect diet that they believe is superior to other's diets" [13].

Further studies should then investigate personality profiles in population with orthorexic eating behaviors including the remaining personality disorder traits (i.e., schizoid, antisocial, histrionic, avoidant, and dependent personality disorder traits), as well as in population with low levels of orthorexic eating behaviors, to compare with samples with high orthorexic behaviors. It would also be interesting to reproduce this study with an orthorexic eating behavior multidimensional measurement tool. Indeed, there is a quite recent ongoing discussion about the multidimensionality of orthorexia in the recent studies [61–63], proposing to distinguish between healthy orthorexia (i.e., adaptive dimension, "tendency to eat healthy food and interest in doing so") and orthorexia nervosa (i.e., the pathological dimension of orthorexia, "pathological preoccupation with a healthy diet"), with only the latter being linked to problems and psychological distress as measured by the problems subscale of the Eating Habits Questionnaire [12] or by the Teruel Orthorexia Scale [61].

There are various limitations in our study. First, the small sample size and the composition of only college students, making it hard to generalize our results to other groups. Replication with other samples would help to overcome these limitations. Second, the ON criteria adopted by our study, although widely adopted by ON researchers, have not yet received a general consensus. Third, the PN cluster ($n = 5$, 4.7%) represents only a small proportion of our orthorexic subsample, which limits the generalizability of conclusions drawn by the differences found between clusters in this study. Fourth, the Cronbach's α for obsessive-compulsive traits indicates a low internal consistency of the subscale, which is not unusual in the literature. This could be due to the dichotomous scoring format that was used in this study. A Cronbach's $\alpha = 0.62$ of the obsessive-compulsive subscale of the PDQ-4 was obtained in a Spanish sample when using a five-point Likert scale [64]. The authors of this study [64] suggested using Likert response format to improve score reliability. Fifth, the cross-sectional design of the study does not allow to draw conclusion about the cause and effect relationships between variables. Further studies should then be conducted to explore the links between development and maintenance of ON with other psychopathological disorder variables, using a longitudinal design.

Conclusion

To conclude, this study suggests that ON can be associated with different personality profiles, some of them displaying significant psychopathological levels. It may also contribute

to identify the more-at-risk of ON groups, emphasizing the importance of taking into account personality disorder traits of young adults with orthorexic eating behaviors, but also to use this personality categorical model when exploring risk and protective factors of ON. Given that the research on ON is a quite recent field and that very less information is available in the literature about the protective and risk factors of this potential condition, results of our study are particularly useful to gain a better understanding of factors which might be involved in its development and maintenance so as to develop guidelines regarding prevention and therapeutic intervention programs.

What is already known on this subject?

Some studies suggested that ON could be linked to personality features such as neuroticism, perfectionism, narcissism, self-directedness, transcendence, low and medium persistence, and harm avoidance.

What does this study add?

The results indicate that orthorexic eating behaviour in young adults can be associated with different personality profiles, some of them displaying significant psychopathological levels.

Author contributions CL and PR designed the study and wrote the protocol. CL conducted literature searches, provided summaries of previous research and wrote the first draft of the following sections of the manuscript: Abstract, Introduction, Method, Discussion, and Conclusion sections. PR conducted statistical analyses, wrote the first draft of the Results section and supervised the writing process. All authors contributed to and have approved the final manuscript.

Funding No funding was provided for this study.

Data availability The authors do not have permission to share the data.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the Comité d’Ethique de la Recherche of the University of Toulouse (Registration number 2019–123) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all the participants included in this study.

Consent for publication All participants were informed that the results from this study were going to be published in scientific journals or

congress. Consent was obtained from all the participants included in this study.

References

1. Bratman S, Knight D (2001) *Health food junkies: orthorexia nervosa: overcoming the obsession with healthful eating*, 1st edn. Broadway, New York
2. Vandereycken W (2011) Media hype, diagnostic fad or genuine disorder? Professionals' opinions about night eating syndrome, orthorexia, muscle dysmorphia, and emetophobia. *Eat Disord* 19:145–155. <https://doi.org/10.1080/10640266.2011.551634>
3. Moroze RM, Dunn TM, Craig Holland J et al (2015) Microthinking about micronutrients: a case of transition from obsessions about healthy eating to near-fatal “Orthorexia Nervosa” and proposed diagnostic criteria. *Psychosomatics* 56:397–403. <https://doi.org/10.1016/j.psych.2014.03.003>
4. American Psychiatric Association, American Psychiatric Association, DSM-5 Task Force (2013) *Diagnostic and statistical manual of mental disorders: DSM-5*
5. Dunn TM, Gibbs J, Whitney N, Starosta A (2017) Prevalence of orthorexia nervosa is less than 1 %: data from a US sample. *Eat Weight Disord-Stud Anorex Bulim Obes* 22:185–192. <https://doi.org/10.1007/s40519-016-0258-8>
6. Brytek-Matera A (2012) Orthorexia nervosa—an eating disorder, obsessive-compulsive disorder or disturbed eating habit. *Arch Psychiatry and psychotherapy* 1:55–60
7. Ryman FVM, Cesuroglu T, Bood ZM, Syurina EV (2019) Orthorexia nervosa: disorder or not? Opinions of Dutch Health Professionals. *Front Psychol* 10:555. <https://doi.org/10.3389/fpsyg.2019.00555>
8. Bartel SJ, Sherry SB, Farthing GR, Stewart SH (2020) Classification of orthorexia nervosa: further evidence for placement within the eating disorders spectrum. *Eat Behav* 38:101406. <https://doi.org/10.1016/j.eatbeh.2020.101406>
9. Barthels F, Meyer F, Huber T, Pietrowsky R (2017) Orthorexic eating behaviour as a coping strategy in patients with anorexia nervosa. *Eat Weight Disord-Stud Anorex Bulim Obes* 22:269–276. <https://doi.org/10.1007/s40519-016-0329-x>
10. Fidan T, Ertekin V, Işıkay S, Kırpınar I (2010) Prevalence of orthorexia among medical students in Erzurum, Turkey. *Compr Psychiatry* 51:49–54. <https://doi.org/10.1016/j.comppsych.2009.03.001>
11. Nevin SM, Vartanian LR (2017) The stigma of clean dieting and orthorexia nervosa. *J Eat Disord*. <https://doi.org/10.1186/s40337-017-0168-9>
12. Gleaves DH, Graham EC, Ambwani S (2013) Measuring “orthorexia”: development of the eating habits questionnaire. *Int J Educ Psychol Assess* 12:1–18
13. Oberle CD, Samaghabadi RO, Hughes EM (2017) Orthorexia nervosa: assessment and correlates with gender, BMI, and personality. *Appetite* 108:303–310. <https://doi.org/10.1016/j.appet.2016.10.021>
14. Donini LM, Marsili D, Graziani MP et al (2004) Orthorexia nervosa: a preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eat Weight Disord-Stud Anorex Bulim Obes* 9:151–157. <https://doi.org/10.1007/BF03325060>
15. Barnes MA, Caltabiano ML (2017) The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. *Eat Weight Disord-Stud Anorex Bulim Obes* 22:177–184. <https://doi.org/10.1007/s40519-016-0280-x>

