



Dietary patterns and eating behaviors on the border between healthy and pathological orthorexia

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Abstract

Purpose The obsession with healthy eating associated with restrictive behaviors is called Orthorexia Nervosa (OrNe). Nevertheless, some studies suggest that orthorexia can also be a non-pathological interest in healthy eating which is called Healthy Orthorexia (HeOr). First, one of the main objectives of this study is to compare HeOr, OrNe and eating behaviors in different dietary patterns (vegan, vegetarian and omnivore). Second is to reveal the relationship between HeOr, OrNe and eating behaviors (cognitive restraint, uncontrolled eating, and emotional eating). Lastly, to determine the potential predictors of HeOr and OrNe.

Methods Participants ($N=426$ with an omnivorous diet; $N=415$ with a vegan diet, $N=324$ with a vegetarian diet) completed a web-based descriptive survey, the Teruel Orthorexia Scale and the Three-Factor Eating Questionnaire-R 21.

Results HeOr and OrNe were more common in individuals following both vegan and vegetarian diets. Individuals following a vegan or a vegetarian diet had lower body mass index and higher body image satisfaction than individuals following an omnivorous diet. Cognitive restraint and following a vegan or a vegetarian diet were the two main predictors of both HeOr and OrNe. Cognitive restraint was positively associated with both HeOr and OrNe (more strongly correlated with OrNe), whereas uncontrolled eating and emotional eating behaviors were positively related to OrNe and negatively related to HeOr.

Conclusion The present study contributes to a better understanding of the some similarities and differences between HeOr and OrNe. It also points to higher rates of orthorexia in individuals following a vegan or vegetarian diet and represents a further step towards developing prevention and intervention programs by identifying risk factors for OrNe.

Level V Cross-sectional descriptive study.

Keywords Orthorexia nervosa · Eating disorders · Vegans · Vegetarians · Diet · Eating behaviors

Introduction

The term “Orthorexia Nervosa” (OrNe) refers to a condition which involves a pathological fixation on a health-conscious diet. According to recent studies [1, 2], OrNe includes multiple symptoms such as a compulsive preoccupation with diet, a lack of dietary flexibility, feelings of guilt and exaggerated emotional distress about unhealthy food choices and impairment in social and/or occupational areas. The symptoms of OrNe are ego-syntonic, compatible with or acceptable to the ego, as eating habits and ideas about eating become central in people’s lives and give them a sense of identity [3].

Different studies have tried to link OrNe to various lifestyle choices, medical conditions (chronic diseases, history of eating disorders, body mass index), body image satisfaction and social media use. Orthorexia symptoms have been associated with healthy lifestyle choices such as eating more

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vegetables, exercise, being a non-smoker and reduced alcohol consumption [4, 5]. OrNe has also been associated with significant dietary restrictions, although there is no apparent association with body mass index (BMI) [4, 6]. It has been indicated that orthorexia begins innocently as a desire to overcome chronic diseases or improve general health [7]. Patients with diabetes mellitus often exhibit OrNe tendencies [8], but research regarding the etiology of dual diagnosis of OrNe and chronic diseases such as hypertension, cancer, diabetes mellitus is still limited.

Negative feelings and thoughts about one's own body can have an impact on dissatisfaction with body image. This is often caused by overrating thoughts about their own body proportions [9]. Few studies analyzing the relationship between OrNe and body image have suggested that OrNe is associated with some specific body image attitudes [10]. There has been conflicting data on the relationship between body image and OrNe. Some studies have represented that OrNe is associated with higher self-perceived weight [11, 12], while others have noted that OrNe is associated with lower self-perceived body fat [13]. It has been hypothesized that people who have a distorted image of their body and feel concerned about being overweight are more likely to develop OrNe symptoms [9, 11]. It has also been predicted to be more likely to experience OrNe-related symptoms as a result of frequent interactions with social media platforms (e.g. Instagram) [9].

Social media has become a big part of life. Nowadays, people compare their bodies to old photos of themselves and photos of other people as they are more concerned about how they appear to others on Instagram. Social media has transformed the way people judge how they eat and their perceptions of weight [14]. The popularity of the “healthy eating” movement on social media has been increasing day by day. Orthorexia has been significantly associated with time spent on Instagram, but not any other social media applications. This finding may be related to the fact that Instagram users are frequently exposed to images that reinforce certain diets and behaviors [15].

