



On orthorexia nervosa: A review of the literature and proposed diagnostic criteria



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ABSTRACT

There has been a growing interest among clinicians and researchers about a condition where people restrict their diet based not on quantity of food they consume, but based on its quality. Bratman (1997) coined the term “orthorexia nervosa” to describe people whose extreme diets – intended for health reasons – are in fact leading to malnutrition and/or impairment of daily functioning. There has also recently been intense media interest in people whose highly restrictive “healthy” diet leads to disordered eating. Despite this condition being first described in the U.S., and receiving recent media interest here, orthorexia has largely gone unnoticed in the North American literature. This review article details the literature of orthorexia nervosa, describing its emergence as a condition first described by a physician in a yoga magazine, to its being discussed in the scientific literature. It also reviews prevalence studies and discusses marked shortcomings in the literature. Finally, diagnostic criteria are proposed, as are future directions for research.

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1. Introduction

Concerns about individuals who engage in pathologically healthful eating have been of interest in recent years, primarily to European researchers and clinicians. While a review (Vandereycken, 2011) of

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Dutch speaking eating disorder specialists ($n = 111$) reports that most are aware of the condition “orthorexia nervosa” (ON), peer-reviewed scholarship regarding this topic has largely been absent in the U.S. literature, with only a single article on the topic appearing in a refereed, North American journal (Moroze, Dunn, Holland, Yager, & Weintraub, 2015). The public’s awareness of this condition began changing in the summer of 2014. This is when a young woman in New York named Jordan Younger, author of a highly successful blog called “The Blonde Vegan,” surprised her 70,000 Instagram followers by admitting that she suffered from an eating disorder that was not based on the quantity of her food intake, but its quality (Pfeffer, 2014). Younger reported that her drive for healthy eating had become pathological and resulted in malnutrition. Major media outlets reported her plight and she was interviewed on programs like ABC News’ Good Morning America and Nightline programs (J. Younger, personal communication, April 9, 2015) inspiring a flurry of other media coverage, such as articles in the *Wall Street Journal* and *Popular Science* (Reddy, 2014; Schwartz, 2015). It is remarkable that this kind of media coverage has been generated for a condition not recognized by the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-5) and not well understood. The purpose of this paper is to review the literature of ON and discuss diagnostic criteria.

2. Review of the literature

2.1. Method

The key words “orthorexia,” “orthorexia nervosa,” “pathologically healthy eating” and “disordered healthy eating” were searched in the databases Academic Search, Biological Abstracts, Google Scholar, MEDLINE/PubMed, and PsychINFO. From these results, articles appearing in peer-reviewed journals, books, and book chapters were reviewed. Except for Bratman’s (1997) original article, we excluded articles that were commentary only, review articles that merely discuss the literature, and items that were unavailable using interlibrary loan/document delivery request through an academic library. Works that were published in a language other than English ($n = 3$) were translated via Google Translate.¹

2.2. Background

ON was first described by physician Steven Bratman in 1997, in an article in *Yoga Journal*. To describe what he saw as a pathological obsession with healthful eating, he coined the term “orthorexia nervosa,” from the Greek “ortho” meaning “straight or “correct,” and “orexi,” meaning appetite. He would later more fully detail the condition in a book (Bratman & Knight, 2000). Other than a review of this book in *JAMA* (Fugh-Berman, 2001) that encourages the term orthorexia nervosa entering the “medical lexicon,” the first article appearing in a peer-reviewed journal was a 2004 Italian study that described ON as a “maniacal obsession” in the pursuit of healthy foods (Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). This seminal paper would give credibility to the condition and the term used to describe it, marking the transition of ON from informal musing into a concept worthy of scientific exploration.

2.3. Case studies

Case studies have long been the mechanism to permit potentially new medical conditions to be introduced into the scientific literature (Vandenbroucke, 1999). Case studies often help drive early attempts at evidence-based treatment and other best practices (Cabán-Martínez &

García-Beltrán, 2012; Edwards, Dattilio, & Bromley, 2004). Soon after the Donini et al. (2004) article appeared, case studies detailing individuals thought to have ON started circulating in the literature. The cases below are important as each describes pathological eating driven by a desire not for thinness, but to have a diet perceived to promote good health. In each case, the authors argue that the patient they describe suffers from ON.