16. Reynolds R (2018) Is the prevalence of orthorexia nervosa in an Australian university population 6.5%? *Eat Weight Disord-Stud Anorex Bulim Obes* 23:453–458. <https://doi.org/10.1007/s40519-018-0535-9>
17. Roncero M, Barrada JR, Perpiñá C (2017) Measuring orthorexia nervosa: psychometric limitations of the ORTO-15. *Span J Psychol* 20:E41. <https://doi.org/10.1017/sjp.2017.36>
18. Asil E, Sürücüoğlu MS (2015) Orthorexia nervosa in Turkish dietitians. *Ecol Food Nutr* 54:303–313. <https://doi.org/10.1080/03670244.2014.987920>
19. Bo S, Zoccali R, Ponzo V et al (2014) University courses, eating problems and muscle dysmorphia: are there any associations? *J Transl Med*. <https://doi.org/10.1186/s12967-014-0221-2>
20. Bağcı Bosi AT, Çamur D, Güler Ç (2007) Prevalence of orthorexia nervosa in resident medical doctors in the faculty of medicine (Ankara, Turkey). *Appetite* 49:661–666. <https://doi.org/10.1016/j.appet.2007.04.007>
21. Kinzl JF, Hauer K, Traweger C, Kiefer I (2006) Orthorexia nervosa in dietitians. *Psychother Psychosom* 75:395–396. <https://doi.org/10.1159/000095447>
22. Tremelling K, Sandon L, Vega GL, McAdams CJ (2017) Orthorexia nervosa and eating disorder symptoms in registered dietitian nutritionists in the United States. *J Acad Nutr Diet* 117:1612–1617. <https://doi.org/10.1016/j.jand.2017.05.001>
23. Herranz Valera J, Acuña Ruiz P, Romero Valdespino B, Visioli F (2014) Prevalence of orthorexia nervosa among ashtanga yoga practitioners: a pilot study. *Eat Weight Disord-Stud Anorex Bulim Obes* 19:469–472. <https://doi.org/10.1007/s40519-014-0131-6>
24. Barthels F, Meyer F, Pietrowsky R (2015) Die Düsseldorf Orthorexia Skala-Konstruktion und Evaluation eines Fragebogens zur Erfassung ortho-rektischen Ernährungsverhaltens. *Z Für Klin Psychol Psychother* 44:97–105. <https://doi.org/10.1026/1616-3443/a000310>
25. Luck-Sikorski C, Jung F, Schlosser K, Riedel-Heller SG (2019) Is orthorexic behavior common in the general public? A large representative study in Germany. *Eat Weight Disord-Stud Anorex Bulim Obes* 24:267–273
26. Chard CA, Hilzendege C, Barthels F, Stroebele-Benschop N (2019) Psychometric evaluation of the English version of the Düsseldorf Orthorexia Scale (DOS) and the prevalence of orthorexia nervosa among a U.S. student sample. *Eat Weight Disord - Stud Anorex Bulim Obes* 24:275–281. <https://doi.org/10.1007/s40519-018-0570-6>
27. He J, Ma H, Barthels F, Fan X (2019) Psychometric properties of the Chinese version of the Düsseldorf Orthorexia Scale: prevalence and demographic correlates of orthorexia nervosa among Chinese university students. *Eat Weight Disord-Stud Anorex Bulim Obes* 24:453–463. <https://doi.org/10.1007/s40519-019-00656-1>
28. Kiss-Leizer M, Rigó A (2019) People behind unhealthy obsession to healthy food: the personality profile of tendency to orthorexia nervosa. *Eat Weight Disord-Stud Anorex Bulim Obes* 24:29–35. <https://doi.org/10.1007/s40519-018-0527-9>
29. Gramaglia C, Gambaro E, Delicato C et al (2019) Orthorexia nervosa, eating patterns and personality traits: a cross-cultural comparison of Italian, Polish and Spanish university students. *BMC Psychiatry* 19:235. <https://doi.org/10.1186/s12888-019-2208-2>
30. Lenzenweger MF, Lane MC, Loranger AW, Kessler RC (2007) DSM-IV personality disorders in the national comorbidity survey replication. *Biol Psychiatry* 62:553–564. <https://doi.org/10.1016/j.biopsych.2006.09.019>
31. Davidson CA, Hoffman L, Spaulding WD (2016) Schizotypal personality questionnaire—brief revised (updated): an update of norms, factor structure, and item content in a large non-clinical young adult sample. *Psychiatry Res* 238:345–355. <https://doi.org/10.1016/j.psychres.2016.01.053>
32. Lasson C, Barthels F, Raynal P (2019) Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students. *Manuscr. Submitt. Publ.*
33. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE (1982) The Eating Attitudes Test: psychometric features and clinical correlates. *Psychol Med* 12:871–878. <https://doi.org/10.1017/S0033291700049163>
34. Leichner P, Steiger H, Puentes-Neuman G et al (1994) Validation d'une échelle d'attitudes alimentaires auprès d'une population québécoise francophone. *Can J Psychiatry* 39:49–54. <https://doi.org/10.1177/070674379403900110>
35. Ferchiou A, Todorov L, Lajnef M et al (2017) Analyse de la structure factorielle de la version brève du questionnaire de personnalité schizotypique (SPQ-B)—format Likert—en population générale en France. *L'Encéphale* 43:558–563. <https://doi.org/10.1016/j.encep.2016.05.011>
36. Raine A, Benishay D (1995) The SPQ-B: a brief screening instrument for schizotypal personality disorder. *J Personal Disord* 9:346–355. <https://doi.org/10.1521/pedi.1995.9.4.346>
37. Bouvard M (2002) Questionnaires et échelles d'évaluation de la personnalité, 2^e éd. rev. et augm. Masson, Paris
38. Hyler SE, Rieder RO, Williams JBW et al (1988) The personality diagnostic questionnaire: development and preliminary results. *J Personal Disord* 2:229–237. <https://doi.org/10.1521/pedi.1988.2.3.229>
39. Chabrol H, Rousseau A, Callahan S, Hyler SE (2007) Frequency and structure of DSM-IV personality disorder traits in college students. *Personal Individ Differ* 43:1767–1776. <https://doi.org/10.1016/j.paid.2007.05.015>
40. Chabrol H, Valls M, van Leeuwen N, Bui E (2012) Callous-unemotional and borderline traits in nonclinical adolescents: personality profiles and relations to antisocial behaviors. *Pers Individ Differ* 53:969–973. <https://doi.org/10.1016/j.paid.2012.07.017>
41. Derogatis LR (1979) Symptom Checklist-90-Revised (SCL-90-R). Lyndhurst NJ NCS Pearson
42. Fortin F, Coutu-Wakulczyk G, Université de Montréal, Faculté des sciences infirmières (1985) Validation et normalisation d'une mesure de santé mentale: le SCL-90-R : rapport final. Université de Montréal, Faculté des sciences infirmières, Montréal
43. Ames DR, Rose P, Anderson CP (2006) The NPI-16 as a short measure of narcissism. *J Res Pers* 40:440–450. <https://doi.org/10.1016/j.jrp.2005.03.002>
44. Braun S, Kempenaers C, Linkowski P, Loas G (2016) French adaptation of the narcissistic personality inventory in a Belgian French-speaking sample. *Front Psychol*. <https://doi.org/10.3389/fpsyg.2016.01980>
45. Fink P, Ewald H, Jensen J et al (1999) Screening for somatization and hypochondriasis in primary care and neurological inpatients: a seven-item scale for hypochondriasis and somatization. *J Psychosom Res* 46:261–273. [https://doi.org/10.1016/S0022-3999\(98\)00092-0](https://doi.org/10.1016/S0022-3999(98)00092-0)
46. Lee S, Ng KL, Ma YL et al (2011) A general population study of the Chinese Whiteley-7 Index in Hong Kong. *J Psychosom Res* 71:387–391. <https://doi.org/10.1016/j.jpsychores.2011.05.013>
47. Carballeira Y, Dumont P, Borgacci S et al (2007) Criterion validity of the French version of Patient Health Questionnaire (PHQ) in a hospital department of internal medicine. *Psychol Psychother Theory Res Pract* 80:69–77. <https://doi.org/10.1348/147608306X103641>
48. Kroenke K, Spitzer RL, Williams JBW, Löwe B (2010) The patient health questionnaire somatic, anxiety, and depressive symptom

- scales: a systematic review. *Gen Hosp Psychiatry* 32:345–359. <https://doi.org/10.1016/j.genhosppsych.2010.03.006>
49. Arthurs E, Steele RJ, Hudson M et al (2012) Are scores on English and French versions of the PHQ-9 comparable? An assessment of differential item functioning. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0052028>
 50. Micoulaud-Franchi J-A, Lagarde S, Barkate G et al (2016) Rapid detection of generalized anxiety disorder and major depression in epilepsy: validation of the GAD-7 as a complementary tool to the NDDI-E in a French sample. *Epilepsy Behav* 57:211–216. <https://doi.org/10.1016/j.yebeh.2016.02.015>
 51. Spitzer RL, Kroenke K, Williams JBW, Löwe B (2006) A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 166:1092. <https://doi.org/10.1001/archinte.166.10.1092>
 52. Connor KM, Kobak KA, Churchill LE et al (2001) Mini-SPIN: a brief screening assessment for generalized social anxiety disorder. *Depress Anxiety* 14:137–140
 53. Radomsky AS, Ashbaugh AR, Saxe ML et al (2006) Psychometric properties of the French and English versions of the Social Phobia Inventory. *Can J Behav Sci Rev Can Sci Comport* 38:354–360. <https://doi.org/10.1037/cjbs2006021>
 54. Foa EB, Huppert JD, Leiberg S et al (2002) The Obsessive-Compulsive Inventory: development and validation of a short version. *Psychol Assess* 14:485–496
 55. Zermatten A, Van der Linden M, Jermann F, Ceschi G (2006) Validation of a French version of the Obsessive-Compulsive Inventory-revised in a non-clinical sample. *Eur Rev Appl Psychol Rev Eur Psychol Appliquée* 56:151–155. <https://doi.org/10.1016/j.erap.2005.07.003>
 56. Rosenberg M (1989) *Society and the adolescent self-image*. Rev. Wesleyan University Press, Middletown
 57. Vallieres EF, Vallerand RJ (1990) *Traduction Et Validation Canadienne-Française De L'échelle De L'estime De Soi De Rosenberg**. *Int J Psychol* 25:305–316. <https://doi.org/10.1080/00207599008247865>
 58. Conrad R, Schilling G, Bausch C et al (2007) Temperament and character personality profiles and personality disorders in chronic pain patients. *Pain* 133:197–209. <https://doi.org/10.1016/j.pain.2007.07.024>
 59. Ha JH, Kim EJ, Abbey SE, Kim T-S (2007) Relationship between personality disorder symptoms and temperament in the young male general population of South Korea. *Psychiatry Clin Neurosci* 61:59–66. <https://doi.org/10.1111/j.1440-1819.2007.01611.x>
 60. Apfeldorfer G (2008) *Mangez en paix !* / Gérard Apfeldorfer. OJacob, Paris
 61. Barrada JR, Roncero M (2018) Bidimensional structure of the orthorexia: development and initial validation of a new instrument. *An Psicol* 34:283. <https://doi.org/10.6018/analesps.34.2.299671>
 62. Barthels F, Barrada JR, Roncero M (2019) Orthorexia nervosa and healthy orthorexia as new eating styles. *PLoS ONE* 14:e0219609. <https://doi.org/10.1371/journal.pone.0219609>
 63. Depa J, Barrada J, Roncero M (2019) Are the motives for food choices different in orthorexia nervosa and healthy orthorexia? *Nutrients* 11:697. <https://doi.org/10.3390/nu11030697>
 64. Fonseca-Pedrero E, Pains M, Lemos-Giráldez S, Muñiz J (2013) Maladaptive personality traits in adolescence: psychometric properties of the Personality Diagnostic Questionnaire-4+. *Int J Clin Health Psychol* 13:207–215. [https://doi.org/10.1016/S1697-2600\(13\)70025-5](https://doi.org/10.1016/S1697-2600(13)70025-5)

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Annexe 22 : Article Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS) (Lasson et al., 2023)

Lasson et al. *Journal of Eating Disorders* (2023) 11:65
<https://doi.org/10.1186/s40337-023-00764-5>

Journal of Eating Disorders

RESEARCH

Open Access



Orthorexic eating behaviors are not all pathological: a French validation of the Teruel Orthorexia Scale (TOS)

Clotilde Lasson^{1*}, Amélie Rousseau¹, Siobhan Vicente², Nelly Goutaudier², Lucia Romo³, María Roncero⁴ and Juan Ramón Barrada⁵

Abstract

As no French validated measurement tool distinguishing healthy orthorexia (HeOr) from orthorexia nervosa (OrNe) currently exists, this study aimed at examining psychometric properties of the French version of the Teruel Orthorexia Scale (TOS). A sample of 799 participants (Mean [SD] age: 28.5 [12.1] years-old) completed the French versions of the TOS, the Düsseldorf Orthorexia Skala, the Eating Disorder Examination-Questionnaire, and the Obsessive–Compulsive Inventory-Revised. Confirmatory factor analysis and exploratory structural equation modeling (ESEM) were used. Although the bidimensional model, with OrNe and HeOr, of the original 17-item version showed an adequate fit, we suggest excluding items 9 and 15. The bidimensional model for the shortened version provided a satisfactory fit (ESEM model: CFI = .963, TLI = .949, RMSEA = .068). The mean loading was .65 for HeOr and .70 for OrNe. The internal consistency of both dimensions was adequate ($\alpha_{\text{HeOr}} = .83$ and $\alpha_{\text{OrNe}} = .81$). Partial correlations showed that eating disorders and obsessive–compulsive symptomatology measures were positively related to OrNe and unrelated or negatively related to HeOr. The scores from the 15-item French version of the TOS in the current sample appears to present an adequate internal consistency, pattern of associations in line with what was theoretically expected, and promising for differentiating both types of orthorexia in a French population. We discuss why both dimensions of orthorexia should be considered in this area of research.

