


# Exploration of orthorexia nervosa and diagnostic overlap with eating disorders, anorexia nervosa and obsessive-compulsive disorder

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Action Editor: B. Timothy Walsh

## Abstract

**Objective:** Orthorexia nervosa (ON) is characterized as obsessional healthy eating that results in malnutrition and/or psychosocial impairment. Yet, ON shares theoretical overlap with eating disorders (EDs), especially anorexia nervosa (AN), as well as obsessive-compulsive disorder (OCD). This study aimed to further understand ON and its overlap with related disorders by assessing the ability of ON for detecting the presence/absence of threshold ED, AN, and OCD symptoms.

**Method:** An observational survey was completed by 197 participants recruited through eating disorder, dieting, and mental health support groups. Receiver operating characteristic (ROC) curve analyses determined the predictive ability of ON symptoms (assessed by Eating Habits Questionnaire [EHQ] orthorexia nervosa [OrNe] and healthy orthorexia [HeOr] subscales, and the Orthorexia Nervosa Inventory [ONI]) for detecting disordered eating symptoms (determined by Eating Disorder Examination Questionnaire [EDE-Q] global cut-scores), probable AN (determined by EDE-Q cut-scores and body mass index [BMI] <18.5), and OCD symptoms and obsessional thinking (assessed by the Revised Obsessive-Compulsive Inventory [OCI-R]).

**Results:** Results showed both the ONI and EHQ OrNe measures are able to adequately predict ED symptoms and AN; however, both were poor to moderate at detecting OCD symptoms and obsessional thinking. Healthy orthorexia was poor to moderate at detecting outcomes.

**Discussion:** These results suggest that ON, as it is currently operationalized, may be more closely related to EDs than OCD, and that ON may represent a subtype of AN. Results also support healthy orthorexia as a distinct construct to ON. While results are limited by the lack of definitive ON diagnostic criteria, findings suggest that treatments developed for EDs might be most suited to ON.

**Public Significance:** ON has been proposed as a psychiatric disorder, and it shares theoretical overlap with several existing disorders. This study adopts a novel approach to assessing and exploring the overlap of ON with EDs, AN and OCD.

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Results suggest that ON shares more overlap with EDs and might best be understood as a subtype of EDs or AN.

**KEYWORDS**

disordered eating, healthy eating, healthy orthorexia, obsessions, obsessive-compulsive disorders, orthorexic tendencies, pathological eating

## 1 | INTRODUCTION

Orthorexia nervosa (ON) is a proposed disorder characterized by an obsessive preoccupation with “healthy” food leading to malnutrition and/or psychosocial impairment (Cena et al., 2019). ON has theoretical overlap with both anorexia nervosa (AN) and obsessive-compulsive disorder (OCD; Koven & Abry, 2015), yet might represent a distinct disorder or a subtype of existing diagnoses (Brytek-Matera, 2012). Until recently (Donini et al., 2022), there has remained a lack of consensus regarding criteria, thereby limiting ON assessment and understanding (Koven & Abry, 2015; Opitz et al., 2020; Reynolds, 2018).

Further limiting current understanding is that much of the extant literature has used the ORTO-15 (Donini et al., 2005), which has been critiqued for poor psychometrics and lacking validity (see Cena et al., 2019; Opitz et al., 2020). More recently, a distinction between ON and healthy orthorexia has been drawn, suggesting the two are related albeit distinct constructs (e.g., Barrada & Roncero, 2018; Hallit et al., 2021; Zickgraf & Barrada, 2022). Healthy Orthorexia is considered to be an interest or fixation on healthy eating that does not lead to impairment or distress, and may even be protective (Atchison & Zickgraf, 2022; Barrada & Roncero, 2018). The lack of delineation between the two constructs in most of the literature to date, especially in studies relying on the ORTO which does not assess impairment (Opitz et al., 2020), further limits what is currently known regarding ON.

