FOOD AND NUTRITION IN COLLECTIVE HEALTH

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Food consumption of individuals with orthorexia and its relationship with physical activity level

Consumo alimentar de indivíduos com ortorexia e sua relação com nível de atividade física

Abstract

Objective: To compare food consumption among individuals identified with or without orthorexia, and their differences in relation to the level of physical activity. *Methods:* A cross-sectional study was carried out with a sample of 59 adult individuals (30 women and 29 men), aged between 18 and 50 years, of both sexes. Participants were assessed and divided about level and type of physical activity (physically active: >150min of exercise per week). Presence of orthorexia was evaluated by ORTO-15 questionnaire, and food consumption was evaluated by a usual one-day recall. Statistical analysis was done by T-Student or Mann-Whitney U Test for comparison between groups with and without orthorexia. Comparison of data described as absolute and percentage frequencies was performed by chi-square. *Results:* The mean age of the sample evaluated was 31.2 ± 8.9 years. There was a prevalence of orthorexia of 78%, being higher in physically active individuals (86% versus 65%, p = 0.05). Individuals with orthorexia consumed more protein in relation to grams per day, kg, percentage of total energy value and kcal (p <0.05); and had lower intake of carbohydrates than the percentage of total energy value (p <0.05), compared to those without orthorexia. This pattern remained significant only in the physically active group. *Conclusion:* The results of this study suggest that orthorexia may be associated with physical exercise and eating behavior with higher intakes of protein and low carbohydrates.

Keywords: Eating behavior. Food Consumption. Eating disorder. Orthorexia. Physical Activity.

Resumo

Objetivo: Comparar o consumo alimentar entre indivíduos identificados com e sem ortorexia, e suas diferenças em relação ao nível de atividade física. *Métodos:* Estudo transversal, com uma amostra de 59 indivíduos adultos (30 mulheres e 29 homens), com idade entre 18 e 50 anos, de ambos os sexos. Os participantes foram avaliados e divididos segundo nível e tipo de atividade física (fisicamente ativos: > 150min de exercício por semana). A presença de ortorexia foi avaliada pelo questionário ORTO-15, e o consumo alimentar avaliado por recordatório habitual de um dia. A análise estatística foi feita por teste *t* Student ou U de Mann-Whitney, para comparação entre os grupos com e sem ortorexia. A comparação dos dados descritos como frequências absolutas e percentuais foi realizada por qui-quadrado. *Resultados:* A média de idade dos indivíduos avaliados foi de 31, 2 ± 8,9 anos. Houve prevalência de ortorexia de

78%, sendo maior nos indivíduos fisicamente ativos (86% *vs* 65%; p=0,05). Indivíduos com ortorexia consumiam mais proteínas em relação às gramas por dia, por kg, percentual do valor energético total e kcal (p<0,05); e tinham um consumo mais baixo de carboidratos em relação ao percentual do valor energético total (p<0,05), em comparação aos sem ortorexia. Esse padrão se manteve significativo apenas dentro do grupo fisicamente ativo. ***Conclusão:*** Os resultados deste estudo sugerem que a ortorexia pode estar associada à prática de exercício físico e a um comportamento alimentar com maior consumo de proteínas e baixo em carboidratos.

Palavras-chave: Comportamento Alimentar. Consumo Alimentar. Transtorno Alimentar. Ortorexia. Atividade Física. .

INTRODUCTION

There has been a growing concern about health and environmental issues associated with food consumption and lifestyle in the industrialized western world, and a worrying movement in many developing countries.[1] The change in food pattern can begin innocently, but later some individuals slowly change their diet, their eating habits in an exaggerated way, also impacting in their mental health and social relationships.[2]

In this way, orthorexia, characterized by obsessive eating behavior, can fit into the category of unspecified eating disorders in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), in which characteristic symptoms of an eating disorder are applied that cause clinically significant suffering or impairment in social and professional functioning, but do not meet all criteria for any disorder in the diagnostic class.[3]

Orthorexia was first described by Bratman[4] in 1997, who coined the term "orthorexia", which means "correct food" and comes from the Latin word ortho (straight, right).[5] The orthorexia expression originates from the Greek words orthos (accurate or correct) and orexis (appetite), and it is defined as an obsessive behavior due to adequate nutrition or obsession with healthy eating.[5] Despite being a poorly studied subject, individuals with orthorexia have obsessive-compulsive personality traits, characterized by pathological obsession with healthy eating and diet purity, which can lead to important dietary restrictions.[6,7]

It has already been shown in the literature that there is a high frequency of orthorexia in physically active individuals and athletes, when compared to sedentary ones,[8] however without assessing food consumption of these individuals. Thus, the aim of this study was to compare food consumption between individuals identified with and without orthorexia, and their differences in relation to the physical activity level.