Keywords Orthorexia, Healthy orthorexia, Orthorexia nervosa, Psychometric evaluation, Healthy eating, Eating disorders, Obsessive–compulsive disorders

Plain English summary

Orthorexia ('right appetite', from the Greek) covers two dimensions: (1) orthorexia nervosa (OrNe), a strong preoccupation with healthy diet with negative emotional, cognitive, and/or social consequences while trying to approach this goal and when the eating behavior deviates from it, and (2) healthy orthorexia (HeOr), which can be defined as a healthy interest in diet, (self-assessed) healthy behavior with regard to diet and eating healthily as part of one's identity. OrNe is not yet indexed into mental disorder classifications. Some prominent measurement tools in the area of orthorexia present important limitations: it is unclear if they validly assess OrNe and they do not tap HeOr by design. To overcome these limitations, a promising self-reported instrument was developed: the Teruel Orthorexia Scale (TOS), a bidimensional questionnaire whose structure has been replicated in different samples. Our research based on

*Correspondence:

Clotilde Lasson

clotilde.lasson@univ-tlse2.fr; lassonclotilde@gmail.com

Full list of author information is available at the end of the article



© The Author(s) 2023. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

799 participants aimed to adapt this instrument in a French speaking population. The results revealed that the French version of the TOS is an empirically supported tool allowing to differentiate both forms of orthorexia (healthy and nervous). It also suggests that OrNe is associated with psychopathological symptoms while opposite patterns were found with HeOr. We discuss the importance of measuring both orthorexia dimensions.

Background

The health benefits of a healthy lifestyle including healthy eating and physical activity have been widely reported over the years (e.g., [61]). However, for some individuals, ideas and interest about healthy eating might become pathological, reaching an obsession with eating they deem healthy, feeling guilty or punishing themselves for deviating from their own standards of healthy diet, and with negative impact in their social lives (orthorexia nervosa, OrNe, [18]). For other individuals, their interest in healthy eating is not associated with psychological or social problems (healthy orthorexia, HeOr) and may even be negatively associated with pathological symptoms [6].

Thus, orthorexia ('right appetite', from the Greek) comprises two dimensions that can and should be differentiated. While HeOr can be defined as a healthy interest in diet, (self-assessed) healthy behaviors with regard to diet, and eating healthily as part of one's identity [6, 21], the core element of OrNe is a strong preoccupation with healthy diet with negative emotional, cognitive, and/or social consequences while trying to approach this goal and when the eating behavior deviates from it. As Roncero et al. [52] noted: "HeOr is not a measure of healthy eating and, thus, should not be confused with it. People who score high on HeOr indicate that healthy eating is an important part of their life and that they devote time and energy to it. However, their beliefs about healthy eating may not coincide with an objective or real definition of healthy eating. For this reason, the two terms should not be taken as synonyms because a high score on HeOr does not necessarily mean that the person is eating healthily" (p. 2).

Despite that these past few years, several diagnosis criteria proposals were made for OrNe (with converging criteria being: obsessional preoccupation with eating "healthy food", severe distress, impairment of physical health, and impairment of social, academic or vocational functioning) [9, 12, 13, 24, 46], OrNe is not yet indexed into mental disorder classifications and the way to categorize it is currently under debate. Some studies suggested that OrNe belongs to the eating disorder spectrum [7, 16, 55], considering that OrNe is close to anorexia nervosa, bulimia nervosa, and avoidant/restrictive food intake disorder. Others have indicated the overlap with obsessive-compulsive and related disorders or even with anxiety disorders

[16, 55]. The convenience of distinguishing OrNe from other eating disorders have even been questioned. Meule and Voderholzer [42] considered that "it is not clear whether ON [OrNe] is actually a diagnostic entity that is distinct from established eating disorders" (p. 1). From our point of view, Meule and Voderholzer [42] confused overlap (and it is clear that OrNe and other eating disorders are related) with equivalence. For instance, Zickgraf and Barrada [64] showed that, controlling for a general measure of eating disorders, orthorexia scores were still related to additional variables. Bhattacharya et al. [11] have argued that OrNe is a "new cultural manifestation" of anorexia nervosa. From our point of view, current knowledge about OrNe allows us to discard this. Indeed, while a key diagnostic criteria of anorexia nervosa in the DSM-5 [1] is a significant low body weight, previous research has shown that OrNe is unrelated to body mass index (e.g., [6, 21]). This lack of consensus on its categorization or even the need for a new diagnosis is notably due, at least in part, to methodological issues in the orthorexia field with important validity problems with some prominent measurement tools [45].

So far, the main focus of the orthorexia literature has been on its pathological form, OrNe [8], for a review see: [41], with the majority of studies relying on the ORTO-15 (or any of its derivatives) to assess the construct [22, 23]. The ORTO questionnaires have been widely criticized [5, 26, 43, 45, 49, 53]. Donini et al. [23] pointed out the lack of efficiency of their questionnaire to distinguish healthy eating behaviors from a pathological obsessive interest in healthy eating. Although a shorter and revised version has been proposed [51], the main problem is still present: questionable content validity. Consider the items "In the last three months, did thoughts of food make you feel guilt, ashamed and anxious?" and "Does thinking about food excessively worry you for more than three hours a day?". "Thinking about food", clearly, is not tapping specifically concerns about healthy eating. Those items could be considered as a general measure of eating disorders, while the ORTO is supposed to measure OrNe. The results of studies based on these assessment tools should then be considered with caution.

To overcome these limitations, several other measurement tools were developed for the assessment of

OrNe, mainly, including the Eating Habits Questionnaire (EHQ; [30]) and the Düsseldorf Orthorexia Skala (DOS; [10]). Both share a characteristic: their internal structure is unclear. It is not clear how many dimensions are being assessed or how to interpret those factors. For the EHQ, solutions of two [33], three [30, 31, 47], and four factors [32] have been proposed. Even for solutions with the same number of factors, neither the distribution of items by factors, nor their theoretical interpretation were equivalent. While Meule et al. [43] found an adequate fit for the original structure on a German sample of 511 participants, no other models were tested. Regarding the DOS, data did not support the presence of a single dimension for the Arabic [33], German [10], English [20], and Chinese [34] versions of the scale. The model fit of the unidimensional solution in the French sample was not satisfactory [37]. In the Spanish version, a unidimensional model offered an excellent fit [48]. For the Chinese version, a three-dimensional solution was considered, with factors labeled Obsession in Healthy Food, Adherence to Nutrition Rules, and Emotional Symptoms. Meule et al. [43] obtained a good fit for the unidimensional solution. Although multidimensional solutions have been commonly proposed for the EHQ and the DOS, it has been a common practice to compute just a single total score. For a recent review showing how these instruments have been used, see Atchison and Zickgraf [3].

Importantly, the DOS and the EHQ could be inadvertently covering both HeOr and OrNe, while they are supposed to be only assessing OrNe [33, 65]. Two specific items from the EHQ: "I am more informed than others about healthy eating" or "Eating the way I do gives me a sense of satisfaction" are currently considered as indicative of OrNe. Nevertheless, why they should be considered as indications of OrNe is difficult to see, but it has been used as such in many publications. The same can be said about these items from the DOS: "Eating healthy food is more important to me than indulgence/enjoying the food" or "I have certain nutrition rules that I adhere to". Considering that the pattern of associations of OrNe and HeOr with third variables is different, combining items from these two dimensions into a single total score can lead to results difficult to interpret.

Recently, Barrada and Roncero [6] proposed to no longer consider orthorexia as a unidimensional construct but as a bidimensional construct with not only a pathological form (OrNe, e.g., "I feel overwhelmed or sad if I eat food that I consider unhealthy") but also an healthy form (HeOr; e.g., "I think that my way of eating is healthier than that of most people") and developed a promising self-report questionnaire called the Teruel Orthorexia Scale (TOS). As Atchison and Zickgraf [3] noted, "the

Teruel Orthorexia Scale (TOS) is the only one of the currently available self-report instruments designed to measure both healthy orthorexia and orthorexia nervosa, and differentiate between these two constructs". Its structure has been replicated across different samples and languages.

The TOS was originally developed in Spanish [6] showing a clear bidimensional structure and its scores indicated good psychometric properties. Further studies have examined the psychometric properties of the bidimensional model of orthorexia in German [58], Arabic [44], Portuguese [50], and English [19, 64] versions and cross-validated the Spanish version [8]. While some studies have used exploratory techniques [6] [CFI=0.965, TLI=0.954, RMSEA=0.060]; [8] [two samples, CFI=0.960/0.973, TLI=0.947/0.965, RMSEA=0.070/0.062]; [19] [CFI=0.98, TLI=0.97, RMSEA=0.06]; [64] [two samples; CFI=0.978/0.967, TLI=0.971/0.957, RMSEA=0.078/0.057]), others have used confirmatory factor analysis (CFA) [58] [CFI=0.873, RMSEA=0.085]; [44] [CFI=0.954, RMSEA=0.069]; [50] [CFI=0.94, TLI=0.93, RMSEA=0.09]).

It can be seen that those studies using exploratory techniques have obtained better model fits. CFAs present an important drawback with respect to exploratory analysis to test the internal structure of a questionnaire. In the most common way of using CFAs, secondary loadings are fixed to zero, that is, there are many parameters fixed to a value different from what is plausible in the population, as we can expect secondary loadings to be minor, but not nul. These restrictions imply that the recovered parameters, both loadings and interfactors correlations, are distorted. Although the presence of relevant cross-loadings can be detected via modification indices in CFA, it is common that researchers do not check relevant areas of localized strain if an adequate fit for the overall model is found [15]. Exploratory techniques tend to show a better model fit, but, more importantly, can better recover the underlying structure [2].

