

SELECTED EATING BEHAVIORS AND THE RISK OF ORTHOREXIA NERVOSA IN A GROUP OF HIGH SCHOOL STUDENTS

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ABSTRACT

Background. Orthorexia nervosa (ON), or the obsessive desire to eat only healthy foods, is closely linked to eating behaviors. Among adolescents, the risk of developing ON and its consequences, including weight loss and malnutrition, can be particularly significant due to the crucial impact of eating behaviors on an individual's psychophysical development.

Objective. The aim of the study was to examine the relationship between the eating behaviors of high school students and the risk of ON.

Material and Methods. Observational study was conducted using the PAPI method among 514 students aged 14-19, of which 59.3% (N=305) were female. The research tool was a proprietary, validated questionnaire that included the ORTO-15 test (cutoff score=35) and the BSQFVF. The questionnaire was used to assess the frequency of consumption of selected food products, the level of dietary fiber intake, the quantity and regularity of meals consumed, as well as other eating behaviors of the participants. The individual responses were then analyzed according to the risk of ON using correlation coefficients.

Results. The prevalence of ON risk was found to be 32.1% (N=165). The percentage of individuals at risk of ON was higher among vegetarians. The results regarding the frequency of consumption of animal protein sources, dietary fiber intake, the number of meals and their regularity were similar in both the group at risk of ON and the group not at risk. Over 80% of individuals who never consumed bars, gummies, and candies were at risk of developing ON.

Conclusions. The risk of ON was higher among vegetarians. Individuals who excluded highly processed foods from their diet were more susceptible to developing ON.

Key words: adolescents, orthorexia nervosa, eating behaviors, ORTO-15, ORTO-35

INTRODUCTION

A proper diet is one of the factors that ensure the appropriate psychophysical development of a young organism. The selection of food products and dishes should be rational and diverse, and the diet should meet all individual nutritional needs. A deficiency in certain vitamins and macro- and micronutrients can lead to impaired nervous system function, including a reduced ability to learn, which is crucial at a young age [1]. The eating behaviors of adolescents partially do not meet the recommendations for proper nutrition, as revealed by nationwide study. The most common dietary mistakes include insufficient intake of vegetables and fruits, whole grain bread, fish, and milk

and dairy products, as well as excessive consumption of sweets, fast food, and sweetened carbonated beverages [2]. One of the responses to these issues is nutritional education, which emphasizes promoting proper eating behaviors [3]. Unfortunately, this emphasis can sometimes be misinterpreted, and efforts to improve dietary habits may become obsessive, potentially leading to the development of ON [4].

The term orthorexia (Lat. orthorexia nervosa; ON) originates from the Greek words *ortho* (proper) and *orexia* (appetite/desire). In 1997, doctor Steven Bratman first used this term to describe the obsession with healthy eating caused by health concerns, which he observed in his patients and himself [5]. ON has not yet been included in the ICD-10/ICD-11 or DSM-5

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classifications of diseases. It is unclear whether ON should be classified as an unspecified eating disorder due to its close connection with eating, or as an obsessive-compulsive disorder due to the presence of symptoms typical of these disorders, such as intrusive thoughts about food, meal preparation rituals, and social isolation [6, 7, 8, 9]. ON is characterized by an excessive focus on a subjectively defined “ideal” or “clean” way of eating. This leads to the elimination of many foods, such as dairy and gluten-containing products, due to a subjective belief that they are detrimental to health. Specific rituals and beliefs related to food may develop, such as consuming only raw products due to fear of thermal processing. Orthorexics are particularly concerned with the quality and safety of food (especially the potential for microbiological contamination or pesticide additives), the method of preparation, and the materials used for food packaging. Deviations from the established dietary rules result in guilt, anxiety, and reduced self-esteem for the individual suffering from ON. Weight loss and malnutrition are consequences of ON. It is also suspected that, in the long term, ON may lead to anaemia and osteoporosis. Due to the similarity of these effects to those of anorexia nervosa (AN), special attention must be paid to differentiating between the two disorders. A significant distinguishing factor of ON from AN is the lack of preoccupation with one’s body weight and the obsessive pursuit of a certain physique. The motivation for dietary restrictions in orthorexics is the desire to avoid serious illnesses or to improve health, rather than achieving a specific body weight [10, 11, 12].

