

Analysis concerning nutritional behaviors in the context of the risk of orthorexia

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Abstract: Orthorexia is recognized as an eating disorder, an obsessive–compulsive spectrum disorder, or a somatoform disorder. The aim of our research was to analyze nutritional behaviors for the assessment of the risk of orthorexia. The authors developed a questionnaire in which 981 respondents participated and used it as a research method. Both men and women ate mostly 4–5 meals per day (46.30% women versus 34.74% men); however, more men than women ate 1–2 meals daily (18.95% men versus 7.9% women). Both place of birth and field of study did not differ in terms of the number of meals. Moreover, it was observed that the number of meals per day was correlated with the declared time spent on planning a diet. People who ate over 3 meals per day more often indicates that they spent >3 h per day on planning their diet in comparison with people who ate only 1–2 meals. Only 17.6% of the respondents declared that they most often ate meals in a company of someone, whereas 45.3% indicated that there was no rule. The remaining 37.1% of the respondents most often consumed their meals alone. Almost twice as many men as women never paid attention to the qualitative composition of nutrition. Women followed a slimming diet more often than men (20.3% versus 5.8%) and this indicated >4 attempts of losing weight. Around one-third of all the respondents suffered or suffer from eating disorders. Owing to insufficient information on orthorexia, it is essential to conduct further research to determine the characteristics of high-risk groups. Taking the growing interest in a healthy lifestyle into account, there is a need to address the problem of orthorexia in the public space.

Keywords: orthorexia, eating disorder, obsessive–compulsive spectrum disorder, nutritional behavior

Introduction

The term “orthorexia” comes from the Greek words “ortho–correct, accurate” and “orexia–appetite”. It means a pathological obsession with organic and healthy nutrition. The disorder was first described by Bratman in 1997. He presented his own struggle with the disease and cases of patients whose rigorous diet had led to a medical condition in a book called “Health Food Junkies”^{1,2}

Orthorexia is not included in the current classifications of physical, mental, or behavioral disorders (International Statistical Classification of Diseases and Related Health Problems - 10th edition and *Diagnostic and Statistical Manual of Mental Disorders* - 5th edition). In literature, it is recognized as an eating disorder, an obsessive–compulsive spectrum disorder, or a somatoform disorder.³ Some studies indicate common clinical features of orthorexia and eating disorders, particularly anorexia nervosa,⁴ while other studies point to the link between the symptoms of orthorexia nervosa and obsessive–compulsive disorder.⁵ The relationship between obsessive–compulsive disorder and orthorexia nervosa has not been sufficiently examined; nevertheless, both disorders are characterized by burdensome obsessions and repetitive activities. However, it is difficult

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to determine whether obsessive thinking about the selection of diet products causes suffering among patients affected by the disease or nutrition-related activities are performed to reduce anxiety. According to Bratman, people characterized by orthorexia behavior are proud of their diet and do not consider themselves sick.^{6,7} In 2003, National Eating Disorders Association published official information about orthorexia, emphasizing the need to conduct further research in this area.⁶

The modification of lifestyle, including a diet, is often caused by willingness to improve one's physical fitness or avoid diseases affecting modern society. The change of a diet may also be caused by ailments of the digestive system or by an allergy. In the beginning, an individual reduces or avoids consumption of products perceived as unhealthy or harmful for the human body. Further products are eliminated over time and ultimately, the diet consists of only such items that are considered the healthiest and safest. One can speak about orthorexia when everyday activities are subordinated to planning, buying, and preparing meals, according to an applied diet.⁶⁻⁸

The prevalence of orthorexia appears to be higher among vegans, fruitarians, or raw foodists, as well as among people engaged in the animal welfare organizations and supporters of organic and/or non-genetically-modified food production.^{6,7} The individuals characterized by orthorexia are more common among physically active people, as well as individuals trying to lose weight or maintain a slim figure promoted in the mass media.^{6,7}

According to the existing studies, the predisposing factors of orthorexia are an improper attitude toward food, an obsessive-compulsive disorder, and values of body mass index (BMI) exceeding the norm.⁹ The studies also indicate a lower level of education.⁹ People who have earlier been diagnosed with an eating disorder tend to develop orthorexia more often.¹⁰

So far, no uniform diagnostic criteria have been established nor there has been a tool for making medical diagnosis. Nonetheless, the three following questionnaires have been developed to evaluate orthorexia nervosa: the Orthorexia Self-Test,² the ORTO-15 test,⁵ and the Eating Habits Questionnaire.¹¹

The issue of excessive preoccupation with healthy food deserves further exploration; therefore, the aim of our research is to analyze eating behavior in the context of the assessment of the risk of occurrence of orthorexia. The field of this study involves health behaviors that may increase the risk of orthorexia.