The original validation study of the TOS [6] indicated the presence of minor, but not zero, secondary loadings. Overall, the different studies have supported the internal structure of the TOS, although with some nuances. In their English validation, Chace and Kluck [19] suggested removing Item 13 ("I would rather eat a smaller portion of healthy food than get full from food that may not be healthy"), as it showed poor differentiation between the factors, and found that Item 9 ("My concern with healthy eating takes up a lot of my time") presented a secondary loading over 0.30. Zickgraf and Barrada [64] worked with two samples, both English versions of the TOS. High secondary loadings (over |.30|) were found for Item 1 ("I feel good when I eat healthy food"; sample 1), Item 9 (sample

2), and Item 15 ("I try to convince the people in my life to follow my healthy eating habits"; sample 1), with almost equal loadings for this item in sample 2. In a Lebanese sample, Mhanna et al. [44], with a CFA, found that OrNe and HeOr factors showed a high correlation ($r=0.74$), much higher than that found with exploratory techniques (e.g., $r=0.43$ in [6], $r=0.44/0.49$ in [8]). As we have said, fixing the secondary loadings to zero can distort the recovered interfactor correlations. These results stress that using exploratory approaches is more adequate, as there are reasons to expect secondary loadings clearly different from zero. Regarding exploratory approaches for testing the internal structure of questionnaires, we direct readers to several publications [39, 40, 56, 57].

The studies using the TOS have provided evidence for the validity of the two-dimensionality of orthorexia. Both factors relate differently and oppositely to various psychopathology variables, suggesting that HeOr is not an "attenuated" OrNe factor or a risk factor, but that they are different dimensions. Studies have shown that HeOr was positively correlated with well-being, positive affect, dispositional mindfulness, and negatively correlated with psychopathology (eating disorders, obsessive-compulsive disorder, negative affect, antagonism, disinhibition, psychoticism) and BMI. On the other hand, OrNe was positively correlated with psychological distress, restrained eating, obsessive-compulsive symptoms, perfectionism, low physical self-esteem, negative affect, detachment, disinhibition, psychoticism, weight control, health anxiety, substance use, sedentary behavior, and negatively correlated with dispositional mindfulness [6, 8, 19, 21, 52, 59, 64]. HeOr was also positively correlated with nutrition knowledge and diet quality whereas OrNe was negatively correlated with nutrition knowledge and diet quality [64]. These patterns of associations were clearer when partial correlations were used, that is, when the partial overlap between OrNe and HeOr (Pearson correlation between both dimensions typically in the range 0.30–0.50) was statistically adjusted. In addition, a high stability of both dimensions has been observed over an 18-month interval, with a correlation above 0.70 for both factors [6].

So far, the TOS has not been translated and validated in French language population. The aim of this study was thus to adapt the TOS into French language and examine its psychometric properties (internal consistency, factor structure, convergent and discriminant validities) in French population as to provide an empirically supported tool to start studying orthorexia both in its healthy and pathological forms in French population, without considering all healthy eating concerns as pathological. Participants also provided responses to

another measure of orthorexia, the DOS [37]. To assess the convergent and discriminant validities of the translated TOS, participants also completed measures of eating disorders (Eating Disorder Examination-Questionnaire [17]), and obsessive-compulsive disorder (OCD, Obsessive-Compulsive Inventory-Revised, [63]) in their French versions. Our first hypothesis was that the French version of the TOS would replicate the bidimensional structure of the original Spanish TOS as well as equivalent psychometric properties. In line with Zickgraf and Barrada [64], as a second hypothesis, we expected that both TOS subscales would be correlated with the DOS, but with OrNe to a greater extent. Although the internal structure of the DOS is unclear, we considered relevant to include this widely used measure in our study to try to understand what this instrument is measuring, as several studies have used it. As prior findings evidenced that DOS items can be a mixture of OrNe and HeOr, the correlations of TOS scores and DOS scores cannot be interpreted as an evidence of convergent validity. Based on results of previous studies using the TOS, our third hypothesis was that OrNe would be positively linked to eating and obsessive-compulsive symptomatology, whereas HeOr would be negatively associated with these variables, after adjusting for the other orthorexia dimension. Recently Atchison and Zickgraf [3] noted that "[...] the true nature of the relationship between ON [OrNe] and eating disorder symptoms may be best explored in study designs that control for the closely related construct of healthy orthorexia. Because of this, statistically adjusting for healthy orthorexia may be necessary to accurately describe the relationship between ON [OrNe] and disordered eating" (p. 2). The convenience of adjusting for the other orthorexia dimension to more accurately describe the associations with different variables can and should be generalized. By doing so, associations are easier to interpret, as the shared variance between OrNe and HeOr is removed. Different studies that have simultaneously considered OrNe and HeOr have used this approach (e.g., [6, 33, 52, 64]). Partial correlations were preferred over other analytical alternatives as regression models—perhaps more commonly reported—for several reasons. First, Pearson and partial correlations are more easily comparable, as both can range from -1 to $+1$, while this is not the case for regression coefficients (even for standardized coefficients). Second, partial correlations and regression coefficients lead to the same inferential conclusions, as both share identical p -values.

Materials and methods

Participants and procedure

Participants were recruited via an advertisement posted on Facebook groups of university students and people with an interest in food and nutrition. Potential participants were provided with the link to an online questionnaire and were told that if they agreed to take part in the study, they would be asked to answer questionnaires about their eating habits. Only those who gave their informed consent and were aged 18 or above could access the questionnaire. Participants involved in this study did not receive any compensation. The questionnaires were anonymous. The study protocol was approved by the ethics committee of the University of Lille (Registration number 2021–514-S95).

Participants of this sample were 799 adults (82.9% women, 16.1% men, and 1.0% other genders) aged between 18 and 73 years ($M = 28.5$, $SD = 12.1$). Based on self-reported height and weight, mean BMI was 23.5 ($SD = 4.96$). The majority of participants were students (58.8%).

Measures

Socio-demographic data

Participants provided information about their gender, age, height, weight, and professional status.

Teruel Orthorexia Scale (TOS; [6])

This scale assesses orthorexia in two separate dimensions: OrNe (8 items; e.g., “Thoughts about healthy eating do not let me concentrate on other tasks”) and HeOr (9 items; e.g., “My interest in healthy food is an important part of the way I am, of how I understand the world”). Responses are scored on a four-point Likert scale ranging from 0 = *completely disagree* to 3 = *completely agree*.

In the current study, the TOS was translated from Spanish to French by bilingual researchers, using a back-translation procedure [14]. The TOS was first translated into French and then back translated into its original language. The expert committee worked on the discrepancy between the original version and the back translated version to ensure the equivalence of the construct between the original version and the French version as well as the correct understanding of all items. Fifteen freshmen were asked to complete the TOS. Once they responded, a discussion was initiated to ensure that all questions were understandable and that none were problematic. We did not receive any feedback on the meaning and structure of the items.

The final version of the French version of the TOS is presented as an Appendix. Item wording in English can be seen in Table 2.

Düsseldorf orthorexia skala (DOS; [10])

This 10-item scale assesses orthorexic eating behaviors. Responses are scored on a four-point Likert-scale ranging from 1 = *this does not apply to me* to 4 = *this applies to me*. An example item is “If I eat something I consider unhealthy, I feel really bad”. Higher scores are interpreted as indicative of higher levels of orthorexic eating behaviors. We used the French version [37]. Cronbach's α value was 0.84 in this study. As we have noted in the introduction, the internal structure and interpretation of DOS scores are not completely clear.

Eating disorder examination-questionnaire (EDE-Q; [27])

This questionnaire assesses symptoms of eating disorders over the past 4 weeks. Items are scored on two seven-point scales ranging from 0 = *no days* to 6 = *every day* or from 0 = *not at all* to 6 = *markedly*, and are divided into 4 subscales: Restraint (5 items), Eating Concern (5 items), Weight Concern (5 items), and Shape Concern (8 items). Higher scores indicate higher eating or body concerns or behaviors. We used the French version [17]. In this study, Cronbach's α values were 0.83 for Restraint; 0.78 for Eating concern; 0.81 for Weight Concern, and 0.91 for Shape concern.

Obsessive-compulsive inventory-revised (OCI-R; [29])

This 18-item self-report scale assesses obsessive-compulsive symptoms. Each item (e.g., “I get upset if others change the way I have arranged things”) is scored on a five-point Likert scale ranging from 0 = *not at all* to 4 = *extremely*. We used the French version [63]. Cronbach's α was 0.89 in this study.

Data analysis

The internal structure of the TOS scores was analyzed with a CFA and an Exploratory Structural Equation Model (ESEM) [2]. ESEM is a technique that, unlike CFA, estimates all secondary loadings and, unlike exploratory factor analysis, allows the incorporation of correlated uniquenesses. Previous analyses have found that, although the internal structure of the TOS was clear and theoretically interpretable, secondary loadings cannot be expected to be equal to zero. In cases like this, a CFA would distort the recovered parameters and could achieve inadequate model fit that could lead to the rejection of theoretically useful and interpretable models. If an adequate model fit was reached, fixing to zero parameters whose value is not null in the population would still distort the recovered parameters. We used CFA to show

the limitations of this analytical approach in cases like the TOS scores. Previous validation studies of this scale have used CFAs, with the exposed limitations. We consider that one of the reasons for doing so may be that ESEM is not still well-known in this area of research. If we only computed ESEM analysis (although this would be a reasonable psychometric approach), we would miss the opportunity to show the comparison between these two approaches. For comparability, we also tested a unidimensional model for the DOS scores. (For unidimensional models CFA and ESEM are equivalent). We defined a single factor as this has been the standard interpretation of this scale. As we used a four-point Likert scale and responses should be considered as ordinal [28], models were analyzed using robust weighted least squares (WLSMV estimator in *MPlus*). Geomin rotation was used. According to conventional cut-offs [36], comparative fit index (CFI) and Tucker Lewis index (TLI) with values greater than 0.95 and RMSEA less than 0.06 were indicative of a satisfactory fit. It should be noted that these cutoffs were developed for CFAs with continuous responses, so these values should be interpreted with caution [62]. Additionally, these cut-off values should be considered as rough guidelines and not interpreted as “golden rules” [38]. Local fit was evaluated using modification indices. Internal consistencies of the TOS scores for both dimensions were computed with Cronbach's alpha.