Although orthorexic eating tendencies have become increasingly common across cultures, OrNe has not been recognized as a distinct disorder by major classification systems, such as Diagnostic and Statistical Manual of Mental Disorders or International Classification of Diseases [16]. There are various views on OrNe in the literature. The prominent debates regarding the relationship between OrNe and eating disorders are whether OrNe is a different eating disorder, a variant of eating disorders [3, 17] or a coping strategy for patients with eating disorders [18, 19].

OrNe has some similarities to vegetarianism and veganism in some aspects such as reduction of food intake according to specific nutrition rules, focusing on quality of food intake, making eating-related issues an important area of

one's own life and healthier behaviors [16]. Health-related aspects are one of the major motivational factors for choosing meat-free diet models [20]. Previous studies assessing the prevalence of OrNe among vegetarians and vegans report contradictory results. Some studies have suggested that OrNe is more common in people who follow a plant-based diet than an omnivorous diet [21, 22], whereas others do not report significant differences between groups [23, 24].

Eating behaviors are individual differences associated with appetite control [25]. Uncontrolled eating refers to the tendency to overeat in response to external food cues and food flavor, while emotional eating refers to the tendency to overeat in response to mood. Both uncontrolled eating and emotional eating can be associated with poor appetite control and weight gain [26]. Cognitive restraint, in contrast, is characterized by controlled eating, restriction of food intake to control body weight [26]. Many features of OrNe such as specific food selection, rigid food rules, and inability to remain flexible in one's eating habits are associated with cognitive restraint [16]. However, no research has been found that surveyed the relationship between emotional eating, uncontrolled eating and orthorexic eating behavior in the literature.

Until recently, research in this field has provided inconsistent results due to the lack of valid measurement tools to distinguish between healthy and pathological eating behaviors [27, 28]. To date, most of the studies have given attention to OrNe, which is the problematic component of orthorexia. Orthorexia and OrNe were considered basically equivalent. Since there have been psychometric problems of OrNe scales, the prevalence of OrNe has been reported from 6 to 90% in non-clinical samples [29]. This is not a possible rate for any psychopathology in the general population. The possible reason why the prevalence of OrNe was so high in the previous studies might have been because healthy eating behavior was also classified as OrNe. Recently, the bidimensionality of orthorexia has been emphasized. A promising new instrument named Teruel Orthorexia Scale (TOS) has been developed and suggested that orthorexia consists of not only the pathological dimension, but also includes a non-pathological interest in healthy eating called healthy orthorexia (HeOr) [30]. HeOr is defined as healthy interest in diet and eating healthily as part of one's identity [21]. It has been proposed that HeOr and OrNe are different concepts and OrNe does not function as a development of HeOr [21].

We believe that more scholarly attention should be paid to assess the valid distinction between pathological and healthy eating behavior and to predict possible factors that lead to the development of these behaviors. Thus, in the presence of potential risk factors, OrNe can be diagnosed earlier, and appropriate treatment can be started more quickly if deemed necessary. Considering all these effects, we were interested in learning which demographic

factors, what types of diets, and which eating behaviors predicted higher HeOr and OrNe. Moreover, we investigated which factors such as lifestyle choices (diet, exercise, smoking, alcohol consumption), social media use, medical conditions (chronic diseases, history of eating disorders, BMI, current mental health status) and body image satisfaction might put someone at risk for OrNe. We investigated the same potential predictors for HeOr. This study is also important to figure out if HeOr differs from OrNe with positive influences such as healthy lifestyle, absence of medical comorbidities and body image satisfaction. It is unclear where to locate HeOr, while it is generally suggested that OrNe is associated with vegan/vegetarian diet and cognitive restraint due to its restrictive nature. In this study, we tried to draw attention to whether HeOr is associated with restrictive eating behavior and vegan/vegetarian diet like OrNe. In addition, no research has been found that surveyed the relationship between uncontrolled eating, emotional eating and orthorexic eating behavior.

So far, studies on orthorexia have been mostly limited by the lack of valid measurement tools of OrNe and HeOr, and the lack of studies investigating eating behaviors, dietary patterns and some medical conditions. Therefore, the objectives of the present study were to (1) compare HeOr, OrNe and eating behaviors (cognitive restraint, emotional eating, uncontrolled eating) in different dietary patterns (vegan, vegetarian and omnivore); (2) reveal the relationship between HeOr, OrNe and eating behaviors; (3) identify predictors such as lifestyle choices, social media use, medical conditions, body image satisfaction, demographic factors, dietary patterns and eating behaviours for HeOr and OrNe.