Hypothesis is that frequent consumption of meals, paying particular attention to the calorific value, and qualitative composition of food constitute an evidence of behavior that may indicate orthorexia disorder.

Materials and methods

The survey included 1,000 people aged between 19 and 26 years. Ultimately, 981 of them (both men and women) were qualified for further analysis, whereas the remaining 19 were excluded because of incomplete questionnaire responses. Oral and written informed consents were obtained from all participants. Approval for this study was obtained from the Ethics Committee of the Medical University of Warsaw.

The characteristics of females and males are summarized in Table 1. An author-developed questionnaire consisting of 22 questions, including one open question, was used in the study. The questionnaire examined health behavior, with a particular focus on nutritional behavior, in the context of the risk of orthorexia. The respondents were also asked about sources of information on nutrition.

The questionnaire was created on the basis of a review of the most recent scientific literature concerning this issue. The existing questionnaires, including standardized questionnaires in English, were analyzed. The author-developed questionnaire used in this study was consulted with a clinical psychologist.

The vocabulary used to formulate questions and answers is transparent and harmonized, which translates into high communicativeness of the questionnaire. While constructing answer choices, particular attention was paid to the fact that answers to one question should not overlap and be included in each other. Referring to the recommendations of Apanowicz,¹² special attention was paid to the necessity of rational approach to the verification of answers, because there are almost always doubts about the objectivity and honesty of responses. Thus, it was necessary to keep a certain perspective while interpreting the results and drawing conclusions.¹²

Table 1 Characteristics of a study group (n=981)

Gender, %	
Men	80.8
Women	19.2
Field of study, %	
Humanistic studies	50.1
Scientific and technical studies	20.9
Medical studies	16.3
Economic studies	12.8
Age groups, years, %	
19–22	70.8
23–26	20.2
Place of birth, %	
City with >500,000 citizens	38.9
City with 10–100,000 inhabitants	25.7
Village	14.7
City with 100–500,000 citizens	14.0
City with up to 10,000 inhabitants	6.7

The adopted indicator describing nutritional behavior of respondents was the coexistence of chosen options of responses to the three questions: 1) How many meals do you eat during a day? 2) Do you pay attention to the calorific value of a meal? and 3) Do you pay attention to the qualitative composition during shopping? The hypothesis that 1) frequent consumption of meals, 2) paying particular attention to the calorific value, and 3) qualitative composition of food constitute an evidence of behavior that may indicate orthorexia disorder was adopted. To assess the correlation between these 3-dimensions defining nutritional behavior of respondents, advanced log-linear modeling for nominal variables was used.¹³

Statistical analysis

The results of the questionnaire have been correlated with the following demographic variables: gender, age, field of study, and the size of the place of residence. In this study, the correlation between variables was estimated on the basis of nonparametric χ^2 Pearson test, and for correlations, the strength of association was assessed by calculating V Cramer coefficient. In addition, the aforementioned model was completed by a fourth variable, which comprised individual responses to the subsequent questions of the questionnaire. In total, a log-linear analysis was carried out for 15 different models. Each of them was assessed in terms of the degree of correlation between the variables using the χ^2 statistics. The software package STATISTICA version 12.5 (StatSoft Inc.) was used for all calculations under the license of Warsaw Medical University. The default (a priori) level of statistical significance for all analyses was assumed as $\alpha=0.05$.

Results

The analyzed groups differ in terms of number of meals ($P<0.001$, $\chi^2=25.219$, V Craméra =0.159). Both men and women eat mostly 4–5 meals a day (46.30% women versus 34.74% men); however, more men than women eat 1–2 meals daily (18.95% men versus 7.9% women). Age (analysis of variance [ANOVA] rang Kruskala–Wallisa, $H=5.104$, $P=0.276$), place of birth ($\chi^2=24.300$, $P=0.083$), and field of study ($\chi^2=16.548$, $P=0.167$) do not differ in terms of the number of meals. Moreover, it was observed that the number of meals per day is correlated with the declared time spent on planning a diet ($\chi^2=54.616$, $P<0.001$, V Craméra =0.165). People who eat over 3 meals per day more often indicate that they spend >3 h each day on planning their diet in comparison with people who eat only 1–2 meals per day (Table 2).