Zamora, Bonaecha, Sánchez, and Rial (2005) thoughtfully describe the case of a 28-year-old woman with severe malnutrition, marked hypoproteinemia, and vitamin B₁₂ deficit, with a Body Mass Index (BMI) of 10.7. At age 14 she was reportedly told by a nutritionist to eliminate fats from her diet to help control severe acne that was refractory to traditional treatments. At age 16, she progressively restricted the types of food she ate to an extreme “lacto-ovo-vegetarian” diet. By age 24, she had eliminated eggs and milk products. By the time of her presentation to the Zamora group, the patient’s weight dropped to 27 kg after isolating herself from friends and family and eating only uncooked vegetables. Zamora et al. (2005) report that the patient had no typical anorexia behaviors: she did not report a desire to be thin, nor did she have distorted body image. She simply believed that different types of proteins or nutrients in the same meal produced toxins and were to be avoided.

Park et al. (2011) recount the case of a 30-year-old male who, in a sole effort to treat a tic disorder, restricted his diet to only 3–4 spoons of brown rice and fresh, unsalted vegetables. After three months, he became “bedridden.” His extreme dietary restriction resulted in severe medical consequences, resulting in a 38-day hospital stay to treat metabolic acidosis, subcutaneous emphysema, pneumothorax and pancytopenia. They do not report that he had self-perceived body image disturbance, nor concerns of being overweight.

Saddichha, Babu, and Chandra (2012) report a 33-year-old woman with an eight year history of maintaining an exclusive diet of only fresh fruits, raw vegetables, and uncooked eggs. The patient did not report concerns about her body type or weight, but reportedly became obsessed about healthful eating. She reportedly was worried that cooking foods would ruin their nutritional qualities. During this time, she reportedly cut ties with her friends and family and developed a BMI of 14.5 requiring medical intervention. Saddichha et al. (2012) conceptualize this case as ON being a prodrome to developing schizophrenia. They note that the patient had ON symptoms for seven years before showing signs of a first time psychotic break. Her psychosis reportedly had nothing to do with food, but concerned paranoid and bizarre ideas about her family. These authors note other cases of eating disorders preceding schizophrenia and argue that the ON was a distinct process not better accounted for by psychotic illness.

Finally, Moroze et al. (2015) discuss a 28-year-old male with three years of reduced nutritional intake, limited to self-made “protein shakes” that included only pure amino powders. He stated that he avoided commercial shakes, as they had unnecessary fillers. This restriction resulted in severe malnutrition, he presented with a BMI of 12.3, weighing 43.5 kg (50% of his ideal body weight). While this patient initially started restricting his diet in response to an episode of constipation, over the period of years, his beliefs reportedly turned to eating food based on its purity. At the time of his treatment, Moroze et al. (2015) note that the patient said that his body was a “temple” and his diet was designed to give him the “pure building blocks” that he needed to be healthy. The authors include a lengthy discussion regarding differential diagnosis. Noting that the patient had no body image concerns or issues regarding his weight, he was diagnosed with eating disorder not otherwise specified (as DSM-IV was in effect at the time of their evaluation).

2.4. Existing criteria for ON

As conceptualized by Donini et al. (2004), in ON, purity of food is valued above all else, including deleterious health effects from such a

¹ Balk, Chung, Chen, Trikalinos, and Kong (2013) report Google Translate as an acceptable method of translation for data extraction, particularly when descriptive statistics are being used.

diet. They suggest those with ON feel anguish when not eating healthfully, obsessiveness with planning and preparing healthy meals, and a sense of superiority over others regarding diet (Donini et al., 2004). From a sample of 404 Italians from the general population, Donini et al. (2004) identified individuals believed to have “health fanatic” eating habits, as well as obsessive–compulsive traits and phobia as measured by an elevated score on Scale 7 of the first edition of the Minnesota Multiphasic Personality Inventory. These individuals ($n = 28$) were identified as having ON. Donini's group do not delineate particular criteria that they believe to be unique to ON. Although Jessica Setnick suggested sample criteria for ON in a self-published work in 2013, the first diagnostic criteria to appear in the refereed literature accompanied the Moroze et al. (2015) case study (see Table 1).

