



Classification of Orthorexia Nervosa: Further evidence for placement within the eating disorders spectrum[☆]

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ABSTRACT

Purpose: Orthorexia Nervosa (ON) may belong on the eating disorder (ED) or obsessive-compulsive (OC) spectrum. We sought to provide additional evidence regarding the working classification of ON as an ED.

Methods: 512 individuals completed a measure of ON symptoms (rBOT), ED symptoms (Eating Disorder Examination Questionnaire), OC symptoms (Obsessive-Compulsive Inventory Revised), food choice motives (Food Choice Questionnaire), and perfectionism (Multidimensional Perfectionism Scale).

Results: ON symptoms were more strongly linked to ED symptoms than to OC symptoms. ON symptoms were related to body weight and shape concerns, and with prioritizing weight above health with respect to food selection. Both ED and ON symptoms were moderately related to perfectionism, while OC symptoms were strongly related to perfectionism.

Conclusion: Our results support ON being classified on the ED spectrum; however, whether ON represents a precursor to an ED, an ED with added health concerns, or a disorder that evolves from an ED is not certain. Future longitudinal research is necessary to test these alternate possibilities.

1. Introduction

Originally proposed in the late 1990s (Bratman, 1997), the concept of orthorexia nervosa (ON) is increasingly studied. Although not currently recognized as a mental disorder, diagnostic criteria for ON are proposed (Barthels, 2014; Dunn & Bratman, 2016; Varga, Dukay-Szabó, Túry, & van Furth Eric, 2013). While these diagnostic criteria differ slightly across proposals, experts agree ON involves marked over-concern with “healthy” eating, wherein affected individuals adhere to strict food rules (Barthels, 2014; Dunn & Bratman, 2016; Varga et al., 2013). Individuals with ON are thought to demonstrate obsessions and/or compulsions regarding quality of food and health, as well as concerns with “healthy” eating that dominate their lives and become clinically impairing (Barthels, 2014; Dunn & Bratman, 2016; Varga et al., 2013). Proposed diagnostic criteria also highlight that these individuals are 1) not concerned with the quantity of food, do not have disordered body image, and lack a desire to lose weight (Dunn & Bratman, 2016; Varga et al., 2013) or 2) intend to lose weight, but body shape and weight concerns are not the overarching symptom (Barthels, 2014).

Authors are attempting to establish where the proposed condition may fit within existing diagnostic systems. Research and theory to date have highlighted a significant overlap between ON and disorders on the eating disorders (ED) and obsessive-compulsive (OC) spectra (see Koven & Abry, 2015 for a review). Currently, the literature appears to treat ON as a disorder on the ED spectrum that is closely linked to OC symptoms, rather than a disorder on the OC spectrum (e.g. Brytek-Matera, 2012); however, research is only in nascent stages regarding whether ON is best conceptualized on the ED or OC spectrum.

Research has shown ED symptoms predict notably larger amounts of variance in ON than do OC symptoms (Strahler, Hermann, Walter, & Stark, 2018); however, such work neglects to account for the overlap between OC and ED symptoms. A recent study suggests that after controlling for ED symptoms, ON is no longer positively correlated with OC (Zickgraf, Ellis, & Essayli, 2019). As such, it is possible that after accounting for ED symptoms within a regression, OC symptoms will not predict significant variance in ON. Our aim was to investigate this possibility, as it extends and clarifies the work of both Strahler et al. (2018) and Zickgraf et al. (2019).

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We also examined the motivations behind food choice in ON. While the theorized hallmark of ON is selecting food solely based on health (i.e. rather than factors such as weight control or price), an existing study on food choice motives found that contrary to the proposed diagnostic criteria for ON, the strongest motivator of food choice in ON was weight control (Depa, Barrada, & Roncero, 2019). The authors therefore suggested ON is a “camouflaged” ED (Depa et al., 2019, p. 707); however, they did not include a measure of ED symptoms in their study. By examining the association of ON symptoms with food choice motives and comparing this to the association of ED symptoms with food choice motives, our extension examined the suggestion by Depa et al. (2019) that ON may be a “camouflaged” ED, as well as provided further evidence regarding the classification of ON.