Methods

Sample

A total number of 1165 adult volunteers, including 426 omnivorous, 415 vegan and 324 vegetarian, participated in the study. Most of the respondents were women ($n = 949$, 81.5%), university or master/doctorate degree ($n = 1100$, 94.4%) and single ($n = 805$, 69.0%). The mean age of the vegan group was 31.79 ± 9.47 , the vegetarian group was 31.09 ± 10.29 , and the omnivorous group was 31.76 ± 10.45 . The mean body mass indexes of the vegan, vegetarian and omnivorous groups were 22.17 ± 3.86 , 22.27 ± 4.04 , and 23.30 ± 4.27 , respectively. Among all participants, 5.2% had history of eating disorders, 13.6% had current psychiatric disorders, and 19% had current physical diseases.

Procedure

Questionnaires were made available via an online platform (Google Forms) and the study's link was accessible from August 2021 to November 2021. This cross-sectional study was advertised as a study on "Comparison of healthy eating obsession and eating behaviors in vegans, vegetarians and omnivores". Recruitment was accomplished through announcements on Twitter and social media accounts of Istanbul Vegan Community. The main exclusion criteria were being younger than 18 years and other types of dietary patterns without vegan, vegetarian or omnivorous diet. All respondents provided informed consent by clicking on a button that indicated that they had read the study information, that they agreed to participate voluntarily in this study, and that they confirmed exclusion criteria.

Measures

The Teruel Orthorexia Scale (TOS)

TOS [30] assesses Orthorexia with two separate dimensions: OrNe (eight items) and HeOr (nine items). The OrNe subscale assesses pathological obsession with healthy eating and consequences of it. The HeOr subscale assesses non-pathological interest and engagement in a healthy diet. Every item is rated on a Likert scale from 0 (completely disagree) to 3 (completely agree). Final score for each dimension was computed as the sum of the item responses. Turkish validity and reliability were performed [31]. In the present study, the Cronbach's α values of the two subscales of TOS were 0.82 for HeOr and 0.79 for OrNe.

The Three-Factor Eating Questionnaire (TFEQ-R21)

The TFEQ-21 [32] assesses three different aspects of eating behaviors: (1) cognitive restraint—effort to restrict food intake to control body weight (2) uncontrolled eating—encompass behaviors that involve a loss of control over food intake, and (3) emotional eating—overeating during dysphoric mood states. In the present study, we used the Turkish version of the TFEQ-21 [33] and the Cronbach's α values of the three subscales were found 0.84 for cognitive restraint, 0.89 for uncontrolled eating and 0.94 for emotional eating.

Sociodemographic, medical and descriptive information

Sociodemographic, medical and descriptive data included age, gender (men, women, non-binary), educational stages, marital status, height and weight (from which the BMI was calculated in kg/m^2), dietary patterns (omnivore, vegetarian, vegan), current mental health status, medical history of eating disorders, presence or absence of chronic physical

diseases requiring treatment, presence or absence of regular exercise, diet programs (to lose weight, to maintain form, for the treatment of disease, none), smoking, types of alcohol consumption (regular, social or none), body image satisfaction (from strongly satisfaction to strongly dissatisfaction) and time spent on Instagram.

Statistical analyses

The data of the study were analyzed using SPSS version 23.0. Descriptive statistics were expressed as frequency, percentage, mean and standard deviation. For the comparison of categorical and ordinal data, the Chi-square test and, when needed, Fisher's exact test was used. Since the skewness and kurtosis values of the numerical variables varied between ± 1.5 , it was assumed that the data showed normal distribution [34]. Research questions were conducted with various statistical tests. While the one-way ANOVA test was used to compare numerical variables in three independent groups (vegan, vegetarian, omnivorous) in the first research question, Pearson correlation analysis was used to reveal the relationship between HeOr, OrNe and eating behaviors in the second research question. In the third research question, multiple linear regression analysis was used to determine predictors of HeOr and OrNe. Internal reliability coefficients (Cronbach's alpha) were used for the reliability analysis of the scale. The level of statistical significance was accepted as $p < 0.05$.