Recent reviews indicate a consistent small to moderate association between ON with ED symptoms (Atchison & Zickgraf, 2022; Zagaria et al., 2022). However, debate remains as to whether ON constitutes a distinct eating disorder (ED) or a subtype of AN, while less is understood around the relationship of Healthy Orthorexia with disordered eating (Atchison & Zickgraf, 2022). ON overlaps with AN, with both characterized by restrictive diets, feelings of guilt over food transgressions (Koven & Abry, 2015), impairments in psychosocial functioning, and malnutrition (Zickgraf et al., 2019). Earlier studies using the ORTO also suggest that ON is associated with a range of characteristics typical of AN, including perfectionism, drive for thinness, and negative body evaluation (Barnes & Calabiano, 2017; Brytek-Matera et al., 2015). However, a range of studies utilizing newer measures have suggested that, while ON is associated with restraint and drive for thinness, ON also appears to diverge from AN, with mixed findings relating to weight and shape concern (Atchison & Zickgraf, 2022) and ON being only weakly correlated with body mass index (BMI; Oberle et al., 2021), despite low body weight and weight/shape

concern being key defining criteria of AN (APA, 2013). Further, eating behaviors are dissimilar between ON and AN (Zickgraf et al., 2019) with a focus on health rather than weight. All of which suggests that ON and AN may be related but distinct.

ON also shares overlap with OCD (Brytek-Matera, 2012; Dell'Osso et al., 2016), with ON characterized by obsessional thoughts (Koven & Abry, 2015) and correlated with OCD symptoms (e.g., Hallit et al., 2022; Oberle et al., 2021). To date, ON research has largely focused on behavior rather than cognitions (Gramaglia et al., 2017), and used the ORTO tools, limiting understanding of the overlap with OCD. Across different assessments of ON, the association with OCD is small (Zagaria et al., 2022) with ED symptoms predicting larger amounts of variance in ON than OCD symptoms (Strahler et al., 2018), while other studies suggest that OCD symptoms are unrelated to ON after adjustment for EDs (Łucka et al., 2019; Zickgraf et al., 2019).

Contrasts between ON and EDs, as well as theoretical overlaps with OCD remain. Recent reviews suggest that ON be understood as an ED (Atchison & Zickgraf, 2022; Zagaria et al., 2022), yet conclusions remain limited by inclusion of studies using the ORTO, high heterogeneity (Zagaria et al., 2022), and the wide use of community samples in the extant literature. Further research to better understand the overlap of ON with OCD to guide differential diagnosis is warranted, as is research exploring ON with specific ED and OCD outcomes (Zagaria et al., 2022). Additionally, further research examining domains of EDs, and that delineates ON from Healthy Orthorexia is needed (Atchison & Zickgraf, 2022).

Therefore, this study aimed to add to understanding around ON and its relationship with EDs, AN, and OCD, as well as ED and OCD domains, in a sample recruited from mental health organizations and groups, by exploring the extent to which ON shares overlap with theoretically related disorders. This was achieved by determining if ON measures could adequately detect the presence/absence of ED, AN, and OCD symptoms, where ability to detect (or not) other disorders may indicate shared commonalities and overlapping constructs, or distinction.

## 2 | METHODS

### 2.1 | Participants

Individuals aged 16+ and self-identifying as dieting and/or having mental health symptoms were eligible. Individuals 16+ were deemed able to consent, as this is the age of consent for health and medical

services in some regions (Kang & Sanders, 2014). The final sample was 197.

## 2.2 | Measures

Demographics including age, gender, education, height, and weight were collected.