Table 2 Frequency of eating meals and time spend on planning a diet by respondents: figures and percentages

How many meals do you eat during a day?	Do you spend more than 3 h during a day on planning your diet?		
	Always and usually, ^a N (%)	Usually not, N (%)	No, never, N (%)
1–2	0 (0)	10 (10)	90 (90)
3	5 (2.25)	45 (20.27)	172 (77.48)
4–5	19 (4.31)	133 (30.16)	289 (62.53)
>5	8 (13.79)	16 (27.59)	34 (58.62)
Other	5 (2.79)	29 (16.20)	145 (81.01)

Note: ^aDue to the low number of responses, “always” and “usually” are combined into one category.

Only 17.6% of respondents declared that they do most often eat meals in a company of someone, whereas 45.3% indicated that there is no rule. The remaining 37.1% of students most often consumed their meals alone. There was no correlation between gender, age, field of study, place of birth, and eating meals in the company of someone (in all cases $P>0.05$).

Almost half of the respondents do not know the energy value of their meals (48.4%). However, less than one-fifth indicated the correct value (18.9%). Women pay attention to the energy value more often than men ($P<0.001$, $\chi^2=35.461$, V Craméra =0.188), most frequently students of medical faculties ($P=0.002$, $\chi^2=26.329$, V Craméra =0.094) and older people (ANOVA rang Kruskala–Wallisa, $H=13.539$, $P=0.004$). It is also relevant that people who pay attention to the energy value of a meal consider the qualitative composition of nutrition when doing shopping ($P<0.001$, $\chi^2=347.381$, V Craméra =0.340; Table 3).

Almost twice as many men as women never pay attention to the qualitative composition of nutrition (15.8% versus 9.1%, $P=0.03$, $\chi^2=8.681$, V Craméra =0.093). Moreover, students of economic faculties more frequently do not pay attention to the qualitative composition of meals in comparison with students from scientific and technical studies (20.6% versus 9.6%), humanistic studies (20.6% versus 9.6%), and medical faculties (20.6% versus 5.6%; $P=0.001$, $\chi^2=27.756$, V Craméra =0.096).

The assessment of a basic log-linear model indicates a significant correlation between respondents concerning 1) the number of consumed meals, 2) paying attention to the energy value, and 3) the qualitative composition of meals (a model $2 \times 1 \ 3 \times 1 \ 3 \times 2$, the goodness of fit $\chi^2=42.941$, $P=0.198$). According to the analysis of models comprising an additional fourth question (4-dimensional), 14 out of the 15 variants indicate significant correlation with respondents concerning paying attention to the energy value and 9 with

Table 3 Paying attention to the energy value of meals and the qualitative composition of nutrition while doing shopping: figures and percentages

Do you pay attention to the energy value of your meals?	Do you take into consideration the qualitative composition of nutrition while doing shopping?			
	Yes, always, N (%)	Usually, N (%)	Usually not, N (%)	No, never, N (%)
Yes, always	53 (67.09)	22 (27.85)	3 (3.80)	1 (1.27)
Usually	87 (31.18)	153 (54.84)	37 (13.26)	2 (0.72)
Usually not	41 (10.25)	188 (47.00)	145 (36.25)	26 (6.50)
No, never	33 (13.64)	54 (22.31)	80 (33.06)	75 (30.99)

taking into consideration the qualitative composition of meals. Only 4 variants of 4-dimensional models indicate a correlation with respondents concerning the number of meals per day. A detailed list of the results of log-linear modeling is presented in Table 4.

An important issue that should be taken into consideration while diagnosing orthorexia is the patient's spending of at least a few hours per day on analyzing his/her diet. A person suffering from orthorexia spends most of his/her time

on searching for products and preparing them in a way that he/she considers the healthiest. The fact of spending >3 h per day on diet planning does not depend on any of the examined variables (age, gender, field of study, and place of birth; $P>0.05$).