Results

Sociodemographic, descriptive and medical features of the sample are shown in Table 1. There were no statistically significant difference in terms of age ($F(2,1162) = 0.61$, $p = 0.544$, $\eta^2 = 0.001$), gender ($X^2 = 2.47$, $p = 0.649$), educational stages ($X^2 = 3.46$, $p = 0.484$), current psychiatric disorders ($X^2 = 0.72$, $p = 0.698$), history of eating disorders ($X^2 = 4.47$, $p = 0.107$), current physical diseases ($X^2 = 2.31$, $p = 0.314$), time spent on Instagram ($X^2 = 13.30$), $p = 0.102$) and smoking ($X^2 = 2.05$, $p = 0.357$) among individuals following vegan, vegetarian and omnivorous diet. However, marital status ($X^2 = 8.27$, $p = 0.016$), body image satisfaction ($X^2 = 38.89$, $p < 0.001$), regular exercise ($X^2 = 6.22$, $p = 0.045$), alcohol consumption ($X^2 = 22.33$), $p < 0.001$) and BMI ($F(2,1162) = 9.61$, $p < 0.001$, $\eta^2 = 0.016$) variables had significant difference between the dietary patterns. 4.3% of those following a vegetarian diet, 3.6% of those following a vegan diet and 8.9% of those following an omnivorous diet indicated that they were not at all satisfied with their physical appearance. The BMI was significantly higher in those following an omnivorous diet (23.30 ± 4.27) than in those

following vegetarian (22.27 ± 4.04) and vegan (22.17 ± 3.86) diets.

Comparison of sum scores between groups is shown in Table 2. Total scores of TOS for both HeOr ($F(2,1162) = 30.716$, $p < 0.001$) and OrNe ($F(2,1162) = 4.385$, $p = 0.013$) were significantly lower in individuals following omnivorous diet. However, both cognitive restraint ($F(2,1162) = 8.990$, $p < 0.001$) and uncontrolled eating ($F(2,1162) = 3.670$, $p = 0.026$) scores were significantly higher in individuals following omnivorous diet. There was no significant difference between the groups in terms of emotional eating ($F(2,1162) = 0.510$, $p = 0.60$) scores.

Correlation coefficients between TOS and TFEQ-R21 scales are shown in Table 3. Correlation analysis was conducted in the whole sample. A positive correlation of HeOr sub-dimension of TOS and cognitive restraint ($r = 0.399$, $p < 0.01$) sub-dimension of TFEQ-R21 was observed. However, there was a negative correlation of HeOr sub-dimension of TOS and emotional eating ($r = -0.187$, $p < 0.01$) and uncontrolled eating ($r = -0.256$, $p < 0.01$) sub-dimensions of TFEQ-R21. A significant positive correlation was found between the OrNe sub-dimension of TOS and all sub-dimensions of TFEQ-R21 ($p < 0.01$ for each).

Multiple linear regression analysis of sub-dimensions of TOS is shown in Table 4. Eating behaviors, socio-demographic characteristics, nutritional patterns and some descriptive variables that may be associated with orthorexia were included in the model.

The predictors of the HeOr sub-dimension of TOS were, in order of importance; higher cognitive restraint ($\beta = 0.319$, $p < 0.001$), vegan/vegetarian diet ($\beta = -0.211$, $p < 0.001$), higher body image satisfaction ($\beta = 0.160$, $p < 0.001$), regular exercise ($\beta = 0.107$, $p < 0.001$), older age ($\beta = 0.105$, $p < 0.001$), lower uncontrolled eating ($\beta = -0.102$, $p = 0.004$), dieting to keep fit ($\beta = 0.088$, $p = 0.001$), not smoking ($\beta = -0.069$, $p = 0.009$), dieting for the treatment of the disease ($\beta = 0.067$, $p = 0.010$), lower BMI ($\beta = -0.060$, $p = 0.048$), not having current psychiatric disorder ($\beta = -0.056$, $p = 0.029$) and no history of eating disorder ($\beta = -0.054$, $p = 0.034$). In this model, the predictors explained 32% of the variance and the model was found to be significant ($F = 30.429$, $p < 0.001$).