Eating behaviors are a major aspect of ON, yet there is a limited amount of research on their impact on the risk of developing ON among adolescents. On one hand, individuals whose eating behaviors need improvement may encounter difficulties in maintaining dietary balance during attempts to change, partly due to fear of reverting to unhealthy behaviors. On the other hand, individuals who already meet dietary recommendations may feel increased pressure to maintain or further improve their eating behaviors due to their nutritional knowledge. Considering that eating disorders (EDs) are more likely to develop during adolescence [13], the described situations, combined with additional risk factors such as perfectionism, body dissatisfaction, and frequent exposure to idealized body images portrayed on social media [14, 15, 16], may potentially contribute to the development of ON. The aim of this study was to investigate the relationship between the eating behaviors of high school students and the risk of developing ON.

MATERIAL AND METHODS

Observational, retrospective study was conducted using the PAPI method in February 2024 at the First

High School in Tychy, following the approval from the school’s principal. The research tool was an anonymous, validated survey questionnaire consisting of:

1. Questions regarding the participants’ gender, age, weight, and height. The data obtained were used to calculate the Body Mass Index (BMI kg/m^2), which was interpreted according to the recommendations of the Global Nutrition Report (<-1 SD: underweight; $>+1$ SD: overweight; $>+2$ SD: obesity) [17], using field tables with z-scores developed by WHO [18]. This section also included a question about whether the participants followed a vegetarian diet.
2. Questions regarding the frequency of consumption of: products that are sources of animal protein (red meat, poultry, eggs, fish and seafood, milk and dairy products, cheese) and highly processed foods (bars/candies/gummies, cakes/cookies/donuts, sweetened breakfast cereals, chips/crackers/pretzels/popcorn, ice cream, processed meat products, fries, instant meals, pizza/kebabs/burgers/hot dogs, sweetened carbonated beverages, energy drinks). Respondents indicated the frequency of consumption of these products by choosing one of the following options: daily/4-6 times a week/2-3 times a week/once a week/less than once a week/never.
3. ORTO-15 – A questionnaire assessing the risk of ON. The study employed a Polish validation of the test with a cutoff score of 35 points [19]. Based on the test results, two groups were identified: individuals at risk of ON (<35 points) and those not at risk of ON (≥ 35 points). The questionnaire consists of 15 questions regarding an obsessive approach to healthy eating, with responses ranging from always/often/sometimes/never. Each response is assigned a score from 1 to 4, with responses indicating a risk of ON scoring 1 point, and those indicating healthy eating behaviors scoring 4 points. The total score ranges from 15 to 60, with lower scores indicating a higher risk of ON.
4. BSQFVF – A questionnaire to assess the intake of fruits, vegetables, and fiber, modified by Czarnocińska et al. [20]. The frequency of consumption of fruit and vegetable juices, fruits, salads, potatoes, legumes, vegetables, bran, cereals, coarse grains, wholemeal and wheat bread was assessed. Each response was assigned a score: daily – 4 points, 4-6 times a week – 3 points, 2-3 times a week – 2 points, once a week – 1 point, less than once a week – 0 points. Based on the total score, acceptable fiber intake (≥ 20 points) and unacceptable intake (<20 points) were distinguished.

Characteristics of the study group

All participants were students of the First High School in Tychy, and being a student at this school was the only inclusion criterion for the study. The students were asked to complete a survey questionnaire during a nutritional education session conducted during classes. The study included 514 participants, comprising 305 (59.3%) females and 209 (40.7%) males, aged between 14 and 19 years (15.88 ± 1.27). A vegetarian diet was followed by 34 (6.6%) individuals. The lowest BMI value was 14.34 kg/m^2 , and the highest 36.31 kg/m^2 .

Statistical analysis

The obtained results were processed in MS Excel and subjected to statistical analysis using Statistica 13.0. Based on the interpretation of the skewness coefficient, appropriate measures of central tendency (mean, median) and dispersion (standard deviation, interquartile range) were determined. Depending on the type of scale assigned to the respective qualitative variables, appropriate correlation coefficients were selected – Cramer's V (V_c) and Phi coefficient (ϕ). The interpretation of the correlation strength was based on the following guidelines: 0 indicates no stochastic relationship between variables, 1 represents a complete correlation between variables (very weak correlation ($x < 0.1$), weak ($0.1 \geq x < 0.3$), moderate ($0.3 \geq x < 0.5$), strong ($0.5 \geq x < 0.7$), very strong ($0.7 \geq x < 0.9$), and almost certain ($0.9 \geq x < 1.0$), where x represents V_c or ϕ).