We computed descriptive statistics (means, standard deviations, skewness, and kurtosis) and correlations between the two orthorexia dimensions and the six additional variables (DOS score, four EDE-Q scores, and OCI-R score). We present Pearson correlations for all the bivariate associations. We compared the correlation sizes for the six additional variables and the two orthorexia factors with Hittner, May, and Silver's technique [35], a modification of Dunn et Clark's one [25], that is, we computed if the subtraction of the correlations with OrNe and HeOr were different from zero. Considering that OrNe and HeOr can be expected to be partially overlapped, we computed partial correlations for all the associations between orthorexia and other variables while controlling for the other orthorexia dimension. By doing so, we expected to better assess the associations of HeOr (or OrNe) with the six psychopathological indicators while controlling for OrNe (or HeOr). The analyses were performed with *MPlus* 8.4 and R 4.1.1.

Results

Internal structure and reliability

Results of model fit for the different models can be found in Table 1. As we anticipated, the model fit of the CFA for the TOS scores was clearly inadequate (CFI=0.881,

Table 1 Goodness of fit indices for the different models

Models	χ^2	df	CFI	TLI	RMSEA
TOS CFA	1181.3	118	.881	.863	.106
TOS ESEM	565.2	103	.948	.932	.075
TOS ESEM No Items 9 & 15	353.9	76	.963	.949	.068
DOS	683.0	35	.877	.842	.152

df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; TOS = Teruel Orthorexia Scale; DOS = Düsseldorf Orthorexia Skala; CFA = confirmatory factor analysis; ESEM = exploratory structural equation model

All *p*-values for the χ^2 test were < .001

TLI=0.863, RMSEA=0.106). This model was greatly improved when scores were modeled with an ESEM, that is, when cross-loadings were also estimated (CFI=0.948, TLI=0.932, RMSEA=0.075), although fit was still below commonly used cut-off points. As can be seen in Table 2, in this model each item presented its higher loading in the intended factor and all cross-loadings could not be considered as relevant (≤ 0.30), but the one for Item 9 (cross-loading=0.40). We decided to remove this item for two reasons: first, empirical, given that cross-loading; second, theoretical. While concern with healthy eating is a core element of OrNe, devoting long time is not, as indicated by the fact that Item 2 ("I spend a lot of time buying, planning, and or/preparing food so my diet will be as healthy as possible") clearly loads in HeOr.

The higher modification index (MI=108.4) in this model indicated that model fit would be improved if we added the correlation of item uniquenesses from Item 14 ("I avoid eating with people who do not share my ideas about healthy eating") and Item 15. These two items belong to different factors, and we could not find any theoretical justification –apart from the general reference to 'people'– for the incorporation of this new parameter. Considering that Item 15 has been found to be problematic in previous analysis of the TOS [64], we decided to remove that item. By doing so, we avoided incorporating correlated uniquenesses without any a priori expectation and theoretical justification for doing so.

For the shortened TOS, without Item 9 and Item 15, model fit was improved, although with TLI and RMSEA results slightly over the cut-point (CFI=0.963, TLI=0.949, RMSEA=0.068). As no modification index clearly stood out (maximum MI=25.3), we considered that no respecification of the model was to be considered. The loadings in this model basically followed what was expected. For HeOr, the mean loading was 0.65 (maximum=0.96, "I mainly eat foods that I consider healthy"; minimum=0.46, "I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy"). For

Table 2 Item loadings of the initial and final version of the Teruel Orthorexia Scale-French version

	Initial Version		Final Version	
	HeOr	OrNe	HeOr	OrNe
1. I feel good when I eat healthy food	0.64	0.00	0.65	0.01
2. I spend a lot of time buying, planning, and or/preparing food so my diet will be as healthy as possible	0.72	0.09	0.71	0.08
3. I think that my way of eating is healthier than that of most people	0.84	− 0.19	0.83	− 0.18
4. I feel guilty when I eat food that I do not consider healthy	− 0.01	0.72	0.00	0.73
5. My social relationships have been negatively affected by my concern about eating healthy food	0.18	0.56	0.18	0.57
6. My interest in healthy food is an important part of the way I am, of how I understand the world	0.59	0.23	0.57	0.23
7. I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy	0.47	0.27	0.46	0.28
8. I mainly eat foods that I consider healthy	0.95	− 0.18	0.96	− 0.17
9. My concern with healthy eating takes up a lot of my time	0.40	0.51	−	−
10. I am concerned about the possibility of eating unhealthy foods	0.21	0.60	0.20	0.59
11. I don't mind spending more money on food if I think it's healthier	0.54	0.02	0.54	0.03
12. I feel overwhelmed or sad if I eat food that I consider unhealthy	− 0.01	0.83	0.00	0.84
13. I would rather eat a smaller portion of healthy food than get full from food that may not be healthy	0.51	0.25	0.51	0.27
14. I avoid eating with people who do not share my ideas about healthy eating	0.28	0.51	0.21	0.52
15. I try to convince the people in my life to follow my healthy eating habits	0.46	0.19	−	−
16. If I ever eat something I consider unhealthy, I punish myself for it	− 0.05	0.85	− 0.07	0.86
17. Thoughts about healthy eating prevent me from concentrating on other tasks	0.03	0.82	0.00	0.82

HeOr = Healthy Orthorexia; OrNe = Orthorexia Nervosa

Loadings in bold indicate unsigned loadings above |.30|

For both versions, $r_{\text{HeOr,OrNe}} = .32$

OrNe, the mean loading was 0.70 (maximum = 0.86, "If, at some point, I eat something that I consider unhealthy, I punish myself for it"; minimum = 0.52, "I avoid eating with people who do not share my ideas about healthy eating"). The mean unsigned cross-loading was small, 0.13, with a maximum 0.28 for Item 7 ("I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't healthy").

For both the initial TOS and final versions the latent correlation between HeOr and OrNe was the same, 0.32. Importantly, the correlation between the initial and final versions was 0.99 for both HeOr and OrNe. The internal consistency of both TOS dimensions was adequate (initial version: $\alpha_{\text{HeOr}} = 0.83$ and $\alpha_{\text{OrNe}} = 0.83$; shortened version: $\alpha_{\text{HeOr}} = 0.83$ and $\alpha_{\text{OrNe}} = 0.81$).

In accordance with previous results, the fit of the uni-dimensional model of the DOS scores was clearly inadequate (CFI = 0.877, TLI = 0.842, RMSEA = 0.152).

Descriptives and associations with other variables

Table 3 shows the descriptive statistics and the associations among the different variables. As could be expected, the mean of HeOr was higher than for OrNe. Also, HeOr presented a more symmetrical shape than OrNe, with a positive skewness for the latter.

Both TOS dimensions presented a positive correlation with DOS score, with TOS OrNe showing a higher association ($r = 0.57$ with TOS HeOr; $r = 0.73$ with TOS OrNe). While HeOr presented small correlations with the different EDE-Q and OCI-R scores ($M_{|\text{r}|} = 0.07$, minimum = 0.02, maximum = 0.24; none statistically significant, but the latter), the associations with OrNe were much higher ($M_{|\text{r}|} = 0.43$, minimum = 0.31, maximum = 0.52; all statistically significant).

Associations between DOS, EDE-Q and OCI-R with TOS showed significant differences when comparing the coefficients found for HeOr and OrNe [$r(\text{variable}, \text{OrNe}) - r(\text{variable}, \text{HeOr})$], that is, all the measures indicative of disorders were more related with OrNe than with HeOr. The size of these differences ranged from 0.16 for DOS to 0.50 for Eating Concern, with all $ps < 0.001$.

When controlling for the other orthorexia dimension, the pattern of partial correlations for HeOr presented interesting differences with respect to Pearson correlations (see Table 3). While the association with DOS scores was reduced from 0.57 to 0.44, the partial correlation still indicated a relevant overlap. For EDE-Q and OCI-R scores, the only positive and statistically significant Pearson correlation was now a near-zero and non-significant partial correlation (from 0.24 to 0.05) and all the other near-zero Pearson correlations showed then negative and statistically significant partial association

Table 3 Descriptive statistics and correlations

	Descriptives				Pearson correlations							Differences in correlations		Partial correlations	
	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>K</i>	1	2	3	4	5	6	7	<i>diff r</i>	<i>p diff</i>	HeOr	OrNe
1. TOS HeOr	12.84	4.69	− 0.26	− 0.22								–	–	–	–
2. TOS OrNe	5.23	3.78	0.88	0.55	.40							–	–	–	–
3. DOS	18.30	5.29	0.72	0.50	.57	.73						.16	<.001	.44	.66
4. EDE-Q Restraint	7.18	7.80	1.07	0.23	.24	.48	.56					.25	<.001	.05	.44
5. EDE-Q Eating Concern	4.37	5.90	1.66	2.14	.02	.52	.44	.54				.50	<.001	−.24	.56
6. EDE-Q Shape Concern	20.80	14.20	0.19	− 1.19	.02	.43	.40	.62	.67			.41	<.001	−.19	.46
7. EDE-Q Weight Concern	11.24	8.44	0.37	− 1.00	.02	.41	.39	.60	.69	.91		.39	<.001	−.17	.44
8. OCI-R	38.35	12.59	0.55	− 0.17	− .05	.31	.24	.19	.39	.29	.27	.36	<.001	−.20	.36

HeOr = healthy orthorexia, OrNe = orthorexia nervosa, *diff r* corresponds to the difference $r(\text{variable}, \text{OrNe}) - r(\text{variable}, \text{dimension}, \text{HeOr})$, *p diff* corresponds to the statistical significance of that difference

Partial correlations are controlling for the other orthorexia dimension

Bold values correspond to statistically significant associations and differences, $p < .05$

in the range $[-0.24, -0.17]$. With respect to OrNe, the association with DOS scores was slightly reduced when controlling for HeOr (from 0.73 to 0.66). The partial correlations with EDE-Q and OCI-R scores increased for all variables except for Restraint.