2.5. Measurement of ON

In his book, Bratman and his co-author (Bratman & Knight, 2000) describe a 10 item questionnaire in a yes/no format to identify those at risk for ON. This scale is without basic psychometric properties, such as data regarding validity, reliability, cut scores, or a reference group. It was designed as a screening instrument, with items such as: “Do you spend more than three hours a day thinking about healthy food?” “Do you sacrifice experiences you once enjoyed to eat the food you believe is right?” and “Do you keep getting stricter with yourself?” Bratman has never suggested that these items are scientifically rigorous and created it only as an informal measure. There are no interpretation guidelines. These 10 items, however, are the basis of the “ORTO-15,” an instrument designed to detect ON (Donini, Marsili, Graziani, Imbriale, & Cannella, 2005).

Table 1
Moroze et al. (2015) criteria for orthorexia nervosa.

Diagnostic criteria
<p>Criterion A. Obsessional preoccupation with eating “healthy foods,” focusing on concerns regarding the quality and composition of meals. (Two or more of the following.)</p> <ol style="list-style-type: none"> 1. Consuming a nutritionally unbalanced diet due to preoccupying beliefs about food “purity.” 2. Preoccupation and worries about eating impure or unhealthy foods, and on the impact of food quality and composition on physical and/or emotional health. 3. Rigid avoidance of foods believed by the patient to be “unhealthy,” which may include foods containing any fat, preservatives, food-additives, animal products, or other ingredients considered by the subject to be unhealthy. 4. For individuals who are not food professionals, excessive amounts of time (e.g. three or more hours per day) spent reading about, acquiring and/or preparing specific types of foods based on their perceived quality and composition. 5. Guilty feelings and worries after transgressions in which “unhealthy” or “impure” foods are consumed. 6. Intolerance of others' food beliefs. 7. Spending excessive amounts of money relative to one's income on foods because of their perceived quality and composition. <p>Criterion B. The obsessional preoccupation becomes impairing by either of the following:</p> <ol style="list-style-type: none"> 1. Impairment of physical health due to nutritional imbalances, e.g. developing malnutrition due to unbalanced diet. 2. Severe distress or impairment of, social, academic or vocational functioning due to obsessional thoughts and behaviors focusing on patient's beliefs about “healthy” eating. <p>Criterion C. The disturbance is not merely an exacerbation of the symptoms of another disorder, such as obsessive compulsive disorder, or of schizophrenia or another psychotic disorder.</p> <p>Criterion D. The behavior is not better accounted for by the exclusive observation of organized orthodox religious food observance, or when concerns with specialized food requirements are in relation to professionally diagnosed food allergies or medical conditions requiring a specific diet.</p>

Note: Reprinted with permission from Psychosomatics, Moroze et al. (2015) Microthinking about micronutrients: a case of transition from obsessions about healthy eating to near-fatal “orthorexia nervosa” and proposed diagnostic criteria, 56(4), 397–407.

2.5.1. ORTO-15

The ORTO-15 is a 15 item multiple choice questionnaire that purports to identify ON in an Italian sample (Donini et al., 2005). In creating the ORTO-15, Donini et al. (2005) use six of the 10 original yes/no Bratman items and also generated an additional nine items. Such additional items include “Are your eating choices conditioned by your worry about your health status?”, “Are you willing to spend money to have healthier food?”, and “Do you think that the conviction to eat healthy food increases self-esteem?” Discarding the yes/no format, Donini et al. believed that a “Latin sample” was “socially more dialectic” than an Anglo-Saxon one, so expanded the scoring to a 1 to 4 scale (always, often, sometimes, never) regarding food preferences and dietary habits (Donini et al., 2005). Higher scores indicate less extreme dieting practices. A cutoff score of 40 was set as being able to correctly identify the 28 individuals believed to have ON based on their MMPI score and eating habits. A validation sample of 110 individuals also took the ORTO-15 and the authors found 100% sensitivity in identifying individuals with ON, 73.6% specificity, a positive predictive value of 17.6%, and a negative predictive value of 100%. The Italian items were translated into English for publication (Donini et al., 2005).