In order to validate the author's part of the questionnaire, 11 subjects (6 women, 5 men) were asked to complete the questionnaire twice with a one-week interval. Cohen's Kappa value was then calculated (0.14-1) and the level of response repeatability was determined based on it (very good response repeatability was obtained for 2 questions, good for 11, medium for 6, poor for 6 and minimal for 1).

RESULTS

Orthorexia nervosa risk considering gender, BMI and vegetarian diet of subjects

The risk of ON was noted in 32.1% (N=165) of the respondents. The average score obtained in the ORTO-15 was 36 ± 6.0 , with the lowest score being 21, and the highest 46.

The gender of the participants was not a predisposing factor for a higher risk of ON, unlike following a vegetarian diet (Table 1). The risk of ON was almost the same among females and males. More than half of the vegetarians were at risk for ON, compared to 30.2% among those following a traditional diet. The average score on the ORTO-15 test among vegetarians was 33.0 ± 8.0 , while for non-vegetarians, it was 37 ± 5.0 .

The risk of developing ON was the same regardless of the participants' age or BMI (Table 2). However, among individuals at risk for ON, a higher percentage were overweight or obese compared to those not at risk.

Table 1. Risk of orthorexia nervosa vs. gender of subjects and vegetarianism

	No risk of ON	Risk of ON	ϕ
Women N (%)	208 (68.2)	97 (31.8)	0.008
Men N (%)	141 (67.5)	68 (32.5)	
Traditional diet N (%)	335 (69.8)	145 (30.2)	0.15
Vegetarian diet N (%)	14 (41.2)	20 (58.8)	

Φ – Phi coefficient

Table 2. Risk of orthorexia nervosa vs. BMI interpretation and age of subjects

	Total N (%)	No risk of ON N (%)	Risk of ON N (%)	V_c
Underweight	68 (13.2)	47 (13.5)	21 (12.7)	0.04
Normal weight	383 (74.5)	264 (75.6)	119 (72.1)	
Overweight	54 (10.5)	33 (9.5)	21 (12.7)	
Obesity	9 (1.8)	5 (1.4)	4 (2.4)	
14 years	77 (14.9)	55 (15.9)	22 (13.3)	0.04
15 years	141 (27.4)	95 (27.2)	46 (27.9)	
16 years	134 (26.1)	89 (25.5)	45 (27.3)	
17 years	97 (18.9)	66 (18.9)	31 (18.8)	
18 years	58 (11.3)	39 (11.1)	19 (11.5)	
19 years	7 (1.4)	5 (1.4)	2 (1.2)	

V_c – Cramer's V coefficient

Orthorexia nervosa risk and selected eating behaviors of subjects

The highest percentage of respondents declared the same responses regarding selected eating behaviors, regardless of their risk of ON (Table 3). More than half of the subjects in both groups consumed 4-5 meals per day. Over 40% of respondents reported eating every 3-4 hours. Regular breakfast consumption was declared by only half of the respondents in both groups. The highest percentage of participants drank 1.5-2 liters of water daily. However, 61.2% of those at

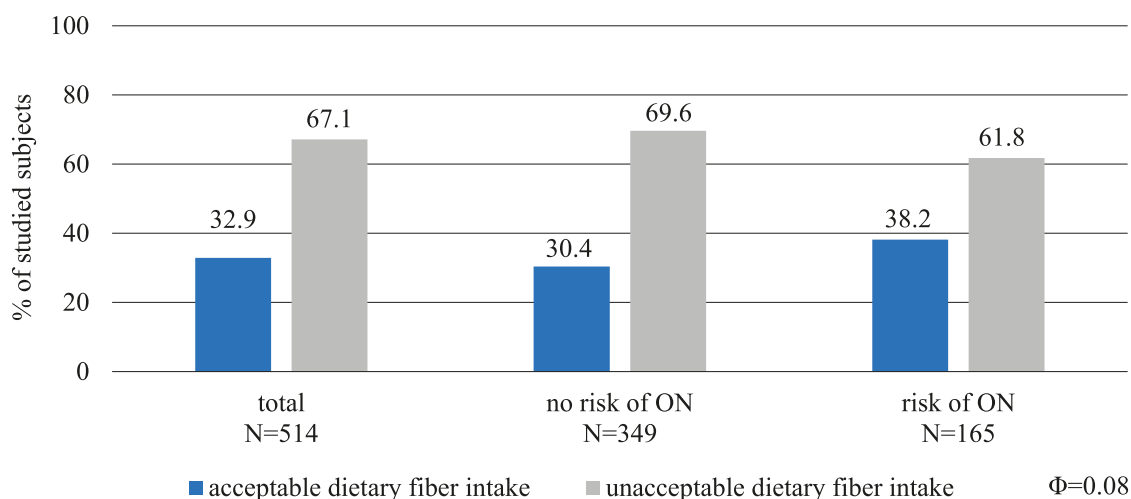
risk of ON drank 1.5-3 liters of water, whereas 72.5% of those not at risk drank 1-2 liters of water, indicating a higher daily water intake among individuals at risk of ON.