The predictors of the OrNe sub-dimension of TOS were, in order of importance; higher cognitive restraint ($\beta = 0.363$, $p < 0.001$), vegan/vegetarian diet ($\beta = -0.145$, $p < 0.001$), higher uncontrolled eating ($\beta = 0.142$, $p < 0.001$), lower body image satisfaction ($\beta = -0.101$, $p = 0.001$), dieting for the treatment of the disease ($\beta = 0.084$, $p = 0.002$), no alcohol consumption ($\beta = -0.087$, $p = 0.002$), lower BMI ($\beta = -0.065$, $p = 0.045$), gender ($\beta = 0.061$, $p = 0.028$), and a history of eating disorders ($\beta = 0.058$, $p = 0.032$). In this

Table 1 Sociodemographic, descriptive and medical characteristics of the sample

Variables	Vegetarian (<i>n</i> = 324)		Vegan (<i>n</i> = 415)		Omnivore (<i>n</i> = 426)		Total (<i>n</i> = 1165)		Group differences	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>X</i> ²	<i>p</i>
Gender									2.47	0.649
Women	271	83.7	331	79.8	347	81.5	949	81.5		
Men	48	14.8	76	18.3	74	17.4	198	17.0		
Other	5	1.5	8	1.9	5	1.1	18	1.5		
Marital status									8.27	0.016
Single	237	73.1	295	71.1	273	64.1	805	69.1		
Married	87	26.9	120	28.9	153	35.9	360	30.9		
Education level									3.46	0.484
High school	15	4.6	22	5.3	28	6.6	65	5.6		
University	214	66	291	70.1	289	67.8	794	68.2		
Masters degree/doctorate	95	29.3	102	24.6	109	25.6	306	26.3		
Current psychiatric disorder ^a	46	14.2	59	14.2	53	12.4	158	13.6	0.72	0.698
History of eating disorder ^a	13	4.0	29	7.0	18	4.2	60	5.2	4.47	0.107
Current physical diseases ^a	65	20.1	69	16.6	87	20.4	221	19.0	2.31	0.314
Body image satisfaction									38.89	<0.001
Not at all	14	4.3	15	3.6	38	8.9	67	5.8		
Not really	77	23.8	77	18.6	116	27.2	270	23.2		
Undecided	87	26.9	87	21.0	84	19.7	258	22.1		
Somewhat	133	41.0	193	46.5	164	38.5	490	42.1		
Very much	13	4.0	43	10.4	24	5.6	80	6.9		
Time spent on Instagram									13.30	0.102
None	26	8.0	40	9.6	34	8.0	100	8.6		
≤ 1 h	104	32.1	159	38.3	133	31.2	396	34.0		
1–3 h	140	43.2	166	40.0	178	41.8	484	41.5		
3–5 h	44	13.6	40	9.6	59	13.8	143	12.3		
≥ 5 h	10	3.1	10	2.4	22	5.2	42	3.6		
Smoking ^a	84	25.9	106	25.5	126	29.6	316	27.1	2.05	0.357
Alcohol consumption									22.33	<0.001
None	92	28.4	142	34.2	185	43.4	419	36.0		
Social drinker	195	60.2	220	53.0	209	49.1	624	53.6		
Regular	37	11.4	53	12.8	32	7.5	122	10.5		
Regular exercise	117	36.1	174	41.9	144	33.8	435	37.3	6.22	0.045
Reasons for dieting ^b										
No dieting	246	75.9	308	74.2	274	64.3	828	71.1	15.15	0.001
To keep fit	53	16.4	75	18.1	83	19.5	211	18.1	1.21	0.545
To lose weight	23	7.1	44	10.6	74	17.4	141	12.1	19.61	<0.001
For the treatment of disease	15	4.6	9	2.2	20	4.7	44	3.8	4.58	0.101
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			<i>F</i>	<i>P</i>
Age	31.79	9.47	31.09	10.29	31.76	10.45	31.53	10.13	0.61	0.544
Body mass index	22.27	4.04	22.17	3.86	23.30	4.27	22.61	4.09	9.61	<0.001