### 2.2.1 | Orthorexia nervosa

The Eating Habits Questionnaire (EHQ; Gleaves et al., 2013) is a 21-item assessment of ON. Two and three-factor solutions have been proposed, producing healthy orthorexia (HeOr) and orthorexia nervosa (OrNe) measures (Hallit et al., 2021), or knowledge, feelings, and problems subscales (Zickgraf et al., 2019). The EHQ has good test-retest reliability (Gleaves et al., 2013; Opitz et al., 2020). Internal consistency was excellent ( $\alpha = .91$ ; OrNe  $\alpha = .86$ ; HeOr  $\alpha = .78$ ). The Orthorexia Nervosa Inventory (ONI; Oberle et al., 2021) is a 24-item self-report tool that was also used to assess ON. The ONI has excellent reliability (Oberle et al., 2021) and internal consistency ( $\alpha = .96$ ).

### 2.2.2 | Eating disorders

The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994, 2008) is a 28-item self-report scale. It contains four subscales—dietary restraint, and weight, shape, and eating concern. A cut-score of 4 indicates clinically significant symptoms (Lavender et al., 2010; Luce et al., 2008; Mond et al., 2008). The EDE-Q has sound psychometrics (Berg et al., 2012; Peterson et al., 2007) and excellent ability to discriminate between ED cases (Aardoom et al., 2012). Internal consistency was excellent ( $\alpha = .96$ ).

### 2.2.3 | Obsessive-compulsive disorder

The 15-item version Obsessive Compulsive Inventory-OCD (OCI-OCD) of the Revised Obsessive-Compulsive Inventory (OCI-R) (Foa et al., 2002) assessed OCD symptoms. A cut-score of 12 is proposed (Wootton et al., 2015). The measure contains subscales, including Obsessional thinking, with a cut-score of 5 (Foa et al., 2002). The OCI-OCD has good convergent and discriminant validity (Wootton et al., 2015). Internal consistency was excellent ( $a = .93$ ; obsessional thinking  $a = .90$ ).

## 2.3 | Procedure

Approval was granted by the University of New England Human Research Ethics Committee (No. HE22-071). Participants were recruited through social media sites of mental health foundations, ED

groups, OCD-support groups, dieting groups, and eating- and mental health-related support groups. Participants completed an online survey hosted by Qualtrics.

## 2.4 | Data analysis

### 2.4.1 | Classification of cases

Threshold ED symptoms were determined as EDE-Q score above clinical cut-off ( $\geq 4$ ). This cut-score was also applied to each of the subscales to classify threshold cases in each domain. Probable AN was classified as those with an EDE-Q score above cut-off and a BMI less than 18.5 (as per DSM-5 criteria for low body weight; APA, 2013; e.g., Au & Cosh, 2022). OCD and obsessional thinking were determined as scores above clinical cut-offs.

### 2.4.2 | Analyses

Receiver operating characteristic (ROC) curve analyses were conducted using SPSS v28. The area under the curve (AUC) was used to ascertain the predictive ability of the ONI and EHQ (HeOr, OrNe). AUC values were characterized as  $<.50$ – $.7$  poor,  $.7$ – $.8$  moderate,  $.8$ – $.9$  excellent, and  $>.9$  outstanding (Hosmer & Lemeshow, 2000). Secondary analyses examined ability for detecting obsessional thinking and ED domains (EDE-Q subscales), and also assessed predictive ability of the EHQ subscales and total score for all outcomes. Optimal cut-scores were determined through examination of sensitivity and specificity, with specificity and sensitivity of  $>75\%$  desirable for clinical and screening purposes (Hanley & Mcneil, 1982). The Youden Index indicates the balance of sensitivity and specificity with  $<.5$  indicating inadequate balance (Berrar, 2019). Given that ON is not a formal diagnosis and there is no validated diagnostic interview, a final determination of false positives and negatives for determining power (Kraemer, 1992) was not possible. However, there were over 10 cases for presence/absence of each diagnosis (Table 1); thus it was considered appropriate to conduct ROC analyses.

## 3 | RESULTS

A large proportion of the sample met threshold for ED and OCD (Table 1). Participant age ranged from 16 to 76 years ( $M = 34.7$ ,  $SD = 14.2$ ) and BMI ranged from 12.5 to 46.9 ( $M = 24.9$ ,  $SD = 6.48$ ).