2.5.2. Measures based on the ORTO-15

Since its publication, the ORTO-15 has spawned additional versions that have been used in other languages. Versions where the original ORTO-15 items and scoring are unchanged and simply translated without modification include those in Turkish (Asil & Sürücüoğlu, 2015; Bosi, Çamur, & Güler, 2007), Portuguese (Alvarenga et al., 2012; Pontes, Montagner, & Montagner, 2014), Polish (Gubiec, Stetkiewicz-Lewandowicz, Rasmus, & Sobów, 2015; Stochel et al., 2015), and Spanish (Jerez, Lagos, Valdés-Badilla, Pacheco, & Pérez, 2015). The ORTO-15 has also been the basis for more complicated adaptations for other languages as well. Table 2 lists various translations into other languages, as well as modifications of the instrument believed to be better suited for the language of the sample being assessed. All four of these measures, the ORTO-11, the ORTO-11-Hu, the Polish ORTHO-15, and the ORTO-9-GE, discard various items from the original ORTO-15 based on confirmatory factor analysis and goodness of fit. Across these four measures, however, all original ORTO-15 items survive to be included in at least one instrument. Indeed, both the ORTO-11 and ORTO-11-Hu contain four fewer items than the ORTO-15; each instrument deleting four different questions.

2.5.3. Other measures

While the ORTO-15 dominates the literature, several studies simply use the original 10 item yes/no test Bratman described in his book (Bratman & Knight, 2000). One of the earliest studies to examine prevalence was Kinzl, Hauer, Traweger, and Kiefer (2005) assessing 286 nutritionists on what they describe as the “Bratman Test.” Similarly, Korinth, Schiess, and Westenhoefer (2010) use the same scale, referring to it only as the “ten items.” Neither study describes in detail the method used to translate the English items into German. Eriksson, Baigi, Marklund, and Lindgren (2008) coin these 10 items the “Bratman Orthorexia Test,” and administer it in Swedish after a single step translation. For this review, these 10 yes/no items will be referenced as the “Bratman Test.”

2.6. Prevalence

The limited literature regarding ON is dominated by studies reporting point prevalence using the ORTO-15 or one of its adaptations. Table 3 summarizes these studies, their prevalence rate, and their country of origin. Generally, these studies are community or university samples. The prevalence of ON varies widely from 6% in an Italian sample to 88.7% in a sample comprised entirely of female nutritionists

Table 2
Instruments assessing orthorexia nervosa (ON) based on the ORTO-15.

Study	Name of new measure	ORTO-15 items discarded in new measure	Summary
Arusoglu, Kabakci, Köksal, and Merdol (2008)	ORTO-11	1, 2, 9, 15	The ORTO-15 was translated into Turkish using a complex, multistep method and administered to 994 members of a university. The authors found through confirmatory factor analysis that only 11 of the 15 items from the ORTO-15 were needed to identify ON.
Varga, Thege, Dukay-Szabó, Túry, and van Furth (2014)	ORTO-11-Hu	5, 6, 8, 14	These authors translated the ORTO-15 into Hungarian using a complicated, multistep procedure. The translated ORTO-15 was administered to 810 university students. Confirmatory factor analysis also revealed that a shortened instrument was adequate to identify ON.
Brytek-Matera, Krupa, Poggiale, and Donini (2014)	Polish ORTHO-15	1, 2, 8, 9, 13, 15	Brytek-Matera et al. refer to the "ORTHO-15" when they clearly mean the ORTO-15. They translate the ORTO-15 from English to Polish using a complicated, multistep method. The resulting items were administered to 400 members of a university community. Through exploratory and confirmatory factor analyses, only nine items were "distinguished as valid" for use in a Polish population.
Missbach et al. (2015)	ORTO-9-GE	1, 2, 8, 9, 13, 14	Using a complicated multistep method the ORTO-15 was translated into German and administered to 1029 individuals free from medical conditions that could influence diet (such as celiac or Crohn's disease). Following confirmatory factor analysis, the model with the best fit was a nine item instrument.