In 67.1% of respondents, dietary fiber intake was noted to be at an unacceptable level (Figure 1). Among those at risk for ON, a higher percentage of subjects achieved acceptable fiber intake compared to those not at risk for ON. The mean score obtained on the BSQFVF for those at risk of ON was 17.82 ± 5.03 , while among those not at risk, it was 16.89 ± 4.88 .

Table 3. Risk of orthorexia nervosa vs. breakfast intake, amount of water drunk, number of meals per day and length of breaks between them

		Total N (%)	No risk of ON N (%)	Risk of ON N (%)	V_c
Number of meals per day	1-2	51 (9.9)	33 (9.5)	18 (10.9)	0.04
	3	177 (34.4)	124 (35.5)	53 (32.1)	
	4-5	267 (51.9)	180 (51.6)	87 (52.7)	
	6 and more	19 (3.8)	12 (3.4)	7 (4.2)	
Breakfast intake	Yes, always	259 (50.4)	172 (49.3)	87 (52.7)	0.04
	Yes, but not always	184 (35.8)	126 (36.1)	58 (35.2)	
	No	71 (13.8)	51 (14.6)	20 (12.1)	
Amount of water drunk per day	I don't drink water	4 (0.8)	3 (0.9)	1 (0.6)	0.14
	0.5 l and less	34 (6.6)	24 (6.9)	10 (6.1)	
	Approximately 1 l	126 (24.5)	91 (26.1)	35 (21.2)	
	1.5-2 l	227 (44.2)	162 (46.4)	65 (39.4)	
	2.5-3 l	85 (16.5)	49 (14.0)	36 (21.8)	
	Above 3 l	38 (7.4)	20 (5.7)	18 (10.9)	
Length of breaks between meals	1 h and less	8 (1.6)	6 (1.7)	2 (1.2)	0.05
	2 h	50 (9.7)	33 (9.5)	17 (10.3)	
	3-4 h	233 (45.3)	154 (44.1)	79 (47.9)	
	5 h	41 (8.0)	30 (8.6)	11 (6.7)	
	6 h and above	23 (4.5)	16 (4.6)	7 (4.2)	
	Are highly irregular	159 (30.9)	110 (31.5)	49 (29.7)	

V_c – Cramer's V coefficient



Φ – Phi coefficient

Figure 1. Orthorexia nervosa risk vs. level of dietary fiber intake

Risk of orthorexia nervosa and frequency of consumption of selected food products

The highest percentage of respondents reported the same frequency of consumption of animal protein

sources, regardless of their risk of ON (Table 4). Over half of the individuals consuming red meat daily were at risk of ON. Similarly, 41.9% of individuals who never consumed red meat were also at risk of ON.

Table 4. Risk of orthorexia nervosa vs. frequency of consumption of products that are sources of animal protein

		Never N (%)	Less than 1 a week N (%)	1 a week N (%)	2-3 times a week N (%)	4-6 times a week N (%)	Daily N (%)	V_c
Red meat	n/risk	36 (58.1)	108 (73.0)	69 (69.0)	98 (72.6)	29 (59.2)	9 (45.0)	0.16
	risk	26 (41.9)	40 (27.0)	31 (31.0)	37 (27.4)	20 (40.8)	11 (55.0)	
Poultry	n/risk	13 (46.4)	15 (55.6)	48 (66.7)	178 (76.7)	81 (63.8)	14 (50.0)	0.20
	risk	15 (53.6)	12 (44.4)	24 (33.3)	54 (23.3)	46 (36.2)	14 (50.0)	
Eggs	n/risk	11 (52.4)	50 (78.1)	89 (72.4)	132 (72.5)	50 (54.4)	17 (53.1)	0.19
	risk	10 (47.6)	14 (21.9)	34 (27.6)	50 (27.5)	42 (45.6)	15 (46.9)	
Fish & seafood	n/risk	52 (68.4)	161 (70.6)	112(70.0)	22 (53.7)	1 (12.5)	1 (100)	0.18
	risk	24 (31.6)	67 (29.4)	48 (30.0)	19 (46.3)	7 (87.5)	0 (0)	
Milk & dairy products	n/risk	3 (30.0)	14 (70.0)	14 (60.9)	71 (71.0)	103 (70.5)	144 (67.0)	0.13
	risk	7 (70.0)	6 (30.0)	9 (39.1)	29 (29.0)	43 (29.5)	71 (33.0)	
Cheeses	n/risk	7 (43.8)	12 (57.1)	24 (66.7)	80 (69.0)	131 (70.4)	95 (68.3)	0.11
	risk	9 (56.2)	9 (42.9)	12 (33.3)	36 (31.0)	55 (29.6)	44 (31.7)	