In addition, we examined the association between ON and perfectionism, a trait that has been posited as an important etiological factor in ED and OC disorders (Altman & Shankman, 2009). Although perfectionism has been demonstrated to be correlated with ON (Barnes & Caltabiano, 2017), no studies to date have compared the correlation of ON, ED, and OC symptomatology with perfectionism to determine whether the correlation between ON and perfectionism more closely resembles OC or ED relations with perfectionism. Examining the strength and nature of the association between these symptoms may shed further light on whether ON is more similar to the ED or OC spectra.

Finally, we sought to study ON with a new measure, the Revised Bratman's Orthorexia Test (rBOT; Haeberle-Savard, 2015). The rBOT is a slight variation of a recommended measure of ON,¹ Bratman's Orthorexia Test (BOT; Bratman & Knight, 2000; Meule et al., 2020). While the vast majority of studies use the ORTO-15 (Donini, Marsili, Graziani, Imbriale, & Cannella, 2005) to measure ON, the psychometrics of the ORTO-15 have been questioned (e.g., Roncero, Barrada, & Perpiñá, 2017). As such, we cannot be confident in the results of studies relying on the ORTO-15 alone.

Our hypotheses were as follows (a) ON would be positively correlated with perfectionism, OC and ED symptoms; (b) both OC and ED symptoms would account for variance in ON, but only ED symptoms and not OC symptoms would account for significant incremental variance in ON symptoms once the other (OC symptoms or ED symptoms, respectively) was taken into account; (c) perfectionism would be more strongly correlated with OC symptoms than with ED or ON symptoms; and (d) both ON and ED symptoms, but not OC symptoms, would be positively correlated with selecting food for weight control reasons.

2. Methods

Five-hundred-and-twelve participants (423 females; mean age = 24.5, range = 17.5–60.5) were recruited through social media, an undergraduate psychology pool, and the general student body of a university in Western Canada using advertisements about a study on overzealous healthy eating. Measures were completed online using a cross-sectional design.

2.1. Measures

2.1.1. Demographic questionnaire

This questionnaire consisted of items asking about variables such as age and sex.

¹ The rBOT includes 8 of the 10 items from the BOT, removing item 6 (“Does your self-esteem get a boost from eating healthily?”) and item 10 (“Do you feel at peace with yourself and in total control when you eat healthily?”). It also expands the wording to clarify the meaning of the questions (e.g. “Have you become stricter with yourself lately?” is changed to “Have you become stricter with yourself lately in regard to your ideal eating habits?”). The rBOT is answered on a scale of 0 (“Not at all”), 1 (“Somewhat”), or 2 (“Very much”), while the BOT is answered yes or no.

2.1.2. rBOT

The Revised Bratman's Orthorexia Test (rBOT; Haeberle-Savard, 2015) is an eight-item modified version of the BOT (Bratman & Knight, 2000). Scores are summed with a possible range of 0–16. The rBOT has good internal consistency ($\alpha = 0.85$) and convergent validity (Haeberle-Savard, 2015). The rBOT appears to tap into the proposed diagnostic criteria of ON (i.e., marked over concern with healthy eating that escalates over time, stricter rules regarding quality of food and health, experiencing negative emotions if food rules are violated, and experiencing distress or impairment).

2.1.3. ORTO-15

The ORTO-15 (Donini et al., 2005) is a 15-item measure of ON. Reliability for this scale ranges from very low to acceptable ($\alpha = 0.23$ –0.79; Roncero et al., 2017; Segura-García et al., 2012). As described below, due to low internal consistency in the current study, the ORTO-15 was not used in our analyses.

2.1.4. OCI-R

The Obsessive-Compulsive Inventory Revised (OCI-R; Foa et al., 2002) is an 18-item measure of OC symptoms. The OCI-R provides a total score and six subscales. The OCI-R total scale and subscales have adequate internal consistency and test-retest reliability, and the OCI-R total scale has adequate convergent and discriminant validity (Foa et al., 2002; Wootton et al., 2015).