Discussion

To date, several orthorexia measurement tools have been translated and validated in French language (i.e., the ORTO-15, [4], the EHQ, [31], and the DOS, [37]). However, all those instruments, arguably, present several limitations [5, 10, 20, 26, 30, 34, 37, 45, 47, 49, 53]. There is evidence that the DOS and the EHQ, simultaneously, tap both OrNe and HeOr [33, 64], but it is still common practice in the area of orthorexia to compute total scores for those scales (see [3] for a review about the associations of those scores with other eating disorders).

In comparison, the TOS presents several advantages. First, it explicitly covers the healthy side of orthorexia. Second, the validity of its scores seems, up to now, clearer. The aim of the current study was thus to examine psychometric properties of the French version of the TOS. To the best of our knowledge, this is the first study proposing a French validation of a questionnaire taking into account both the healthy and pathological forms of orthorexia.

One would expect OrNe and HeOr to represent a continuum, ranging from no interest in healthy eating to an important negative impact of deviance from own healthy eating standards, with an optimal interest as a middle point. However, as noted in previous studies (e.g., [6]), these two factors can and should be separated. In this study, for both the initial TOS and final versions the latent correlation between HeOr and OrNe was the same,

that is 0.32. Comparing the correlations showed with both dimensions, they are very different and opposite for most factors, mainly when controlling for the other orthorexia dimension [21, 52, 59, 64]. A person can score high on HeOr without necessarily experiencing distress or interference in their life. This is very important, as it indicates that interest for healthy eating and considering that life-style option as part of own identity is not associated to psychopathology. In fact, HeOr negatively correlates with psychopathology and positively correlates with positive affect [6, 8]. This pattern of associations can be seen in the results found in the present study with the French version of the TOS.

Unlike prior validation studies [44, 50, 59] exploring the bidimensional structure of the TOS using CFA, we used an ESEM allowing estimation of secondary loadings and correlated uniquenesses. As anticipated, the model fit of the CFA for the TOS scores was clearly inadequate and it was greatly improved when using ESEM. Our general advice would be to avoid CFA when cross-loadings can be expected (and this is more the norm than the exception), so exploratory approaches should be favored. Similarly, the CFA conducted on the DOS scores showed an unsatisfactory fit, questioning the unidimensional structure of the measure [37]. Based on ESEM, we obtained a 15-item two-factor solution that provided a good fit with the data and clearly replicated the bidimensional structure found in several TOS validation studies [6, 19, 44, 50, 59, 64]. Nevertheless, while the Portuguese [50], Arabic [44], and one of the English validation studies [64] replicated a 17-item version of the TOS, which was consistent with the original Spanish version [6], we chose to retain a 15-item solution and removed Item 9 and Item 15. Regarding Item 9, cross-loadings were already found in

other validation studies [19, 64]. On a theoretical standpoint, we may consider that while “concern with healthy eating” is a core component of OrNe, it can also cover several activities such as planning, shopping or cooking already assessed by Item 2, which is clearly on the HeOr factor. Another important point to emphasize is that this time-consuming component might be considered subjectively depending on people and Item 9 does not specify an amount of time above which a pathological behavior could be considered. Thus, the cross-loading of this item could be explained by its non-specific and vague nature. Regarding Item 15, an English validation study [64] has already questioned its relevance given that reverse patterns of loadings were observed between the two samples recruited in the study. Thus, trying to convince others to consume healthy food would not be specific to one type of orthorexia, suggesting the need to focus on motivations underlying eating habits that could play a part in the development of each type of orthorexia.

Regarding scale properties, in line with previous studies [6, 19, 44, 50, 59, 64], the OrNe and HeOr subscales showed only moderate latent intercorrelations ($r = 0.32$). The internal consistency of both TOS dimensions was adequate (initial version: $\alpha_{\text{HeOr}} = 0.83$ and $\alpha_{\text{OrNe}} = 0.83$; shortened version: $\alpha_{\text{HeOr}} = 0.83$ and $\alpha_{\text{OrNe}} = 0.81$) and of comparable magnitude of values reported in the original Spanish version [6] as well as in other TOS validation studies [19, 44, 59], suggesting that this version of the TOS is an empirically supported tool to explore orthorexia both in its healthy and pathological forms in French samples.

Although both TOS subscales were found to be associated with another measure of Orthorexia Nervosa – the DOS–, providing support for convergent validity, the strongest correlation was observed with the OrNe subscale ($r_{\text{DOS-OrNe}} = 0.73$ vs. $r_{\text{DOS-HeOr}} = 0.57$). As was noted in previous research [64], if the DOS was a pure marker of OrNe, that is, it was assessing other constructs to a large degree, controlling for TOS-OrNe, TOS-HeOr would be minimally correlated with the DOS. We did not find such associations. This result, combined with the unidimensional model fit with these data and previously reported data, indicates that the DOS is a measure which should be further improved.

Regarding the relationships with measures of disordered eating behaviors and obsessive–compulsive symptoms, as predicted, HeOr and OrNe showed opposite patterns of correlations, which is in line with previous validation studies [6, 64]. As expected, the correlation between HeOr and obsessive–compulsive symptoms (OCI-R) was near-to-zero while it was significant but moderate with OrNe. Interestingly, when controlling for the other dimension, the OCI-R-HeOr partial

correlation became significant but negative, however small, with the reverse pattern for the OCI-R-OrNe that slightly increased. These results suggest that OrNe and OCD share common clinical manifestations. According to the literature, the overlapping symptoms might be obsessions, preoccupations specifically oriented towards healthy eating, a considerable amount of time devoted to obsessions and preoccupations (planning, shopping, preparation), and an important rigidity concerning certain rules leading to guilt if not followed.

Concerning the relationships between HeOr and eating disorder symptoms (EDE-Q four subscales: Restraint, Eating Concern, Weight Concern and Shape Concern), the correlations were non-significant except for one – Restraint– which was small, whereas the correlations between EDE-Q subscales and OrNe were all much higher and statistically significant. More interestingly, the partial correlations between HeOr and EDE-Q subscales became all significant and negative, yet small, when controlling for OrNe, except with the Restraint subscale that became a near-to-zero and non-significant partial correlation. On the contrary, the partial correlations between EDE-Q subscales and OrNe all increased, except for the Restraint subscale that slightly decreased. These results confirm previous findings and the two-dimensional conception of orthorexia [6, 19, 44, 64]. One important finding is indeed the negative relationships found here between the HeOr dimension and the eating, shape and weight concern symptoms that are core features of eating disorders. Overall, these findings suggest the importance of distinguishing HeOr from OrNe.

As Valente et al. [60] have pointed, the proposal of OrNe leads to the emergence of a discursive tension: are we pathologizing healthy eating? From our point of view, the researchers in the area of OrNe should acknowledge that we, to some degree, have been “anti-health” and pathologizing healthy eating and healthy life choices. For many years, the main instrument to measure OrNe has been the ORTO-15. Among its items we can find “Are you willing to spend more money to have healthier food?” or “Do you think that on the market there is also unhealthy food?”. That is, an economic compromise with healthy food has been used as a marker of a (new proposed) eating disorder. Willing to spend money on health was indicative of pathology. Also, having basic nutritional knowledge (not all what is sold in a market is healthy) has also been used as a marker of eating disorder. As we have already noted, other questionnaires present similar problems. If part of the general public has understood that the proponents of OrNe were trying to pathologize healthy eating [54], we should accept that, to some degree, it has been a fault from our research community.

Clearly separating between what is pathological and what is not, between OrNe and HeOr can clarify both constructs. People highly engaged with healthy eating and no pathological approach to healthy eating (high HeOr, low OrNe) will not recognize themselves with the OrNe items of the TOS. We are offering a label for those that could identify with HeOr (healthy interest in diet, self-assessed healthy behavior with regard to diet, and eating healthily as part of one's identity).

From our point of view, the bidimensional structure of orthorexia has been useful to advance the understanding of the topic. First, it has offered a theoretical model that has helped to understand the structure of some commonly used questionnaires in the area. Second, it has clearly shown that some elements that, at a superficial inspection, could be considered as elements of OrNe, in fact, are not, like devoting a long time to prepare food or considering that our own diet is healthier than that of most people. This helps us to refine how we conceptualize OrNe. A high engagement with healthy eating is not a problem. The disorder is based on feeling guilty, punishing for eating what is considered unhealthy, or social isolation.

Despite several strengths in the current study (sample size, wide age range, data gathered in the general population, accurate statistical analyses, validated tools for exploring convergent and discriminant validities), some limitations need to be acknowledged. Although the study was conducted on a large sample of participants, there is, as for prior validation studies [19, 44], an over representation of women (82.9%) which limits the representability of the results. Moreover, professional domains of activities and socioeconomic status were not specifically requested, and such lifestyle-related variables may have a considerable influence on nutrition knowledge and food quality availability. In addition, it is noteworthy that data were collected during the COVID-19 pandemic which might have influenced eating habits and/or general mental health. Finally, the cross-sectional design of the study precludes drawing conclusions about the causality between OrNe and symptoms of eating disorders and obsessive-compulsive disorder.

Conclusions

The current study provides additional evidence for a bidimensional conception of orthorexia and suggests that the TOS, in a 15-item version, could be an empirically supported instrument for differentiating both types of orthorexia (i.e., OrNe vs. HeOr) in a French population. To date, the available measurement tools in French language showed some discrepancies and limited psychometric properties [4, 37]. Beyond such inconsistencies, none of the existing French assessment

tools have yet considered a bidimensional approach of orthorexia. Thus, the current validation of the TOS could have important implications for future studies in French speaking populations and could allow the replication of international studies. Regarding clinical implications, our findings suggest the need to provide appropriate psychoeducative information to individuals demonstrating healthy food preoccupation to avoid the development of pathological manifestations. Future studies should include measures of quality of life, distress, motivations, and emotion regulation in order to better characterize the pathological and non-pathological dimensions of orthorexia.

Appendix-Teruel Orthorexia Scale

Les questions suivantes concernent les idées et les attitudes que vous avez vis-à-vis de l'alimentation. Plus précisément, nous souhaiterions savoir dans quelle mesure il est important pour vous de suivre une alimentation saine ou de consommer des aliments, par exemple, sans gras, sans sel, sans conservateurs, sans additifs ou toute substance que vous considérez comme nocive ou toxique comme les pesticides.