M mean, *SD* standard deviation

^aOnly “yes” option

^bMore than one option has been ticked

Table 2 Comparison of scales between dietary patterns

	Dietary patterns			<i>F</i>	<i>p</i>	Pairwise comparisons	Effect size η^2
	Vegetarian ¹ (<i>n</i> = 324)	Vegan ² (<i>n</i> = 415)	Omnivore ³ (<i>n</i> = 426)				
TOS- Healthy orthorexia	18.19 ± 4.51	17.94 ± 5.18	15.63 ± 5.40	30.716	<0.001	1–3 ^a <0.001 2–3 ^a <0.001	0.050
TOS- Orthorexia nervosa	5.82 ± 4.00	5.73 ± 4.15	5.03 ± 4.20	4.385	0.013	1–3 0.027 2–3 0.044	0.007
TFEQ-R21- Cognitive restraint	13.05 ± 4.65	12.10 ± 4.49	13.39 ± 4.48	8.990	<0.001	1–2 ^a 0.014 2–3 ^a <0.001	0.015
TFEQ-R21- Emotional eating	13.29 ± 6.05	13.11 ± 6.23	13.54 ± 6.31	0.510	0.600		0.001
TFEQ-R21- Uncontrolled eating	18.98 ± 7.06	19.41 ± 7.07	20.33 ± 7.06	3.670	0.026	1–3 0.029	0.006

TOS Teruel Orthorexia Scale, TFEQ-R21 three-factor eating behaviors questionnaire

¹Vegetarian diet, ²Vegan diet, ³Omnivore diet

^aSignificant after Bonferroni correction

Table 3 Correlation coefficients between scales

	<i>M</i>	<i>SD</i>	1	2	3	4	5
(1) TOS- Healthy orthorexia	17.17	5.21	–				
(2) TOS- Orthorexia nervosa	5.50	4.14	0.399**	–			
(3) TFEQ-R21-Cognitive restraint	12.83	4.56	0.278**	0.410**	–		
(4) TFEQ-R21-Emotional eating	13.32	6.21	–0.187**	0.206**	0.256**	–	
(5) TFEQ-R21-Uncontrolled eating	19.62	7.08	–0.256**	0.194**	0.158**	0.689**	–

M mean, *SD* standart deviation, TOS teruel orthorexia scale, TFEQ-R21 three-factor eating behaviors questionnaire

**p* < .05

***p* < .001

model, the predictors explained 24% of the variance and the model was found to be significant ($F = 20.244$, $p < 0.001$).

Discussion

The present study was designed to determine whether there were differences in eating behaviors, HeOr and OrNe among individuals following an omnivorous and a vegan/vegetarian diet, and to investigate the relationship between eating behaviors, HeOr and OrNe. In addition, we planned to reveal the factors which predict emergence of HeOr and OrNe.

Previous studies focusing on differences between dietary patterns and cognitive restraint reported contradictory findings. Several studies [35–37] suggested that individuals following a vegetarian diet indicated higher cognitive restraint scores, whereas others [38–40] indicated higher cognitive restraint scores in non-vegetarians. Individuals following vegan diet were often classified in the vegetarian group and they were not considered as an independent group in these studies. Our results indicated that individuals following a

vegan diet had a significantly lower cognitive restraint scores than individuals following omnivorous and vegetarian diets. A possible explanation for this may be that vegans have a different attitude towards food and food intake. They are more likely to be aware of different aspects of food and eating than omnivores. Cognitive restraint could counteract the effects of overconsumption in individuals following vegetarian and omnivorous diets. This state may signal adverse appetite traits, attempts to control intake through weight loss dieting, and overeating tendencies. Also, individuals following omnivorous diet showed significantly higher uncontrolled eating than individuals following vegetarian diet in this study. Veganism seem to have the healthiest attitude towards food. It may be assumed that higher cognitive restraint scores in individuals following vegetarian and omnivorous diets can be interpreted as one of the early signs of developing eating disorders.

This study corroborates the findings of a great deal of the previous studies [16, 21], which indicated that individuals following vegetarian and vegan diets did not differ in HeOr and OrNe, but both groups presented higher levels of