in Brazil. Most prevalence studies for ON regularly report rates from 30% to 70%. On the surface, these numbers look alarming. However, these findings are inconsistent with the broader understanding of eating disorders that are believed to be relatively rare in the general population. Point prevalence rates of the established and well-known eating disorders, Anorexia Nervosa and Bulimia Nervosa, are estimated to be no higher than about 2% (Smink, van Hoeken, & Hoek, 2012). Given this disparity, and what seem to be impossibly high prevalence rates, one explanation for such high rates is the absence of items on any of the ON measurement scales that ask about disruption in everyday functioning, interpersonal distress, or health problems because of diet. It can be difficult to determine when a particular behavior can be described as extreme, or atypical, but not yet pathological.

One widely accepted practice to determine pathological behavior, or "clinical significance," is whether the behavior is interpersonally distressing, or causes impairment in important areas of functioning: occupational, social, or educational (Spitzer & Wakefield, 1999). Behavior also crosses a line from extreme to an area of concern when individuals suffer medical effects from their actions. Taken in this light, without items that identify clinically significant behavior, interpersonal distress, or medical problems concerning diet, it is possible that these scales are simply identifying healthy eating. Their flaw, then, is that they do not simultaneously determine whether the behavior is also pathological. This certainly can account for why there are high numbers of individuals scoring in the ON range in particular groups, such as 86% of Ashtanga yoga practitioners (Valera et al., 2014), 88.7% of nutrition students (de Souza & Rodrigues, 2014), and 81.9% of dietitians (Alvarenga et al., 2012).

Other authors also raise concerns about these instruments. Ramacciotti et al. (2011), for example, worry that the cutoff score of 40 on the ORTO-15 is too high, resulting in too many false positives, suggesting that a score of 35 would improve detection. They note that the prevalence rate in their sample drops from 57.6% to 11.9% by making such an adjustment. Others have concerns about the psychometric properties of the ORTO-15 (Missbach et al., 2015; Varga et al., 2014). Donini et al. (2005) are commended for this early, important first step in attempting to validate an ON measure, however, the ORTO-15 has several psychometric limitations. There is inadequate evidence that the authors followed a traditional approach of test construction. Development of construct validity is not clearly articulated, the creation of an item pool is not discussed, standardization methods are absent, and no basic psychometric properties are provided; all are essential features of test construction (Cicchetti, 1994; Clark & Watson, 1995; Cook &

Beckman, 2006; Cronbach & Meehl, 1955). Further, adapting a measure developed in one culture to be used in another is difficult. When Bosi et al. (2007) took the ORTO-15 from Italian researchers, they acknowledge they were using a North American construct of healthy eating (the Bratman Test), that had been translated into Italian (and expanded from a yes/no format to a scale), with items reported in an English language journal, that they then translated into Turkish. Many adaptations of the ORTO-15 do not go beyond simple translation of test items. It is mandatory that attention be paid to whether features of one culture are adequately captured by the instrument when used in another country (Geisinger, 1994).

3. Analysis

The ON literature tends to be published by European researchers with a small number of articles based in South American or Australian journals. Data-driven studies are dominated by articles determining prevalence in a particular sample using the ORTO-15 or one of its adaptations. As mentioned above, there are many shortcomings regarding ORTO-15. We echo the concerns of Varga, Dukay-Szabó, Túry, and van Furth (2013) and Missbach et al. (2015) and urge caution using the ORTO-15, or its derivatives, to reliably measure prevalence of ON due to psychometric limitations. There are also cultural concerns regarding U.S. criteria being translated for use in other countries. Finally, it is likely that the instruments used to sample prevalence are not taking into account whether eating behavior is becoming clinically significant or inducing medical problems. This also can account for why prevalence rates are much higher than other eating disorders. In short, there are no reliable studies regarding the prevalence of ON.