2.1.5. EDE-Q

The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a 28-item self-report version of the Eating Disorder Examination interview (Fairburn, Cooper, & O'Connor, 2008). The EDE-Q provides a global score, as well as four subscales. The EDE-Q has adequate internal consistency, convergent validity, and construct validity (Berg, Peterson, Frazier, & Crow, 2012).

2.1.6. FMPS

Frost's Multidimensional Perfectionism Scale (FMPS; Frost, Marten, Lahart, & Rosenblate, 1990) is a 35-item measure of perfectionism. The scale provides an overall perfectionism score, as well as scores on six subscales. The FMPS has good convergent validity and internal consistency ($\alpha = 0.90$) (Frost et al., 1990).

2.1.7. FCQ

The Food Choice Questionnaire (FCQ; Steptoe, Pollard, & Wardle, 1995) is a 36-item self-report measure of motives for food choice. Nine motives are examined. The FCQ has satisfactory subscale internal consistency ($\alpha = 0.72$ –0.86), test-retest reliability, and construct validity (Markovina et al., 2015; Steptoe et al., 1995).

3. Results

3.1. Descriptive statistics

Descriptive statistics, bivariate correlations and Cronbach's alphas values, appear in Table 1. All scales and subscales had adequate internal consistency, with the exception of the ORTO-15 ($\alpha = 0.38$). Due to this poor reliability, we chose not to include the ORTO-15 in our analyses. Females and males scored similarly on the rBOT (Female M (SD) = 5.62(3.79); Male M (SD) = 5.32(3.60). In terms of norms, BMI in our sample ranged from underweight (13.97) to obese (49.92), with the mean (23.77) in the normal weight range. The average EDE-Q total and subscale scores fell within the 55th–75th percentiles for young adult women (Fairburn & Beglin, 1994; Quick & Byrd-Bredbenner, 2013). Thirty-four percent of our participants had OCI-R scores over the clinical cut-off of 21 (Foa et al., 2002). Norms do not exist for the rBOT.

Table 1
Means, standard deviations, and bivariate correlations between the rBOT, demographic variables, the EDE-Q and OCI-R.

Variable	M	SD	α	rBOT	EDE-Q total	OCI-R total
rBOT	5.58	3.76	0.83	1	0.63**	0.27**
BMI	23.77	4.88	–	0.16**	0.28**	0.05
Age (months)	293.80	81.93	–	–0.04	–0.06	–0.13**
EDE-Q						
Total	1.95	1.96	0.91	0.63**	–	0.34**
Weight concern	2.20	1.60	0.82	0.51**	0.92**	0.39**
Shape concern	2.58	1.69	0.87	0.55**	0.93**	0.34**
Eating concern	1.35	1.35	0.84	0.57**	0.88**	0.34**
Restraint	1.69	1.43	0.74	0.63**	0.78**	0.21**
OCI-R						
Total	18.27	12.98	0.91	0.27**	0.34**	–
Washing	2.04	2.74	0.81	0.15**	0.18**	0.67**
Obsessing	3.58	3.29	0.85	0.20**	0.28**	0.74**
Hoarding	3.55	2.87	0.76	0.19**	0.25**	0.68**
Ordering	4.20	3.22	0.88	0.21**	0.26**	0.77**
Checking	3.05	2.68	0.76	0.25**	0.26**	0.79**
Neutralizing	1.95	2.42	0.68	0.23**	0.23**	0.68**
FCQ health	18.45	3.65	0.84	0.29**	0.09*	0.04
FCQ sensory appeal	11.25	2.51	0.71	–0.13**	0.02	0.14**
FCQ natural content	7.50	2.47	0.85	0.27**	0.06	0.12**
FCQ mood	14.94	4.00	0.82	0.11*	0.15**	0.31**
FCQ convenience	13.82	3.16	0.78	0.01	0.14**	0.17**
FCQ price	8.42	2.24	0.81	–0.05	0.06	0.09*
FCQ weight control	7.43	2.31	0.75	0.50**	0.56**	0.23**
FCQ familiarity	6.32	2.10	0.73	0.02	0.12**	0.24**
FCQ ethics	5.65	2.18	0.74	0.05	0.05	0.17**
FMPS						
Total	83.32	21.61	0.94	0.24**	0.35**	0.45**
Concern over mistakes	25.34	8.75	0.93	0.25**	0.42**	0.39**
Doubts about actions	10.97	4.01	0.83	0.26**	0.33**	0.46**
Personal standards	24.39	6.11	0.88	0.22**	0.30**	0.27**
Parental expectations	14.06	4.84	0.85	0.04	0.12**	0.30**
Parental criticism	8.72	4.06	0.85	0.07	0.20**	0.34**