It should be noted, however, that women indicated fruits as a basis of the nutrition pyramid significantly more often than men (51.7% versus 36.3%, $P<0.001$, $\chi^2=33.865$, V Craméra =0.184). No statistical associations

Table 4 The results of log-linear analysis for the model of correlation between the responses to questions concerning 1) the number of meals, 2) paying attention to the energy value, 3) qualitative composition of nutrition, and 4) the alternating component of the model

Alternating component of the model (4-dimension)	Basic components of the model			P-value ^a
	(1-dimension) How many meals do you eat during a day?	(2-dimension) Do you pay attention to the energy value of your meals?	(3-dimension) Do you take into consideration the qualitative composition of nutrition while doing shopping?	
Do you spend >3 h during a day on planning your diet?	Yes	Yes	Yes	0.998
With whom do you most often eat meals?	Yes	Yes	No	0.985
How many calories accounts for proteins, lipids, and carbohydrates?	No	Yes	Yes	0.999
How often do you use the following food preparation process? (frying)	No	Yes	Yes	0.998
How often do you use the following food preparation process? (grilling)	No	Yes	No	0.999
How often do you use the following food preparation process? (roasting)	No	Yes	Yes	0.997
How often do you use the following food preparation process? (steaming)	No	Yes	Yes	0.998
How often do you use the following food preparation process? (stewing)	No	Yes	Yes	0.999
How often do you drink alcohol?	No	No	Yes	0.999
How often do you smoke cigarettes?	No	Yes	No	0.998
Are you or were you on a slimming diet?	No	Yes	No	0.999
How many times were you on a slimming diet?	No	Yes	No	0.997
How often do you exercise? eg. jogging, fitness, body building, gym	Yes	Yes	Yes	0.999
Do you have or did you have any eating disorders?	Yes	Yes	No	0.993
Do you know the term orthorexia?	No	Yes	Yes	0.847

Notes: ^aFor the indications Yes: a significant secondary effect between variables in a model; No: lack of correlation between variables in the model. The test's probability χ^2 for the goodness of fit ($P>0.05$ means the good fitting of variables to the model).

were found between other analyzed demographical variables ($P>0.05$).

Food preparation skills ensure preservation of nutritional qualities. Nutrients are very sensitive to high temperatures and any exposure to high temperature causes their decomposition or harmful processes. Boiling in water for a long time or frying a dish results in losing the most of its important nutrients. Therefore, people suffering from orthorexia most often resign from the most popular food preparation processes, which they consider unhealthy. The most recommended techniques include boiling and steaming, as well as roasting and stewing. Their proper use allows for limiting the amount of lipids in a diet and minimizing the loss of nutrients in products.¹⁴ The most popular food preparation techniques among students include frying and roasting. The least common technique is grilling. Men use frying more often than women (51.6% men versus 42.8% women responded “very often”, $P=0.007$, $\chi^2=19.280$, V Craméra =0.139); women use boiling and steaming more often than men (39.9% women versus 23.7% men responded that they use boiling “very often”; $P<0.0001$, $\chi^2=45.230$, V Craméra =0.213; 19.6% women versus 14.2% men responded that they use steaming “very often”; $P<0.0001$, $\chi^2=27.048$, V Craméra =0.164). Roasting is most often used by people born in the biggest cities and most rarely by people from cities up to 10,000 inhabitants ($P=0.0007$, $\chi^2=40.471$, V Craméra =0.101).

The qualitative composition of products taken into account by respondents while assessing meals does not differ between the analyzed groups (in all cases, $P>0.05$).

This study shows that men drink alcohol more often than women (36.3% versus 22.7% indicate drinking alcohol often, $P=0.002$, $\chi^2=15.200$, V Craméra =0.123).

Smoking can reduce appetite.¹⁵ The nicotine increases metabolism, which in turn may increase the burning of calories. In this study, men smoke cigarettes more often than women (23.2% versus 15.1% indicated smoking “often”, $P=0.039$, $\chi^2=8.342$, V Craméra =0.091). Students of humanistic and economic faculties admit often that they smoke more than the students of scientific and technological studies and medical faculties (19.2% versus 18.3% versus 15.3% versus 8.7%; $P=0.035$, $\chi^2=17.978$, V Craméra =0.077).