While the literature is limited in this area, there are convincing case studies and broad anecdotal evidence to conclude that sufficient evidence exists to pursue whether ON is a distinct condition. At present, using the DSM classification system, disordered eating driven by the need to follow an obsessively rigid diet designed to promote good health would likely be best classified as "Avoidant/Restrictive Food Intake Disorder," (ARFID) (Kreipe & Palomaki, 2012). This disorder manifests by disinterest in eating, avoiding food of certain colors or shapes, or concern about the aversive consequences of eating. As the concern about the aversive consequences of eating is typically interpreted as a response to a previous traumatic event (such as choking) or aversive experience (like repeated vomiting) (Bryant-Waugh & Kreipe, 2012; Kreipe & Palomaki, 2012), and not due to concerns about being unhealthy, we believe that ON is not adequately described

Table 3

A summary of studies reporting prevalence of orthorexia nervosa (ON) using the ORTO-15, or a derivative, in chronological order.

Study	Prevalence rate (%)	Country	Summary
Donini et al. (2005)	6.9	Italy	This article describes the creation of the ORTO-15, a 15 item instrument to detect ON based on Bratman's 10 yes/no items. The ORTO-15 is based on a 525 person sample from the community. By identifying individuals who were classified as having both "health fanatic eating habits" and obsessive/compulsive traits and phobia "linked to personality" based on Scale 7 of the original version of the Minnesota Multiphasic Personality Inventory, an orthorexia group ($n = 121$) was identified. A cutoff score of 40 correctly classified 100% of those in the orthorexia group.
Bosi et al. (2007)	45.5	Turkey	The ORTO-15 is translated into Turkish using a single step design. When administered to 318 resident physicians, nearly half score in the range of ON.
Aksoydan and Camci (2009)	56.4	Turkey	Using the Bosi et al. (2007) ORTO-15 translation, 94 Turkish artists were evaluated. Overall, more than half scored in the ON range. Of the different types of artists, 81.8% of opera singers, 32.1% of ballet dancers, and 36.4% of musicians were identified by the ORTO-15 as having ON.
Fidan, Ertekin, İşıkay, and Kirpınar (2010)	43.6	Turkey	This study used the "ORTO-11," an instrument developed from the ORTO-15 by Arusoglu et al. (2008). When sampling 878 Turkish medical students, more than 40% were believed to suffer from ON.
Ramacciotti et al. (2011)	57.6	Italy	The aim of this study was to determine ON in the "general population." When using the Donini et al. (2005) cutoff score of 40, the prevalence rate was 57.6%. The authors suggest a different cutoff ORTO-15, a score of 35 (derived arbitrarily for a "sensibly lower" prevalence rate), that results in only 11.9% of their sample scoring in the ON range.
Alvarenga et al. (2012)	81.9	Brazil	The ORTO-15 was translated into Portuguese using a multistep method, using both the published English items and its original items in Italian. In a sample of 392 Brazilian dietitians, more than 8 out of 10 score in the ON range. This group also reports severe reservations regarding the ORTO-15 based on its psychometric properties.
Segura-García et al. (2012)	Men: 28 Women: 30	Italy	An examination of 577 Italian athletes, where 28% of women and 30% of men scored in the ON range on the ORTO-15 using a cutoff score of 35.
de Souza and Rodrigues (2014)	88.7	Brazil	A second study involving the ORTO-15 in Portuguese. These authors used an instrument that was the result of a complicated, multistep "cultural adaptation" of the ORTO-15 by Pontes et al. (2014). Nutrition students ($n = 150$), all women, were sampled and nearly 9 out of 10 showed "high risk behavior" for ON.
Varga et al. (2014)	74.2	Hungary	The authors used a complicated multistep method to adapt the English items of the ORTO-15 into Hungarian. They administered this instrument to 810 college students, finding about three out of four scored in the ON range when using the cutoff score of 40. They further performed factor analysis and identified only 9 items were indicated. They call their new instrument the ORTO-11-Hu.
Valera, Ruiz, Valdespino, and Visioli (2014)	86	Spain	When 136 members of a Spanish Ashtanga yoga community were sampled, almost 90% scored in clinical range for ON with the ORTO-15 cutoff score of 40 and 43% when a cut score of 35 was used. The authors do not describe their process of adapting the English items into Spanish, but infer that their participants were directed to an online version of the original (English) items.
Asil and Sürücüoğlu (2015)	41.9	Turkey	Despite referencing the ORTO-11, the authors administer the ORTO-15 to 117 Turkish dietitians. There is no description of their method to translate the instrument from English into Turkish. Using a cutoff score of 40, they find a prevalence rate of higher than 40%.
Brytek-Matera, Donini, Krupa, Poggiogalle, and Hay (2015)	Men: 43.2 Women: 68.6	Poland	Brytek-Matera et al. (2014) created the "ORTHO-15," a Polish version of the ORTO-15. Using it, this group administered it to 327 college students, identifying a majority of women and nearly half of men were "preoccupied with consuming healthy food." Their cutoff score was 40.
Gubiec et al. (2015)	59	Poland	The sample consisted of 155 Polish nutrition students. The ORTO-15 was simply translated from English to Polish by one of the authors. Almost 60% of their sample was believed to have ON, using a 40 as the cutoff score.
Jerez et al. (2015)	30.7	Chile	High school students ($n = 205$) made up this sample. The authors do not describe their process for translating the ORTO-15 into Spanish. Using a cutoff score of 35, they report 3 out of 10 students having "orthorexic behavior."
Missbach et al. (2015)	69.1	Austria	After a complicated, multistep translation method, this group derived a German language version of the ORTO-15. They administered the translated instrument to 1029 people recruited through social media. Confirmatory factor analysis showed that only nine items were necessary. Even then, however, Missbatch et al. still found almost 70% of their sample showed "orthorectic" tendencies.
Stochel et al. (2015)	Study 1: 53.7 Study 2: 52.6	Poland	This is another translation of the ORTO-15 (Italian items) into Polish using a complex, multistep method. Once translated, the Polish version was administered to 399 Polish high school students. This was a reliability study, with the translated ORTO-15 administered twice under similar conditions. In both studies, more than half the sample scored in the ON range when a cutoff score of 40 was used.
Segura-Garcia et al. (2015)	Clinical: 58 Control: 6	Italy	This study is unique in that it compares an eating disorder sample ($n = 32$) to a matched sample, healthy control participants ($n = 32$). It has a very small sample size to be convincing as a prevalence study, but indicates that ON may become prevalent during the recovery phase of either anorexia nervosa or bulimia nervosa.