	Pas du tout d'accord	Plutôt pas d'accord	Plutôt d'accord	Tout à fait d'accord
1. Je me sens bien quand je mange des aliments sains				
2. Je passe beaucoup de temps à acheter, à planifier et/ou à préparer la nourriture pour que mon alimentation soit la plus saine possible				
3. Je considère que ma façon de manger est plus saine que celle de la plupart des gens				
4. Je me sens coupable lorsque je mange de la nourriture que je considère comme mauvaise pour la santé				

	Pas du tout d'accord	Plutôt pas d'accord	Plutôt d'accord	Tout à fait d'accord
5. Ma préoccupation à manger sainement a eu un impact négatif sur mes relations sociales				
6. Mon intérêt pour une alimentation saine définit ma manière d'être, de comprendre le monde				
7. Je préfère manger une nourriture saine et peu savoureuse qu'une nourriture savoureuse mais mauvaise pour la santé				
8. Je consomme principalement des aliments que je considère sains				
9. Je suis préoccupé(e) par l'éventualité de manger des aliments mauvais pour la santé				
10. Cela ne me dérange pas de dépenser plus d'argent pour un aliment si je le considère plus sain				
11. Je me sens bouleversé(e) ou triste si je mange des aliments que je considère mauvais pour la santé				
12. Je préfère manger peu, mais de la nourriture saine, que d'être rassasié(e) avec de la nourriture mauvaise pour la santé				
13. J'évite de manger avec des personnes qui ne partagent pas mes idées sur une alimentation saine				

	Pas du tout d'accord	Plutôt pas d'accord	Plutôt d'accord	Tout à fait d'accord
14. S'il m'arrive de manger quelque chose que je considère comme mauvais pour la santé, je me punis pour cela				
15. Des pensées concernant une alimentation saine m'empêchent de me concentrer sur d'autres tâches				

Calcul des scores

Échelle de réponse: Pas du tout d'accord = 0, pas d'accord = 1, plutôt d'accord = 2, tout à fait d'accord = 3.

TOS—Orthorexie saine = TOS1 + TOS2 + TOS3 + TOS6 + TOS7 + TOS8 + TOS10 + TOS12.

TOS—Orthorexie nerveuse = TOS4 + TOS5 + TOS9 + TOS11 + TOS13 + TOS14 + TOS15.

Acknowledgements

We are grateful to Jeanne Danel for her help in back-translating the TOS, and to Clarisse Morgado, Clémence Bourgeois, Léa Wlodek, Lucie Tricoteaux, and Marie-Aubine Tur for their help in data collection.

Author contributions

CL, AR, SV, NG, LR designed the study, wrote the protocol, and participated in the back translation of the questionnaire. AR and CL wrote the Ethics Committee application form and collected data. CL wrote the first draft of the Introduction and Methods sections. JB conducted statistical analyses and wrote the Data Analysis and Results sections. CL, AR, SV, NG, LR, MR and JB wrote the Discussion and Conclusion sections, revised the first draft, and approved the final manuscript.

Funding

No funds, grants, or other support was received.

Data availability

The data that support the findings of this study are available from the corresponding author (CL), upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the ethical standards and have been approved by the ethics committee of the University of Lille (Registration number 2021–514-S95) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all the participants included in this study.

Consent for publication

All participants were informed that results from this study were going to be published in scientific journals or congress.

Competing interests

The authors declare no competing interests.

Author details

¹Laboratoire CERPPS (Centre d'Etudes Et de Recherches en Psychopathologie Et Psychologie de La Santé), Université Toulouse-Jean Jaurès, UT2J, 5 allées Antonio Machado, 31058 Toulouse, France. ²Centre de Recherches Sur La Cognition Et L'apprentissage—CeRCA (CNRS, UMR 7295) MSHS, Université de Poitiers, 5 Rue Théodore Lefebvre, 86073 Poitiers Cedex 9, France. ³UR4430 CLIPSYD, Université Paris Nanterre; HU Raymond-Poincaré, Inserm CESP 1018 UPS, Nanterre, France. ⁴Departamento de Personalidad, Evaluación y Tratamientos Psicológicos, Facultad de Psicología, Universitat de València, Valencia, Spain. ⁵Departamento de Psicología y Sociología, Universidad de Zaragoza, Zaragoza, Spain.

Received: 6 December 2022 Accepted: 26 February 2023

Published online: 28 April 2023

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 5th edn. 2013. <https://doi.org/10.1176/appi.books.9780890425596.744053>
- Asparouhov T, Muthén B. Exploratory structural equation modeling. *Struct Equ Model*. 2009;16(3):397–438. <https://doi.org/10.1080/1070510903008204>
- Atchison AE, Zickgraf HF. Orthorexia nervosa and eating disorder behaviors: A systematic review of the literature. *Appetite*. 2022;177:106134. <https://doi.org/10.1016/j.appet.2022.106134>
- Babeau C, Le Chevanton T, Julien-Sweerts S, Brochenin A, Donini LM, Fouques D. Structural validation of the ORTO-12-FR questionnaire among a French sample as a first attempt to assess orthorexia nervosa in France. *Eat Weight Disord Stud Anorex Bulim Obes*. 2019. <https://doi.org/10.1007/s40519-019-00835-0>
- Barnes MA, Calabiano ML. The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. *Eat Weight Disord Stud Anorex Bulim Obes*. 2017;22(1):177–84. <https://doi.org/10.1007/s40519-016-0280-x>
- Barrada JR, Roncero M. Bidimensional structure of the orthorexia: development and initial validation of a new instrument. *Anal Psicol*. 2018;34(2):283. <https://doi.org/10.6018/analesps.34.2.299671>
- Bartel SJ, Sherry SB, Farthing GR, Stewart SH. Classification of orthorexia nervosa: further evidence for placement within the eating disorders spectrum. *Eat Behav*. 2020;38:101406. <https://doi.org/10.1016/j.eatbeh.2020.101406>
- Barthels F, Barrada JR, Roncero M. Orthorexia nervosa and healthy orthorexia as new eating styles. *PLoS ONE*. 2019;14(7):e0219609. <https://doi.org/10.1371/journal.pone.0219609>
- Barthels F, Meyer F, Pietrowsky R. Orthorexic eating behaviour. A new type of disordered eating. *Ernahrungs Umsch*. 2015;62(10):156–61. <https://doi.org/10.4455/eu.2015.029>
- Barthels F, Meyer F, Pietrowsky R. Die düsseldorfer orthorexie skala-konstruktion und evaluation eines fragebogens zur erfassung orthorektischen ernährungsverhaltens. *Z Klin Psychol Psychother*. 2015;44(2):97–105. <https://doi.org/10.1026/1616-3443/a000310>
- Bhattacharya A, Cooper M, McAdams C, Peebles R, Timko CA. Cultural shifts in the symptoms of anorexia nervosa: the case of orthorexia nervosa. *Appetite*. 2021. <https://doi.org/10.1016/j.appet.2021.105869>
- Bratman S. Orthorexia vs. theories of healthy eating. *Eat Weight Disord Stud Anorex Bulim Obes*. 2017;22(3):381–5. <https://doi.org/10.1007/s40519-017-0417-6>
- Bratman S, Knight D. Health food junkies: orthorexia nervosa: overcoming the obsession with healthful eating, 1st edn, Broadway; 2001.
- Brislin RW. Back-translation for cross-cultural research. *J Cross Cult Psychol*. 1970;1(3):185–216. <https://doi.org/10.1177/135910457000100301>
- Brown TA. Confirmatory factor analysis for applied research, 2nd edn. The Guilford Press; 2015. pp. xvii, 462.
- Brytek-Matera A. Orthorexia nervosa—an eating disorder, obsessive-compulsive disorder or disturbed eating habit? *Arch Psychiatry Psychother*. 2012;1(1):55–60.
- Carrard I, Lien Rebetez MM, Mobbs O, Van der Linden M. Factor structure of a French version of the eating disorder examination-questionnaire among women with and without binge eating disorder symptoms. *Eat Weight Disord Stud Anorex Bulim Obes*. 2015;20(1):137–44. <https://doi.org/10.1007/s40519-014-0148-x>
- Cena H, Barthels F, Cuzzolaro M, Bratman S, Brytek-Matera A, Dunn T, Varga M, Missbach B, Donini LM. Definition and diagnostic criteria for orthorexia nervosa: a narrative review of the literature. *Eat Weight Disord Stud Anorex Bulim Obes*. 2019;24(2):209–46. <https://doi.org/10.1007/s40519-018-0606-y>
- Chace S, Kluck AS. Validation of the Teruel orthorexia scale and relationship to health anxiety in a U. S. sample. *Eat Weight Disord EWD*. 2021. <https://doi.org/10.1007/s40519-021-01272-8>
- Chard CA, Hilzendege C, Barthels F, Stroebele-Benschop N. Psychometric evaluation of the English version of the Düsseldorf Orthorexia Scale (DOS) and the prevalence of orthorexia nervosa among a U. S. student sample. *Eat Weight Disord Stud Anorex Bulim Obes*. 2019;24(2):275–81. <https://doi.org/10.1007/s40519-018-0570-6>
- Depa J, Barrada J, Roncero M. Are the motives for food choices different in orthorexia nervosa and healthy orthorexia? *Nutrients*. 2019;11(3):697. <https://doi.org/10.3390/nu11030697>
- Donini LM, Marsili D, Graziani MP, Imbriale M, Cannella C. Orthorexia nervosa: a preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eat Weight Disord Stud Anorex Bulim Obes*. 2004;9(2):151–7. <https://doi.org/10.1007/BF03325060>
- Donini LM, Marsili D, Graziani MP, Imbriale M, Cannella C. Orthorexia nervosa: validation of a diagnosis questionnaire. *Eat Weight Disord Stud Anorex Bulim Obes*. 2005;10(2):e28–32. <https://doi.org/10.1007/BF03327537>
- Dunn TM, Bratman S. On orthorexia nervosa: a review of the literature and proposed diagnostic criteria. *Eat Behav*. 2016;21:11–7. <https://doi.org/10.1016/j.eatbeh.2015.12.006>
- Dunn OJ, Clark VA. Correlation coefficients measured on the same individuals. *J Am Stat Assoc*. 1969;64:366–77.
- Dunn TM, Gibbs J, Whitney N, Starosta A. Prevalence of orthorexia nervosa is less than 1 %: data from a US sample. *Eat Weight Disord Stud Anorex Bulim Obes*. 2017;22(1):185–92. <https://doi.org/10.1007/s40519-016-0258-8>
- Fairburn CG, Beglin SJ. Assessment of eating disorders: interview or self-report questionnaire? *Int J Eat Disord*. 1994;16(4):363–70.
- Finney SJ, DiStefano C. Nonnormal and categorical data in structural equation modeling. In: *Structural equation modeling: a second course*, 2nd edn. IAP Information Age Publishing; 2013. pp. 439–492.
- Foa EB, Huppert JD, Leiberg S, Langner R, Kichic R, Hajcak G, Salkovskis PM. The obsessive-compulsive inventory: development and validation of a short version. *Psychol Assess*. 2002;14(4):485–96. <https://doi.org/10.1037/1040-3590.14.4.485>
- Gleaves DH, Graham EC, Ambwani S. Measuring "orthorexia": development of the eating habits questionnaire. *Int J Educ Psychol Assess*. 2013;12(2):1–18.
- Godefroy V, Trinchera L, Dorard G. Optimizing the empirical assessment of orthorexia nervosa through EHQ and clarifying its relationship with BMI. *Eat Weight Disord Stud Anorex Bulim Obes*. 2020. <https://doi.org/10.1007/s40519-020-00909-4>
- Halim ZM, Dickinson KM, Kemps E, Prichard I. Orthorexia nervosa: examining the Eating Habits Questionnaire's reliability and validity, and its links to dietary adequacy among adult women. *Public Health Nutr*. 2020;23(10):1684–92.
- Hallit S, Barrada JR, Salameh P, Sacre H, Roncero M, Obeid S. The relation of orthorexia with lifestyle habits: arabic versions of the eating habits questionnaire and the dusseldorf orthorexia scale. *J Eat Disord*. 2021;9(1):102. <https://doi.org/10.1186/s40337-021-00455-z>
- He J, Ma H, Barthels F, Fan X. Psychometric properties of the Chinese version of the Düsseldorf Orthorexia Scale: prevalence and demographic correlates of orthorexia nervosa among Chinese university students. *Eat Weight Disord Stud Anorex Bulim Obes*. 2019;24(3):453–63. <https://doi.org/10.1007/s40519-019-00656-1>
- Hittner JB, May K, Silver NC. A monte carlo evaluation of tests for comparing dependent correlations. *J Gen Psychol*. 2003;130(2):149–68. <https://doi.org/10.1080/00221300309601282>
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model*. 1999;6(1):1–55. <https://doi.org/10.1080/10705519909540118>