Notes: rBOT = Revised Bratman's Orthorexia Test; BMI = body mass index; OCI-R = Obsessive-Compulsive Inventory Revised; EDE-Q = Eating Disorder Examination Questionnaire; FCQ = Food Choice Questionnaire; FMPS = Multidimensional Perfectionism Scale.

* $p < .05$.
** $p < .01$.

3.2. Bivariate correlations

As the majority of variables were skewed, we computed Spearman's Rank Order correlations. In accordance with Cohen (1988), $r = 0.1$, $r = 0.3$, and $r = 0.5$, were considered small, medium, and large effects, respectively. Like ED symptoms and unlike OC symptoms, ON was positively correlated with BMI (small effect) and unrelated to age. As hypothesized, ON was significantly positively correlated with EDE-Q (large effects) and OCI-R total scales (medium effects). Given the findings of Zickgraf et al. (2019), we also examined the partial Spearman's correlations between ON and the OCI-R after controlling for the EDE-Q (see Table 2). Controlling for ED symptoms reduced ON to OCI-R correlations to small or absent effects. ON was associated with the FCQ subscales of Health and Natural Content (medium effects), Mood (small effect), and Weight Control (large effect), but not with the FCQ subscales of Price, Convenience, Familiarity, or Ethics. ON was negatively correlated with the FCQ subscale of Sensory Appeal (small effect). Software developed by Lee and Preacher (2013) was used to compare the strength of correlations. This software transforms correlation coefficients into a z-score and then uses Steiger's (1980) equations to ascertain equality (Lee & Preacher, 2013). Results indicated the rBOT was more strongly correlated with the Weight Control FCQ subscale than the Health and Natural Content FCQ subscales ($p < .01$).

ON was correlated with total FMPS scores (small effect) and all

Table 2
Partial r controlling for EDE-Q scores.

OCI-R	rBOT
Total	0.08
Washing	0.06
Obsessing	0.05
Hoarding	0.05
Ordering	0.08
Checking	0.11*
Neutralizing	0.12*

Notes: rBOT = Revised Bratman's Orthorexia Test; OCI-R = Obsessive-Compulsive Inventory Revised.

* $p < .05$.

subscales (small-medium effects), except for Parental Criticism and Parental Expectations. Both the OCI-R and EDE-Q total scores were correlated with total FMPS scores and all subscales (small-medium effects). The correlation of the FMPS total score with the rBOT (medium effect), EDE-Q (medium effect), and OCI-R (large effect) total scores were also compared (Lee & Preacher, 2013). The correlations of the FMPS total score with the OCI-R and EDE-Q were significantly greater in magnitude than the correlations of the FMPS total score with rBOT ($p < .05$). Similarly, the correlation of the FMPS total score with the OCI-R was significantly greater in magnitude than the correlation of the FMPS total score with the EDE-Q ($p < .01$).

3.3. Hierarchical regression analyses

All model accuracy statistics and assumption values fell within the acceptable ranges. No univariate outliers were detected. Mahalanobis distance values indicated four participants were multivariate outliers and these participants were removed from the linear regressions. As BMI was significantly correlated with ON, it was controlled for in the analyses.