Table 4 Multiple linear regression analysis of sub-dimensions of TOS

Variables	Healthy orthorexia			Orthorexia nervosa		
	β (95% CI for B)	<i>t</i>	<i>p</i>	β (95% CI for B)	<i>t</i>	<i>p</i>
Age	0.105 (0.025; 0.082)	3.708	<0.001	0.038 (−0.008; 0.040)	1.281	0.200
Gender	−0.013 (−0.767; 0.456)	−0.499	0.618	0.061 (0.064; 1.092)	2.207	0.028
Dietary patterns (vegan/vegetarian and omnivorous),	−0.211 (−2.827; −1.754)	−8.384	<0.001	−0.145 (−1.697; −0.795)	−5.427	<0.001
Current physical diseases	−0.011 (−0.842; 0.556)	−0.401	0.689	0.029 (−0.282; 0.893)	1.019	0.308
Current psychiatric disorders	−0.056 (−1.604; −0.089)	−2.192	0.029	−0.003 (−0.672; 0.602)	−0.108	0.914
History of eating disorder	−0.054 (−2.439; −0.093)	−2.117	0.034	0.058 (0.092; 2.064)	2.144	0.032
Body image satisfaction	0.160 (0.498; 1.080)	5.314	<0.001	−0.101 (−0.642; −0.152)	−3.182	0.001
BMI	−0.060 (−0.153; −0.001)	−1.980	0.048	−0.065 (−0.129; −0.002)	−2.011	0.045
Time spent on instagram	−0.042 (−0.520; 0.044)	−1.655	0.098	0.015 (−0.168; 0.306)	0.571	0.568
Smoking	−0.069 (−1.415; −0.207)	−2.635	0.009	−0.037 (−0.851; 0.164)	−1.327	0.185
Alcohol consumption	−0.004 (−0.458; 0.392)	152	0.879	−0.087 (−0.929; −0.215)	−3.142	0.002
Diet for keeping fit	0.088 (0.475; 1.899)	3.272	0.001	0.053 (−0.0027; 1.170)	1.875	0.061
Diet for treatment of diseases	0.067 (0.435; 3.220)	2.574	0.010	0.084 (0.649; 2.989)	3.050	0.002
Diet for losing weight	−0.028 (−1.304; 0.396)	−1.049	0.295	−0.008 (−0.817; 0.612)	−0.282	0.778
Regular exercise	0.107 (0.598; 1.706)	4.079	<0.001	0.042 (−0.104; 0.827)	1.522	0.128
TFEQ-R21- Cognitive restraint	0.319 (0.301; 0.428)	11.221	<0.001	0.363 (0.275; 0.383)	12.044	<0.001
TFEQ-R21- Uncontrolled eating	−0.102 (−0.126; −0.025)	−2.917	0.004	0.142 (0.040; 0.125)	3.826	<0.001
TFEQ-R21- Emotional eating	−0.056 (−0.108; 0.013)	−1.539	0.124	0.002 (−0.049; 0.052)	0.060	0.952
Model statistics	$F = 30.429, p < 0.001, R^2 = 0.323$			$F = 20.244, p < 0.001, R^2 = 0.241$		

BMI body mass index, TFEQ-R21 three-factor eating behaviors questionnaire

HeOr and OrNe than individuals following omnivorous diet. What is important for us to recognise here, is that vegetarian diet, vegan diet and OrNe reveal several overlapping characteristics. They are all characterized by the specific criteria, and include “allowed” and “forbidden” nutrition rules [23]. These strict dietary rules and inability to remain flexible in eating habits are the basic elements of “rigid” cognitive restraint. Based on this information, it is not surprising to find that cognitive restraint and vegan/vegetarianism were two main predictors of OrNe in this study. Rigid cognitive restraint is characterized by an all-or-nothing approach and a tendency to alternate between periods of strict diet and periods of disinhibited eating [41]. It is well established that rigid cognitive restraint serves as a risk factor for eating disorders [42]. OrNe may even be seen as a coping strategy in individuals with anorexia nervosa [23]. Since there is a high correlation between OrNe and restricted eating, which is an important risk factor for eating disorders, this result might indicate that OrNe has a more complex relationship with eating disorders than previously assumed.

To date, far too little attention has been paid to examine the relationship between HeOr, OrNe and eating behaviors in the literature. Although a number of studies [23, 43] showed that individuals with higher OrNe behaviour displayed more cognitive restraint, no studies to date have investigated the potential associations of OrNe with emotional

and uncontrolled eating. Even surprisingly, there were no studies which examined the relationship between HeOr and eating behaviors in the literature. The correlation coefficient between HeOr and OrNe was found 0.39, which confirmed that they were separate concepts even though they were partially related to each other. This finding mirrors those of the previous study, which found the correlation between HeOr and OrNe was 0.43 [30]. Cognitive restraint was positively associated with both OrNe and HeOr, but more strongly correlated with OrNe. From this result, it can be concluded that cognitive restraint may not cause problems and may even be beneficial for health in the context of HeOr. This type of eating can be referred to as “flexible” restraint [44]. Uncontrolled eating and emotional eating behaviors were positively associated with OrNe and negatively associated with HeOr. This result suggests that OrNe may be somehow related to eating disorders and can be separated from HeOr with clear boundaries.