by ARFID. Certainly, an argument could be made for simply describing ON as a subtype of ARFID. However, given that our understanding of pathologically healthful eating is evolving, we propose that further study of the condition, with its own diagnostic criteria as if it were a condition separate from ARFID, is appropriate.

4. Proposed diagnostic criteria

At present, only the Moroze et al. (2015) criteria for ON are widely available. While these criteria do acknowledge an obsessive-compulsive feature thought to be present in the condition as cogently reviewed

by Koven and Abry (2015) and demonstrated by Koven and Senbonmatsu (2013), the Moroze et al. (2015) criteria do not address the role of weight loss in ON. Additionally, the criteria erred by including details of one specific dietary theory rather than recognizing that the content of the dietary theories embraced by individuals with ON may be fluid. In order to improve the conceptualization of ON, new diagnostic criteria are presented below. It is believed that with developed criteria, better measures will follow. Better measures will bring more valid prevalence rates, identify risk factors, and help validate treatment modalities. These criteria were generated after a critical review of published case histories, narrative descriptions presented by eating disorders professionals, and several hundred self-reports of ON sent to a website maintained by one of the authors (SB). Additionally, developing versions of the criteria were discussed with and commented upon by eating disorders professionals from the U.S., Norway, Poland, Sweden, Australia, Italy, and Germany. Conceptually there was broad agreement on the definition as presented below.

The opening paragraph for Criterion A is intended as a condensed narrative description of the condition. Criterion A1 is designed to capture the fundamental characteristic of orthorexia: excessive focus on a theory of healthy eating. A2 describes the exaggerated emotional and physical responses to dietary transgression that separate ordinary health-food enthusiasm from a potential illness. A3 indicates the typical pattern of escalation that transforms mildly disordered eating into significant pathology. Criterion B is included to indicate the wide range of possible impairments associated with the condition, from the relatively subtle to the life-threatening. In consideration of the above, we propose the following:

4.1. Proposed diagnostic criteria for ON

4.1.1. Criterion A

Obsessive focus on “healthy” eating, as defined by a dietary theory or set of beliefs whose specific details may vary; marked by exaggerated emotional distress in relationship to food choices perceived as unhealthy; weight loss may ensue as a result of dietary choices, but this is not the primary goal. As evidenced by the following:

1. Compulsive behavior and/or mental preoccupation regarding affirmative and restrictive dietary practices² believed by the individual to promote optimum health.³
2. Violation of self-imposed dietary rules causes exaggerated fear of disease, sense of personal impurity and/or negative physical sensations, accompanied by anxiety and shame.
3. Dietary restrictions escalate over time, and may come to include elimination of entire food groups and involve progressively more frequent and/or severe “cleanses” (partial fasts) regarded as purifying or detoxifying. This escalation commonly leads to weight loss, but the desire to lose weight is absent, hidden or subordinated to ideation about healthy eating.

4.1.2. Criterion B

The compulsive behavior and mental preoccupation becomes clinically impairing by any of the following:

1. Malnutrition, severe weight loss or other medical complications from restricted diet.
2. Intrapersonal distress or impairment of social, academic or vocational functioning secondary to beliefs or behaviors about healthy diet.
3. Positive body image, self-worth, identity and/or satisfaction excessively dependent on compliance with self-defined “healthy” eating behavior.

Other traits in the literature are commonly associated with ON. While the authors feel that these are not essential to making the diagnosis, they may help confirm it. These include obsessive focus on food choice, planning, purchase, preparation, and consumption; food regarded primarily as source of health rather than pleasure; distress or disgust when in proximity to prohibited foods; exaggerated faith that inclusion or elimination of particular kinds of food can prevent or cure disease or affect daily well-being; periodic shifts in dietary beliefs while other processes persist unchanged; moral judgment of others based on dietary choices; body image distortion around sense of physical “impurity” rather than weight; and persistent belief that dietary practices are health-promoting despite evidence of malnutrition.

5. Limitations

This analysis is limited to studies that are in the peer-reviewed literature, books, and book chapters. It is possible that there are important studies that are theses and dissertations and have not yet been published. Additionally, some caution should be exercised when using “machine translation” to translate articles into English. However, there is evidence that suggests data extraction using Google Translate is acceptable (Balk et al., 2013). Further, there were only three non-English studies, not likely sufficient to influence the analysis. The proposed diagnostic criteria also have limitations, chief among them is that they are not empirically derived. However, defining criteria about a condition is an essential first step to being able to measure it (Kline, 1986). It is also similar to the process used when establishing Binge Eating Disorder as a distinct disorder (Spitzer et al., 1992; Yanovski, 1993). It is our hope that other researchers will build upon these criteria and further refine them. Finally, given that ON is presently generating more interest in academic circles outside of North America, the criteria should be applicable to a wide number of cultures. This may be problematic as the criteria were developed by U.S. researchers. However, the criteria were refined with the input from eating disorder specialists outside the U.S. Still, they may have limited utility in African or Asian populations. Translating the criteria into other languages using a multi-step process, with attention paid to whether there is fidelity between the English meaning and resulting items, will maximize utility in other cultures.

6. Conclusion

Despite flawed measurement tools to assess ON, there is sufficient evidence that ON is a distinct condition that is different from ARFID. Unlike ARFID, individuals with ON choose not to restrict their intake based a disinterest in food, the sensory properties of what they eat, or because of a previous aversive experience with food, but because of a pathological drive to be as healthy as possible. While these individuals can suffer severe medical consequences due to their behavior, like many with anorexia nervosa, those with ON tend not to have issues with how they perceive their weight or body shape, nor is their self-evaluation unduly influenced by weight or shape. These distinctions are important, as traditional treatment approaches to eating disorders like anorexia may not be appropriate for those with ON. Finally, there is a paucity of research in this area. The existing research is largely based on non-clinical samples and a small number of case studies. Future directions for scholarship with ON will need to focus on clinical samples and development of psychometric instruments to aid in diagnosis and measuring treatment efficacy.

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² Dietary practices may include use of concentrated “food supplements.”

³ Exercise performance and/or fit body image may be regarded as an aspect or indicator of health.

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