As expected, ED symptoms explained significant variance in ON beyond BMI (see Table 3, R^2 values of step 2). OC symptoms explained significant, but notably less variance in ON beyond BMI (see Table 4, R^2 values of step 2). OC symptoms did not explain notable variance beyond BMI and ED symptoms in the rBOT (see Table 3, R^2 values of step 3), but ED symptoms did explain substantial variance beyond BMI and OC symptoms in the rBOT (see Table 4, R^2 values of step 3).

4. Discussion

As hypothesized, ON was moderately correlated with overall OC symptoms as well as mildly to moderately correlated with the various

Table 3
Association between OCI-R scores and ON controlling for BMI and EDE-Q scores.

Variables	rBOT <i>N</i> = 479	
	R^2	β
Step 1	0.01**	
BMI		0.16**
Step 2	0.41**	
EDE-Q total		0.65**
Step 3	0.41**	
OCI-R total		0.07*

Notes: BMI = body mass index; rBOT = Revised Bratman's Orthorexia Test; OCI-R = Obsessive-Compulsive Inventory Revised; EDE-Q = Eating Disorder Examination Questionnaire.

* $p < .05$.
** $p < .01$.

Table 4
Association between EDE-Q scores and ON controlling for BMI and OCI-R scores.

Variables	rBOT N = 479	β
	R ²	
Step 1	0.01*	
BMI		0.13**
Step 2	0.09**	
OCI-R total		0.28**
Step 3	0.41**	
EDE-Q Total		0.63*

Notes: BMI = body mass index; rBOT = Revised Bratman's Orthorexia Test; OCI-R = Obsessive-Compulsive Inventory Revised; EDE-Q = Eating Disorder Examination Questionnaire.

* $p < .05$.

** $p < .01$.

characteristics of OC disorders (e.g. checking); however, when controlling for ED symptoms, the association between ON and OC symptoms was notably smaller or absent. Thus, while it appears OC tendencies extend beyond food and into the lives of individuals with ON symptomatology, this may largely be a reflection of the overlap of symptoms and high rates of comorbidity between ED and OC disorders rather than an indication that ON belongs on the OC spectrum (Altman & Shankman, 2009).

ON was strongly associated with total and subscale EDE-Q scores, indicating ON symptoms are associated with dissatisfaction and preoccupation with shape and weight, and with actively attempting to control and influence weight through dietary choices. Thus, ON may not represent purely a concern with quality of food, but also with quantity of food, and body size/shape. While this contradicts the majority of proposed diagnostic criteria for ON (e.g. Varga et al., 2013), it aligns with extant research (e.g. Brytek-Matera, Donini, Krupa, Poggiogalle, & Hay, 2015; Eriksson, Baigi, Marklund, & Lindgren, 2008). Furthermore, it aligns with our replication of Depa et al. (2019) showing the strongest food choice motive associated with ON symptoms was weight control. The strength of this association was similar for ON and ED symptoms indicating that, in both cases, the predominant motive for choosing food relates to the impact of food on weight.

The associations between ON and concerns about weight control, quantity of food, body size/shape may represent several different processes. First, these associations may be driven by health-related motives. Given that BMI was positively correlated with ON symptoms and that being overweight is associated with deleterious health effects (Guh et al., 2009), ON individuals may be concerned with food quantity and body size/shape for purely health-related reasons. However, as Depa et al. (2019) found pathological, but not non-pathological, "healthy eating" was associated with the weight control motive, it is unlikely that the associations between ON symptoms and weight and body shape/size concerns merely reflect an adaptive concern for the health consequences of being overweight. Second, the rBOT may not be correctly tapping into the construct of ON. While the rBOT appears to include questions capturing almost all aspects of the proposed diagnostic criteria for ON, it may rather be capturing a population of non-pathological "healthy eaters" who are concerned with eating and body image (Dunn, Gibbs, Whitney, & Starosta, 2017). Third, it may be that aspects of the conceptualization of ON are incorrect, and ON individuals do have concerns typically associated with EDs that dominate the syndrome.