n/risk – no risk of ON; risk – risk of ON; V_c – Cramer's V coefficient

Table 5. Risk of orthorexia nervosa vs. frequency of consumption of highly processed foods

		Never N (%)	Less than 1 a week N (%)	1 a week N (%)	2-3 times a week N (%)	4-6 times a week N (%)	Daily N (%)	V_c
Bars, candies, jellies	n/risk	4 (16.7)	48 (53.9)	54 (64.3)	126 (73.3)	82 (80.4)	35 (81.4)	0.31
	risk	20 (83.3)	41 (46.1)	30 (35.7)	46 (26.7)	20 (19.6)	8 (18.6)	
Cookies, cakes, donuts	n/risk	7 (26.9)	111 (62.7)	110 (73.3)	87 (75.6)	24 (72.7)	10 (76.9)	0.23
	risk	19 (73.1)	66 (37.3)	40 (26.7)	28 (24.4)	9 (27.3)	3 (23.1)	
Salty snacks, e.g. crisps, crackers	n/risk	15 (48.4)	153 (65.7)	101 (68.7)	65 (82.3)	13 (68.4)	2 (40.0)	0.17
	risk	16 (51.6)	80 (34.3)	46 (31.3)	14 (17.7)	6 (31.6)	3 (60.0)	
Sweetened breakfast cereals	n/risk	83 (57.6)	123 (71.1)	46 (69.7)	54 (68.3)	24 (77.4)	19 (90.5)	0.17
	risk	61 (42.4)	50 (28.9)	20 (30.3)	25 (31.7)	7 (22.6)	2 (9.5)	
Ice cream	n/risk	14 (40.0)	227 (69.9)	66 (68.0)	34 (77.3)	8 (80.0)	0 (0)	0.21
	risk	21 (60.0)	98 (30.1)	31 (32.0)	10 (22.7)	2 (20.0)	3 (100)	
Processed meats, e.g. sausages	n/risk	23 (42.6)	43 (66.2)	62 (74.7)	95 (68.8)	82 (79.6)	44 (62.0)	0.22
	risk	31 (57.4)	22 (33.8)	21 (25.3)	43 (31.2)	21 (20.4)	27 (38.0)	
Fast food	n/risk	11 (42.3)	229 (67.7)	79 (69.9)	25 (78.1)	4 (100)	1 (100)	0.15
	risk	15 (57.7)	109 (32.3)	34 (30.1)	7 (21.9)	0 (0)	0 (0)	
Fries	n/risk	28 (59.6)	227 (66.4)	68 (74.7)	19 (76.0)	5 (71.4)	2 (100)	0.10
	risk	19 (40.4)	115 (33.6)	23 (25.3)	6 (24.0)	2 (28.6)	0 (0)	
Instant meals	n/risk	146 (60.8)	161 (72.5)	23 (82.1)	17 (85.0)	1 (50.0)	1 (50.0)	0.16
	risk	94 (39.2)	61 (27.5)	5 (17.9)	3 (15.0)	1 (50.0)	1 (50.0)	
Sweetened carbonated beverages	n/risk	60 (47.6)	141 (77.5)	59 (68.6)	59 (73.8)	18 (72.0)	12 (80.0)	0.26
	risk	66 (52.4)	41 (22.5)	27 (31.4)	21 (26.2)	7 (28.0)	3 (20.0)	
Energy drinks	n/risk	243 (67.9)	72 (72.0)	10 (50.0)	13 (61.9)	5 (83.3)	6 (66.7)	0.10
	risk	115 (32.1)	28 (28.0)	10 (50.0)	8 (38.1)	1 (16.7)	3 (33.3)	

n/risk – no risk of ON; risk – risk of ON; V_c – Cramer's V coefficient

A similar trend of higher ON risk for extreme consumption frequencies was observed for poultry and eggs. Increased ON risk was evident with relatively higher frequencies of fish and seafood consumption (2-3/4-6 times per week). For milk and dairy products, as well as cheese, higher ON risk was found among individuals who never consumed these products.