### 3.1 | Diagnostic prediction

#### 3.1.1 | Eating disorders

The ONI had outstanding predictive ability for detecting threshold ED symptoms (AUC .915, 95% CI [.876, .654]), and prediction of the

**TABLE 1** Sample characteristics.

|                               | M (SD)      | N (%)                  |
|-------------------------------|-------------|------------------------|
| Gender                        |             |                        |
| Women                         |             | 172 (87.3)             |
| Men                           |             | 16 (8.1)               |
| Non-binary/withheld           |             | 8 (4.1)                |
| Ethnicity <sup>a</sup>        |             |                        |
| Australasia <sup>b</sup>      |             | 86 (43.7)              |
| North America                 |             | 67 (34)                |
| South America                 |             | 2 (1.0)                |
| Europe                        |             | 33 (16.8)              |
| Asia                          |             | 6 (3.0)                |
| Africa                        |             | 2 (1.0)                |
| Middle East                   |             | 1 (.01)                |
| Location                      |             |                        |
| Metropolitan                  |             | 138 (70.1)             |
| Rural                         |             | 53 (26.9)              |
| Remote                        |             | 6 (3.0)                |
| Education                     |             |                        |
| Postgraduate studies          |             | 46 (23.4)              |
| Graduate studies              |             | 73 (37.1)              |
| Vocational training           |             | 12 (6.1)               |
| High school                   |             | 58 (29.4)              |
| Did not complete high school  |             | 8 (4.1)                |
| Orthorexia                    |             |                        |
| ONI                           | 48.9 (19.4) |                        |
| EHQ-orthorexia nervosa        | 16.3 (6.13) |                        |
| EHQ-healthy orthorexia        | 18.7 (4.57) |                        |
| Disordered eating             |             |                        |
| EDE-Q global                  | 3.35 (1.67) | 90 (45.7) <sup>c</sup> |
| EDE-Q and BMI <18.5           |             | 17 (9.2) <sup>c</sup>  |
| Obsessive-compulsive disorder |             |                        |
| OCI-OCD                       | 20.5 (13.9) | 132 (67.0)             |
| Obsessional thinking subscale | 6.20 (4.00) | 121 (61.4)             |

Abbreviations: BMI, body mass index; EDE-Q, Eating Disorder Examination Questionnaire; EHQ, Eating Habits Questionnaire; ONI, Orthorexia Nervosa Inventory.

<sup>a</sup>Ethnicity was self-reported using categories as per the Australian Bureau of Statistics.

<sup>b</sup>N = 2 participants identified as of Aboriginal or Torres Strait Islander descent.

<sup>c</sup>Determined using EDE-Q global >4.

OrNE (EHQ) was excellent (AUC .885, 95% CI [.839, .930]). See [Supporting Information](#) for figures. A cut-score of 48 on the ONI achieved the best Youden Index (Table 2; see [Supporting Information](#) for all scores), while an OrNe cut-score of 17 yielded the highest Youden Index. HeOr was poor at detecting threshold EDs (AUC .658, 95% CI [.583, .734]) and no suitable cut-score was identified (see [Supporting Information](#) for EHQ subscales and total score results).

**TABLE 2** Sensitivity and specificity for predicting threshold disordered eating, probable AN, and threshold OCD symptoms.