History of an eating disorders was a significant predictor of OrNe in this study. This result seems to be consistent with other research [19] which found that the prevalence of OrNe among patients with anorexia or bulimia was higher than in a control group. In addition, a number of studies reported increased tendency toward OrNe was associated with previously diagnosed with an eating disorder [11, 45]. In this study, higher uncontrolled eating scores and body dissatisfaction

were significant predictors of OrNe. It is now well established from a variety of studies that OrNe are also associated with the body image disturbances and body weight [46–49]. A possible explanation for this might be that OrNe has some similar characteristics to anorexia nervosa and bulimia nervosa, and the person switches between these disorders. The underlying reason may be the fear of being overweight [19]. This study showed that lower BMI was one of the important predictors of OrNe. OrNe might serve as a socially acceptable alternative for hiding the real attempt to control the amount of food intake. More recently, literature has emerged that offers contradictory findings about higher BMI scores are associated with OrNe [50, 51].

Cognitive restraint was the most prominent predictor in HeOr, just as in OrNe. “Flexible” cognitive restraint is not unexpected when it comes to healthy eating. Individuals who exhibit more flexible restraint tend to have better weight control, lower BMI, more body satisfaction and less eating disorder than those with rigid restraint [52]. Our findings opposite to OrNe predictors that predict HeOr (lower uncontrolled eating scores, body satisfaction, no history of eating disorder) suggest that OrNe has an “unhealthy” side far beyond the obsession with healthy eating. The fact that older age, regular exercise, vegan/vegetarian diet, dieting to keep fit and not smoking are predictors of HeOr supports the hypothesis that a non-pathological interest in healthy eating will be associated with non-dietary indicators of a healthy lifestyle. The direct relation of unhealthy eating and poor mental health is known [53]. This also accords with our findings, which showed that the absence of psychiatric disease predicted HeOr.

The main strength of this study is the sample size. Previous studies in this area did not have such a large sample and participants from different types of diets. Another important strength of this study is that unlike many studies in this field, individuals following vegan diet were not considered in vegetarian sample but as a separate group. Recently, the number of studies on the distinction between HeOr and OrNe has been increasing. However, there is no study in the literature examining all sociodemographic, descriptive and medical predictors of both HeOr and OrNe.

Finally, a number of limitations need to be considered. First, the cross-sectional nature of the data means only the relationship could be implied, not causation. Second, BMI could not be measured by objective methods. Therefore, body measurements (weight and height) were subjective. Third, employed instruments were based on self-report questionnaires which may lead to potential bias with high uniformity. Finally, we cannot exclude the possibility of sampling bias. The study may have primarily appealed to individuals interested in a healthy lifestyle. Therefore, more diverse samples may be required for future studies.

What is already known on this subject?

It is still unclear which factors contribute to development of OrNe and what its developmental pathway. This gap blurs the line between HeOr and OrNe, and may lead to applying the label ‘disordered eating behavior’ also to healthy eating practices.

What does this study add?

Present findings suggest certain variables as possible risk factors. We have revealed that cognitive restraint and vegan/vegetarian diet are two main predictors of both HeOr and OrNe. The findings clearly indicate that HeOr and OrNe were higher level in individuals following vegan and vegetarian diets, restraint eating behavior was positively associated with both HeOr and OrNe (more strongly correlated with OrNe), uncontrolled eating and emotional eating behaviors were positively related to OrNe and negatively related to HeOr. Furthermore, individuals following vegetarian or vegan diets had lower BMI and higher body image satisfaction than individuals following an omnivorous diet. The insights gained from this study might be of assistance to develop prevention and intervention programs by identifying possible risk factors for individuals with higher orthorexia symptoms. Further studies are required to understand the complexity of the relationship between dietary patterns, OrNe and eating behaviors.

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Data availability The data that support the findings of this study are available upon reasonable request from the corresponding author.

Declarations

Conflict of interest The authors declare no possible conflicts of interest with respect to the research, authorship, and/or publication of this article.

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