Apart from proper nutrition, physical activity is considered an essential element of a healthy lifestyle. At present, it constitutes the basis of the healthy nutrition pyramid. It plays an important role in preventing and treating many diseases, including the increasing problem of obesity. Low physical activity is considered to be one of the causes for increasing mortality due to cardiovascular

diseases and neoplasms.¹⁶ However, there are no differences in terms of the physical activity between the examined groups ($P>0.05$). Nevertheless, the results of the presented studies do not indicate any significant correlation between the declared frequency of undertaking physical activity and the respondents’ age (Spearman’s rank correlation coefficient =-0.04, $P>0.05$). Whereas students of humanistic as well as scientific and technological faculties exercise every day more often (6.4% and 5.3%) than students of economic (2.3%) and medical studies (2.5%; $P=0.021$, $\chi^2=9.531$, V Craméra =0.081).

Almost half of the examined students were on a slimming diet in the past, of which only 21.1% were on a diet once, 43.3% for two or three times, and 37.7% for four times or more. Women follow a slimming diet more often than men (20.3% versus 5.8% indicated >4 attempts of losing weight; $P<0.001$, $\chi^2=36.790$, V Craméra =0.192). Around one-third of all the respondents suffered or suffer from eating disorders. The responses for being on a slimming diet do not vary depending on the respondents’ age, place of residence, or field of study ($P>0.05$).

Out of the respondents who were asked about the meaning of the term orthorexia, 71% answered that they did not know this term. The remaining 29% of the respondents, who most frequently declared the knowledge of the term correctly, stated that it is an obsession with healthy nutrition or a disorder characterized by an excessive preoccupation with eating food believed to be healthy. Among them, 14 people incorrectly indicated orthorexia as a term describing an aversion to eating; that is, anorexia, a fear of gaining weight or an addiction to slimming diets. Whereas according to 2 people, this term means a norm, proper appetite. The knowledge of the meaning of the term orthorexia does not depend on any of the analyzed demographic variables ($P>0.05$).

There are a number of sources of information about nutrition. The most popular sources enumerated by students include forums, blogs, social networking sites, and so on. A large number of respondents also pointed out family or acquaintances. To a lesser degree, nutrition information is obtained from a doctor, a dietician, or another health care practitioner (Table 5). This may cause misinformation of the whole society, thereby leading to the dissemination of incorrect information concerning balanced eating habits.

Students most often pointed out an individual’s personality, influence of the mass media, and influence of peers as the main causes of eating disorders. The fewest people indicated that gender influences the causing of disorders. Yet, only a small percentage of students (1.8%) stated that they

Table 5 Main sources of information about nutrition

Sources of information about nutrition enumerated by respondents	Responses (%)
Books and professional magazines	32.2
Magazines for men and women	32.7
Television and radio	24.9
Forums, blogs, social networking sites, etc	60.3
Specialist websites, eg, IZZ (Food and Nutrition Institute) website	24.1
Teachers/lecturers	14.7
Family/acquaintances	40.1
Doctors/dieticians/health care practitioners	19.3
I have no interest in this topic	15.7
Other	0.9

lack knowledge on this topic. Other causes of developing eating disorders, such as stress, sedentary lifestyle, lack of time, large accessibility of ready-to-eat and processed food, overeating, mental diseases, not-enough physical activity or insufficient knowledge about healthy nutrition, and awareness of one's own body, were indicated.

Discussion

Orthorexia constitutes a relatively new problem, which explains the insufficient knowledge about this phenomenon. Not many empirical studies concerning its course, characteristics, and prevalence have been conducted so far. The epidemiology is still unknown due to inconsistent data from literature and a small number of scientific studies.

The World Health Organization recognized nutrition and diet¹⁷ as one of the basic health determinants. Such a determinant is also the quality of food connected with its contamination with preservatives, food colors, or other chemical substances used for production and preservation. People with orthorexia pay excessive attention to the quality of consumed food; they also rather do not eat unhealthy food. They spend at least a few hours during a day analyzing their own diet. Such persons spend most of their time searching for food products and preparing them according to the technique that he/she considers the healthiest. For a person suffering from orthorexia, the most important factor during consuming meals is its qualitative composition (an appropriate balance between nutrients and their optimal composition; for example, *cis* and *trans* isomers, complete and incomplete proteins, simple and complex carbohydrates). Sufferers prepare meals with the best-possible qualitative composition. They avoid eating in restaurants or bars, unless they have their own meal. They do not eat anything of foreign origin, unless they learn the detailed qualitative composition of a given meal. This may lead to social isolation of an individual with orthorexia.