| Disordered eating             | Threshold |               |               |               |
|-------------------------------|-----------|---------------|---------------|---------------|
|                               | ONI > 48  | EHQ OrNe > 17 | EHQ HeOr > 17 |               |
| Sensitivity                   | 80%       | 77%           | 81%           |               |
| Specificity                   | 90%       | 84%           | 46%           |               |
| Youden Index                  | .70       | .61           | .27           |               |
| PPV                           | 84.9      | 82.9          | 55.7          |               |
| NPV                           | 84.7      | 77.7          | 74.2          |               |
| Probable anorexia nervosa     | ONI > 53  | ONI > 60      | EHQ OrNe > 21 | EHQ HeOr > 20 |
|                               | Threshold |               |               |               |
| Sensitivity                   | 100%      | 88%           | 88%           | 94%           |
| Specificity                   | 70%       | 80%           | 76%           | 57%           |
| Youden Index                  | .70       | .68           | .64           | .51           |
| PPV                           | 25.4      | 30.6          | 26.8          | 18.0          |
| NPV                           | 100       | 98.5          | 98.4          | 99.0          |
| Obsessive-compulsive disorder | Threshold |               |               |               |
|                               | ONI > 41  | EHQ OrNe > 17 | EHQ HeOr > 21 |               |
| Sensitivity                   | 72%       | 71%           | 42%           |               |
| Specificity                   | 77%       | 72%           | 68%           |               |
| Youden Index                  | .49       | .47           | .11           |               |
| PPV                           | 86.4      | 92.1          | 74.7          |               |
| NPV                           | 57.5      | 48.8          | 37.7          |               |

Abbreviations: EHQ, Eating Habits Questionnaire; HeOr, healthy orthorexia; NPV, negative predictive value; ONI, Orthorexia Nervosa Inventory; OrNe, orthorexia nervosa; PPV, positive predictive value.

The ONI showed exceptional ability for detecting probable AN (AUC .907, 95% CI [.859, .957]) and OrNe was excellent (AUC .861, 95% CI [.787, .935]). An ONI score of 53 had the highest Youden Index; however, specificity remained low (<75%), whereas 60 achieved sensitivity and specificity >75% (Table 2). An OrNe score of 21 produced the best Youden Index and met 75% thresholds. HeOr was moderate for detecting probable AN (AUC .737, 95% CI [.654, .820]). A score of 20 produced the best Youden Index, but specificity was low.

Sensitivity analyses for the EDE-Q subscales showed excellent AUCs for both the ONI and OrNe, with excellent ability to detect threshold dietary restraint, weight concern, and shape concern. HeOr was moderate at detecting dietary restraint, but poor across other domains (see [Supporting Information](#)).

### 3.1.2 | Obsessive-compulsive disorder

The ONI and OrNe were moderate at predicting OCD (AUC .767, 95% CI [.699, .835]; AUC .777, 95% CI [.711, .844]). HeOr was no better than chance (AUC .558, 95% CI [.478, .638]). All Youden Index

scores across measures were  $<.5$ . Detection of obsessional thinking followed a similar pattern (see [Supporting Information](#)).

## 4 | DISCUSSION

This study contributes to understanding ON and the extent to which it shares overlaps with other theoretically related disorders. Assessment of symptoms of ON was able to discriminate between both threshold ED symptoms and probable AN, and non-cases, suggesting a strong relationship, whereas ability of ON measures to detect OCD symptoms and obsessional thinking was poor to moderate. These findings suggest that ON may have more overlap with EDs, in line with prior correlational research (Łucka et al., 2019; Zagaria et al., 2022; Zickgraf et al., 2019), lending support for the understanding of ON as an ED. ON measures were excellent at detecting dietary restraint, and weight and shape concern, further suggesting overlap with AN and adding to the mixed literature regarding ON and weight/shape concerns to date (Atchison & Zickgraf, 2022).

The ability for ON measures to detect OCD and obsessional thinking was within the recommended range for health research (Youngstrom, 2014), suggesting some overlap. This might reflect (a) that ON measures were detecting presence/absence of distress, (b) the high rates of comorbidity between EDs and OCD (Altman & Shankman, 2009), or (c) the presence of shared traits between EDs and OCD (e.g., Naylor et al., 2011; Swinbourne & Touyz, 2007). Sensitivity and specificity were limited for detecting OCD and obsessional thinking. Taken together, results are in line with previous suggestions that ON and OCD are distinct (Brytek-Matera, 2012; Koven & Abry, 2015). Findings also raise some questions over obsessional thinking as the defining characteristic of ON (Strahler & Stark, 2020). Conversely, this finding may reflect limitations in the understanding of obsessional thinking in ON, or that OCD measures do not assess “healthy eating” obsessions.