37. Lasson C, Barthels F, Raynal P. Psychometric evaluation of the French version of the Düsseldorf Orthorexia Skala (DOS) and prevalence of orthorexia nervosa among university students. *Eat Weight Disord EWD*. 2021;26(8):2589–96. <https://doi.org/10.1007/s40519-021-01123-6>.
38. Marsh HW, Hau K-T, Wen Z. In search of golden rules: comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) Findings. *Struct Equ Model*. 2004;11(3):320–41. https://doi.org/10.1207/s15328007sem1103_2.
39. Marsh HW, Lüdtke O, Muthén B, Asparouhov T, Morin AJS, Trautwein U, Nagengast B. A new look at the big five factor structure through exploratory structural equation modeling. *Psychol Assess*. 2010;22(3):471–91. <https://doi.org/10.1037/a0019227>.
40. Marsh HW, Morin AJS, Parker PD, Kaur G. Exploratory structural equation modeling: an integration of the best features of exploratory and confirmatory factor analysis. *Annu Rev Clin Psychol*. 2014;10(1):85–110. <https://doi.org/10.1146/annurev-clinpsy-032813-153700>.
41. McComb SE, Mills JS. Orthorexia nervosa: a review of psychosocial risk factors. *Appetite*. 2019;140:50–75. <https://doi.org/10.1016/j.appet.2019.05.005>.
42. Meule A, Voderholzer U. Orthorexia nervosa—it is time to think about abandoning the concept of a distinct diagnosis. *Front Psychiatry*. 2021; 41.
43. Meule A, Holzapfel C, Brandl B, Greetfeld M, Hessler-Kaufmann JB, Skurk T, Quadflieg N, Schlegel S, Hauner H, Voderholzer U. Measuring orthorexia nervosa: A comparison of four self-report questionnaires. *Appetite*. 2020;146:104512. <https://doi.org/10.1016/j.appet.2019.104512>.
44. Mhanna M, Azzi R, Hallit S, Obeid S, Soufia M. Validation of the Arabic version of the Teruel Orthorexia Scale (TOS) among Lebanese adolescents. *Eat Weight Disord Stud Anorex Bulim Obes*. 2021. <https://doi.org/10.1007/s40519-021-01200-w>.
45. Missbach B, Barthels F. Orthorexia nervosa: moving forward in the field. *Eat Weight Disord Stud Anorex Bulim Obes*. 2017;22(1):1–1. <https://doi.org/10.1007/s40519-017-0365-1>.
46. Moroze RM, Dunn TM, Craig Holland J, Yager J, Weintraub P. Microthinking about micronutrients: a case of transition from obsessions about healthy eating to near-fatal "orthorexia nervosa" and proposed diagnostic criteria. *Psychosomatics*. 2015;56(4):397–403. <https://doi.org/10.1016/j.psych.2014.03.003>.
47. Oberle CD, Samaghabadi RO, Hughes EM. Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*. 2017;108:303–10. <https://doi.org/10.1016/j.appet.2016.10.021>.
48. Parra-Fernández ML, Onieva-Zafra MD, Fernández-Muñoz JJ, Fernández-Martínez E. Adaptation and validation of the Spanish version of the DOS questionnaire for the detection of orthorexia nervosa behavior. *PLOS ONE*. 2019;14(5):e0216583. <https://doi.org/10.1371/journal.pone.0216583>.
49. Reynolds R. Is the prevalence of orthorexia nervosa in an Australian university population 6.5%? *Eat Weight Disord Stud Anorex Bulim Obes*. 2018;23(4):453–8. <https://doi.org/10.1007/s40519-018-0535-9>.
50. Roberto da Silva W, Cruz Marmol CH, Nogueira Neves A, Marôco J, Bonini Campos JAD. A portuguese adaptation of the teruel orthorexia scale and a test of its utility with Brazilian Young adults. *Percept Mot Skills*. 2021;128(5):2052–74. <https://doi.org/10.1177/00315125211029240>.
51. Rogoza R, Donini LM. Introducing ORTO-R: A revision of ORTO-15: Based on the re-assessment of original data. *Eat Weight Disord Stud Anorex Bulim Obes*. 2020. <https://doi.org/10.1007/s40519-020-00924-5>.
52. Roncero M, Barrada JR, García-Soriano G, Guillén V. Personality profile in orthorexia nervosa and healthy orthorexia. *Front Psychol*. 2021;12:710604. <https://doi.org/10.3389/fpsyg.2021.710604>.
53. Roncero M, Barrada JR, Perpiñá C. Measuring orthorexia nervosa: psychometric limitations of the ORTO-15. *Span J Psychol*. 2017;20:E41. <https://doi.org/10.1017/sjp.2017.36>.
54. Ross Arguedas AA. "Can naughty be healthy?": Healthism and its discontents in news coverage of orthorexia nervosa. *Soc Sci Med*. 2020;246:112784. <https://doi.org/10.1016/j.socscimed.2020.112784>.
55. Ryman FVM, Cesuroglu T, Bood ZM, Syurina EV. Orthorexia nervosa: disorder or not? Opinions of Dutch health professionals. *Front Psychol*. 2019;10:555. <https://doi.org/10.3389/fpsyg.2019.00555>.
56. Sánchez-Carracedo D, Barrada JR, López-Guimerà G, Fauquet J, Almenara CA, Trepát E. Analysis of the factor structure of the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-3) in Spanish secondary-school students through exploratory structural equation modeling. *Body Image*. 2012;9(1):163–71. <https://doi.org/10.1016/j.bodyim.2011.10.002>.
57. Steenkamp J-BEM, Maydeu-Olivares A. Unrestricted factor analysis: a powerful alternative to confirmatory factor analysis. *J Acad Mark Sci*. 2023;51(1):86–113. <https://doi.org/10.1007/s11747-022-00888-1>.
58. Strahler J. The dark side of healthy eating: links between orthorexic eating and mental health. *Nutrients*. 2020;12(12):3662. <https://doi.org/10.3390/nu12123662>.
59. Strahler J. Trait mindfulness differentiates the interest in healthy diet from orthorexia nervosa. *Eat Weight Disord-Studies on Anorexia, Bulimia and Obesity*. 2021;26:993–8.
60. Valente M, Cesuroglu T, Labrie N, Syurina EV. "When are we going to hold orthorexia to the same standard as anorexia and bulimia?" Exploring the medicalization process of orthorexia nervosa on twitter. *Health Commun*. 2022;37(7):872–9. <https://doi.org/10.1080/10410236.2021.1875558>.
61. World Health Organization. Hearts: technical package for cardiovascular disease management in primary health care. World Health Organization. 2016. <https://apps.who.int/iris/handle/10665/252661>.
62. Xia Y, Yang Y. RMSEA, CFI, and TLI in structural equation modeling with ordered categorical data: the story they tell depends on the estimation methods. *Behav Res Methods*. 2019;51(1):409–28. <https://doi.org/10.3758/s13428-018-1055-2>.
63. Zermatten A, Van der Linden M, Jermann F, Ceschi G. Validation of a French version of the Obsessive-Compulsive Inventory-Revised in a non-clinical sample. *Eur Rev Appl Psychol*. 2006;56(3):151–5. <https://doi.org/10.1016/j.erap.2005.07.003>.
64. Zickgraf HF, Barrada JR. Orthorexia nervosa vs. healthy orthorexia: Relationships with disordered eating, eating behavior, and healthy lifestyle choices. *Eat Weight Disord EWD*. 2022;27(4):1313–25. <https://doi.org/10.1007/s40519-021-01263-9>.
65. Zickgraf HF, Ellis JM, Essayli JH. Disentangling orthorexia nervosa from healthy eating and other eating disorder symptoms: relationships with clinical impairment, comorbidity, and self-reported food choices. *Appetite*. 2019;134:40–9. <https://doi.org/10.1016/j.appet.2018.12.006>.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