In this study, students who responded that they “always” and “usually” pay attention to the qualitative composition of products and “always” and “usually” spend >3 h per day on planning their diet were classified as demonstrating the greatest tendency to orthorexia behavior. The students classified into this category accounted for 3% of the whole group. Similar results were achieved by Fidan et al who diagnosed the prevalence rate of orthorexia in a group of medical students as 1.9%.⁴ Higher values were achieved by Donini et al who diagnosed the prevalence of orthorexia in case of 6.9% of respondents.⁵ Kinzl et al (using Bratman test) diagnosed orthorexia among female dieticians in 12.8% of the sample.¹⁸ However, he emphasized that a state close to orthorexia was present among 34.9% of the sample.

Such results may indicate the need to put more emphasis on observing health behavior of the aforementioned groups in terms of risk of orthorexia. Paradoxically, in such cases, exceptional medical knowledge and willingness to protect one's health become a starting point for developing this disorder.

The research of Donini et al⁵ indicated that the prevalence rate was higher among men when compared with women. The study of Fidan et al also revealed higher prevalence rate among men.⁴ The author-developed questionnaire did not demonstrate any significant differences regarding gender, similar to that of the research of Bagci Bosi et al among medical residents.^{5,19} The study of Brytek-Matera et al also demonstrated lack of differences in regard to gender.²⁰ The discrepancies in the results of the cited studies demonstrate a need to undertake further scientific initiatives to examine this phenomenon in more detail.

Moreover, it should be noted that international literature confirms the thesis about an increased level of risk of developing orthorexia in medical professions; such data are provided by Dos Santos Alvarenga in Brazil or Energin in Turkey.^{21,22}

An analysis of the available literature proves that orthorexia is a worldwide problem; a growing interest in health, in particular in the developed and developing countries, caused a new disorder. It is worth pointing out that the adapted versions of ORTO-15 questionnaire were developed in Hungary, Portugal, and Poland.

As far as the risk groups are concerned, the occurrence of orthorexia was also analyzed among athletes.²³ They are a part of the population that pays particular attention to health and as such are more prone to develop such disorder.¹⁸ This is consistent with the result of the author's study, as well as with the aforementioned research of Kinzl et al¹⁸ and Donini et al.⁵ It confirms the thesis about the need to pay greater

attention to the possible symptoms of orthorexia in specific population groups.

The Hungarian studies indicated that 56.9% of university students demonstrate tendencies to develop orthorexia. The studies revealed also a correlation between orthorexia, consumption, and distorted perception of own body.^{24,25}

The treatment of orthorexia demands a multidisciplinary team consisting of psychotherapists and dieticians. A balanced diet should be the basis of such treatment. At the beginning of treatment, it is necessary to focus on the compensation of nutritional deficiencies. An individual suffering from orthorexia should also realize that he/she has a problem concerning eating behavior, understand that the quality of food consumed is not the only factor which determines health, and learn to eat without falling into an obsession. Experts recommend a treatment consisting of cognitive behavioral therapy combined with selective serotonin reuptake inhibitors (such as sertraline, fluoxetine, and paroxetine). Working with the immediate environment of patients and promoting nutrition education are also essential components of the therapy.¹

It is also worth pointing out that unlike other patients with eating disorders, patients suffering from orthorexia tend to respond to treatment better because of their concerns about their health and self-care.¹

Conclusion

Due to insufficient information about orthorexia, further research is essential to determine the characteristics of high-risk groups.

Taking into account the growing interest in a healthy lifestyle, the problem of orthorexia in the public space needs to be addressed, including developing targeted activities of primary and secondary prevention.

Orthorexia is difficult to diagnose. Medical staff, especially primary care physicians and nurses, should obtain the necessary training/education to be able to diagnose this disorder.

This study demonstrates health behaviors increasing the risk of orthorexia with respect to social and demographic data. The obtained results indicate the direction to conduct further studies concerning the conditions of the occurrence of orthorexia.

Disclosure

The authors report no conflicts of interest in this work.

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