Among those excluding particular highly processed foods from their diet, a higher percentage were at risk of ON (Table 5). Among individuals who never consumed bars, candies, and jellies, 83.3% were at risk of ON. Conversely, among those who consumed them 2-3/4-6 times per week or daily, over 70% were not at risk. A similar trend was observed for the consumption of cakes, cookies, donuts, salty snacks, ice cream, processed meats, fast food, and sweetened carbonated beverages. The highest percentage of individuals at risk of ON most often never consumed instant meals, sweetened breakfast cereals, and carbonated beverages, whereas among those not at risk, the highest percentage consumed these products less than once a week.

DISCUSSION

In the conducted study, the prevalence of the risk of ON was found to be 32.1% (N=165). Other researchers adopting the same cutoff score (ORTO-35) obtained results at similar levels – 27.8%, 28.3%, 34.9% [21, 22, 23], or slightly lower – 13.7% [24].

The authors of ORTO-15, when introducing the tool in 2005, obtained an ON prevalence of 6.9% (N=36) in a group of 525 subjects [25]. If the present study, conducted on a similar sized group of subjects (N=514), had adopted the cutoff recommended for ORTO-40, it would have yielded an ON prevalence of 80.7% (N=415). This is an almost 12-fold increase over 20 years. On the one hand, this may indicate a tendency for the ORTO-15 test to overestimate the risk of ON, which is also confirmed by the results of other studies – an increase from 27.8% to 76.7%, following a change in the cutoff score in the study by Łucka et al. [21]. On the other hand, it reflects a growing interest in healthy eating and, unfortunately, an improper approach to it that has developed in society over the past two decades.

No influence of gender on the risk of ON was observed. A similar observation was noted by Australian, Hungarian and Polish researchers [21, 26, 27]. The lack of gender variation in the incidence of ON risk, may be a specific aspect of ON, stemming from its source – fear for one's health [10]. This concern, may affect both genders equally, unlike the pressure to have a slim figure, which affects women more often and is a risk factor for EDs such as AN or bulimia nervosa (BN) [28].

The transition from a traditional diet to a vegetarian diet at a young age involves certain dietary restrictions. This may also be a time when a young person starts paying attention to the nutritional value of the foods they consume. If an excessively strict dietary regime is applied, the above situation could lead to the development of EDs [29]. In the present study, a higher risk of ON was demonstrated among vegetarians, which is consistent with the results of other studies [30, 31, 32]. Dittfeld et al. [33] noted a relationship involving an inversely proportional increase in the risk of ON to age and length of adherence to a vegetarian diet, indicating a higher risk of ON among younger and novice vegetarians. This draws attention to the fact that switching to a plant-based diet at a young age should be done under supervision and with parental support.

In the study conducted, those at risk of ON consumed more dietary fiber, drank more water, and avoided breakfast less often compared to those not at risk, which can be considered manifestations of more positive eating behaviors. A similar relationship, involving a higher intensity of pro-healthy eating behaviors, has been noted in other studies [22, 34, 35]. Adopting proper eating behaviors, especially at a young age, is a desirable phenomenon. At the same time, however, the emphasis on maintaining a healthy dietary approach and balance should be as strong as the emphasis on improving eating behaviors, which could reduce the risk of ON or other EDs. Excessive restrictions – even on highly processed foods – are not beneficial for mental health [36, 37]. The risk of ON was higher among those who completely excluded products commonly (and rightly) considered unhealthy, e.g., candy bars, chips, fast food dishes. However, the risk was higher, even compared to those with lower consumption of these products (less than once a week). In this case, wouldn't occasional appetite-driven consumption of products considered unhealthy be more beneficial from a psychodietetic point of view?

Strengths and limitations

The study was conducted on a large sample using a contact method; however, all participants attended the same school. Expanding the study to include students from other schools would provide a valuable evaluation, giving it a regional perspective.

CONCLUSIONS

The risk of developing orthorexia nervosa was higher among vegetarians. Individuals who excluded highly processed foods from their diet were more prone to developing ON. Apart from the aforementioned factors, no significant differences were observed in

the eating behaviors of those at risk of ON compared to those not at risk.

Conflict of interest

The authors declare no conflict of interest.

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