This third option suggests two possibilities: (a) ON may represent a precursor to EDs whereby individuals begin focusing only on the quality of food and then transition to focusing on the quantity of food or ON may represent morphing of ED symptoms, whereby in-recovery ED patients shift their focus from the quantity of food to the quality of food

(Segura-García, Ramacciotti, Rania, Aloï, Caroleo et al., 2015). In this way, ON may be a "subthreshold" ED; or (b) ON may represent a typical ED with an added element of health-related concerns. This latter option aligns with our results that ON symptoms, but not ED symptoms, are related to choosing food for health-related and natural content reasons. As individuals with ON symptoms value health, and it is likely more socially acceptable to identify as a "healthy eater" than someone with an "ED", they may choose to solely cite the desire to be healthy as the reason for their restrictive diets. As such, ON may be a "camouflaged" ED (Depa et al., 2019, p. 707) that may exist as a distinct ED, or a typical ED with additional symptoms.

Our perfectionism results provide further evidence that ON may belong on the ED spectrum. ON and ED symptoms had a significantly smaller association with overall perfectionism (small-medium effects) than did OC symptoms (large effect). Moreover, ON and ED symptoms appear to share a more similar relationships with subscales of perfectionism than do ON and OC symptoms. Together, this suggests that the association between perfectionism and ON symptoms may be more similar to ED symptoms than OC symptoms. Despite this, both ED and OC symptoms shared some important differences from ON symptoms in regard to perfectionism. First, ED and OC symptoms were more strongly correlated with perfectionism than were ON symptoms. Second, while ED and OC symptoms were correlated with all subscales of perfectionism (small to medium effects), ON symptoms were not correlated with Parental Expectations and Parental Criticism. Ultimately, this raises the possibilities that ON may not be as strongly linked with perceived high parental standards, and perfectionism may not be as important for the etiology of ON as it is for both ED and OC disorders (Altman & Shankman, 2009).

Finally, this research also adds to the mounting evidence against the psychometrics of the ORTO-15. Much like others (e.g., Roncero et al., 2017), we found that the ORTO-15 to have poor psychometric properties. This adds further evidence that other emerging measures of ON, such as the rBOT, should be used in place of the ORTO-15 or its variants. The Düsseldorf Orthorexia Scale (Chard, Hilzendegen, Barthels, & Stroebel-Benschop, 2019), the Eating Habits Questionnaire (Gleaves, Graham, & Ambwani, 2013), or the Orthorexia Nervosa Inventory (Oberle, De Nadai, & Madrid, 2020) also appear to be promising measures of ON.

4.1. Limitations and future directions

Our results are limited by our sample; it is possible that the relationships between ON, ED, and OC symptoms may look different in a clinical population. This research is also limited by the use of the rBOT, as it is unclear whether the symptoms we are measuring result in significant levels of distress or impairment necessary for categorization of a mental disorder (see Strahler et al., 2018). Future research may consider using the recently published Orthorexia Nervosa Inventory (Oberle et al., 2020), which includes items aimed at delineating non-pathological health eating behaviors from pathological ON behaviors.

Research should investigate the motivation behind our findings that ON symptoms are associated with selecting food for weight control reasons to ascertain whether they are driven by health and/or appearance reasons. Additionally, research should investigate personality vulnerabilities for ON to better understand its etiology. Moreover, before firmly classifying ON within our diagnostic system, it is important to examine the association between ON and other theoretically similar disorders (e.g., illness anxiety disorder; see Koven & Abry, 2015).

5. Conclusions

We found ON symptoms are more strongly related to ED symptoms than to OC symptoms. Our results add to the growing number of studies directly challenging the idea that ON does not include body image disturbances or concerns about the quantity of food (Brytek-Matera

et al., 2015). In fact, our study indicates individuals with ON symptoms appear to prioritize choosing food for weight control reasons, above health reasons. Ultimately, our study adds further credence to the idea of ON being conceptualized along the ED spectrum.

CRedit authorship contribution statement

S. Bartel: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing. **S.B. Sherry:** Supervision, Writing - review & editing. **G.R. Farthing:** Conceptualization, Methodology, Investigation, Supervision, Writing - review & editing. **S.H. Stewart:** Supervision, Writing - review & editing.

Declaration of competing interest

None.

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