While findings may reflect measurement tools used, results were similar across assessments indicating that ON, as it is currently operationalized and defined, aligns with EDs and AN more than with OCD. Both measures performed adequately for detecting distress and overlapping symptoms; however, there remains a need for further research comparing ON assessment tools (e.g., Hallit et al., 2021) to guide future research and understanding. Notably, measures of ON were better at detecting disordered eating outcomes and OCD symptoms than were measures of Healthy orthorexia (with the problems subscale of the three-factor structure of the EHQ, which reflects orthorexia distress [Zickgraf et al., 2019], also better at detecting disordered eating outcomes than other two subscales), further supporting that ON and healthy orthorexia appear to be distinct (Zickgraf & Barrada, 2022). The current results are also largely consistent with suggestions that healthy orthorexia is not related to ED symptoms (Atchison & Zickgraf, 2022), or clinical impairment (Zickgraf & Barrada, 2022). However, healthy orthorexia was moderate at detecting probable AN. Thus, while healthy orthorexia is viewed as non-pathological (Barrada & Roncero, 2018), results suggest some possible overlap with AN, which appears related to dietary restraint. This result somewhat contrasts suggestions that

healthy orthorexia may be protective (Atchison & Zickgraf, 2022), highlighting the need for continued investigation.

### 4.1 | Strengths and limitations

Limitations of the current study include the use of screening tools to determine the presence/absence of disorders, although these have been used previously in a number of studies to assess diagnostic prediction (e.g., Dennis et al., 2013; Evans et al., 2021; Hare & Davis, 1996; Means-Christensen et al., 2005; Snijkers et al., 2021; Yu et al., 2019). Assessment of ON is limited by the lack of formal diagnostic criteria, limiting the ability to definitively determine ON (and adequately assess power). Furthermore, probable diagnoses relied on self-report measures and thresholds, thus limiting ability to assess impact on functioning. Determination of probable AN through thresholds and low self-reported BMI may overestimate cases. Further, there was a disproportionate number of women, which may reflect that EDs are more prevalent among women. While the non-clinical sample is a limitation, the recruitment was from mental health and eating forums may extend findings from community samples. We were not able to determine which sites participants were recruited from, and this may limit generalizability to community or clinical samples. Participants were predominantly from Australasia, Europe, and North America. Further exploration among diverse and representative samples is warranted.

## 5 | CONCLUSION

The current study found that ON, as it is currently conceptualized and assessed, can distinguish between the presence of threshold EDs and AN and non-cases, more so than OCD and obsessional thinking, indicating a stronger association with EDs than OCD; thus, suggesting that ON may better be understood as a subset or subtype of EDs. Individuals presenting with ON would likely benefit from ED treatment versus treatment for OCD.

### AUTHOR CONTRIBUTIONS

**Suzanne M. Cosh:** Conceptualization; data curation; formal analysis; methodology; supervision; writing – review and editing. **Jemma Olson:** Investigation; project administration; writing – original draft. **Phillip J. Tully:** Conceptualization; writing – review and editing.

### ACKNOWLEDGMENT

Open access publishing facilitated by University of New England, as part of the Wiley - University of New England agreement via the Council of Australian University Librarians.

### FUNDING INFORMATION

The authors received no funding or financial support for this study.

### CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.



## DATA AVAILABILITY STATEMENT

The data are available from the authors upon request.

## ETHICS STATEMENT

The study received ethics approval from the University of New England's Human Research Ethics Committee (approval no. HE22-071).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Cosh, S. M., Olson, J., & Tully, P. J. (2023). Exploration of orthorexia nervosa and diagnostic overlap with eating disorders, anorexia nervosa and obsessive-compulsive disorder. *International Journal of Eating Disorders*, 56(11), 2155–2161. <https://doi.org/10.1002/eat.24051>