METHODS

Cross-sectional study, whose initial sample consisted of 100 adult individuals (over 18 years old) from Porto Alegre-RS, Brazil, 50% male and 50% physically active. Physically active participants were considered to practice more than 150 minutes of exercise per week; they filled out a questionnaire about frequency, duration and type of exercise practiced. After exclusion of poorly completed food surveys or missing data, 59 individuals remained for the final analysis. Participants who were undergoing treatment or nutritional follow-up under nutritionist guidance, or with a disease that changed their eating patterns (celiac disease, allergies, intolerances, diabetes, kidney disease) were excluded. Participants were recruited through the internet and social networks spreading. Data collection was carried out individually with the interviewees, with scheduled time and place according to the participant's availability or in the places of exercise practice.

The study was approved by the Research Ethics Committee of the Centro Universitário Ritter dos Reis (Ritter dos Reis University Center) - Uniritter (CAAE: 68614217.6.0000.5309). Participants who voluntarily accepted to participate in the research signed the Informed Consent Form, which presented the research details.

Participants' food consumption was assessed by a previously trained interviewer, using as parameter the food report referred by the patient as the usual (the most frequent food consumption routine), always calculated by the same researcher, maintaining a standardization of measures and Food Composition Tables previously defined by the researchers. The record was calculated with Dietbox® software for kilocalories (kcal), macronutrients (in g, g / kg, kcal and percentage of the total energy value - TEV) and fibers (g).

Presence of orthorexia indicating behavior was assessed using ORTO-15 questionnaire, originally elaborated by Donini et al.[9] and adapted to Portuguese by Pontes et al.[5] The questionnaire contains 15 multiple-choice questions, with answer scales such as: always, often, sometimes and never. For this scale points were awarded, and the related orthorexia

behavior was attributed weight 1, and healthier behavior, weight 4. To identify the diagnosis of orthorexia nervosa, a cut-off point below 40 was considered, as suggested by authors in population studies.[5]

Data were presented according to the distribution of variables, with continuous data with normal distribution being presented as mean and standard deviation, and non-parametric data as median and interquartile range. Analysis was performed by Student t test or Mann-Whitney U test for comparison between groups with and without orthorexia. The comparison of data described as absolute frequencies and percentages was performed by Chi-square. Statistical significance was set at $p < 0.05$.

RESULTS

The sample included in the final statistical analysis was 59 participants, with an average age of 31, 2 ± 8.9 years, 51% were female, mostly white, with the most prevalent profession referred to higher education students (23%) and administrators (20%) and with income up to R $ 2,000.00 (47.4%). As for the BMI (kg / m²), the average was 25.3 ± 3.9.

There was a percentage of orthorexia diagnosed by ORTO-15 of 78% in the total sample, with physically active individuals having a higher prevalence than sedentary ones (86% versus 65%; p = 0.05), there was no difference between genders.

When analyzing food consumption of the total sample (n = 59), separated by the diagnosis of orthorexia, differences were observed between groups regarding carbohydrates consumption as to the % of the total energy value (% TEV) and proteins (g, kcal, % TEV g / kg), with the group with orthorexia consuming a lower percentage of carbohydrates and higher protein values in all evaluated units (table 1).

Table 1. Comparison of food consumption between individuals with and without orthorexia in Porto Alegre-RS, 2018.

	Without orthorexia (n = 15)	With orthorexia (n = 46)	P VALUE
ENERGETIC VALUE (KCAL)	1357 (1166 – 1738)	1637 (1322 – 2020)	0.170
CHO (G)	144 (114 – 206)	145 (103 – 209)	0.694
CHO (KCAL)	576 (458 – 827)	580 (412 – 839)	0.694
CHO (% TEV)	48.1 ± 11	38.4 ± 12	0.013*
CHO (G / KG)	2.18 (1.7 – 3.1)	2.13 (1.358 – 2.8)	0.351
PTN (G)	97.7 (65 – 114)	123 (86 – 178)	0.047*
PTN (KCAL)	390 (258 – 458)	494 (345 – 714)	0.047*
PTN (% TEV)	23 ± 7.9	30.8 ± 9.4	0.008*
PTN / KG	1.21 ± 0.5	1.83 ± 0.9	0.036*
LIP (G)	52.1 ± 29	57.2 ± 20	0.473
LIP (KCAL)	469.2 ± 266.6	514.8 ± 179.9	0.473
LIP (% TEV)	28.8 ± 6	30.8± 7.4	0.394
LIP (G / KG)	0.71 (0.53 – 0.8)	0.72 (0.6 – 1)	0.390
FIBERS (G)	17 (14 – 23)	19 (11 – 23)	0.826

Data presented as median and interquartile range were analyzed using the Mann-Whitney U test. Data presented as mean and standard deviation were analyzed by Student's t test. * Statistical significance was set at $p < 0.05$. Subtitle: CHO: Carbohydrate; PTN: Protein; LIP: Lipid; TEV: total energy value.

When separating the population by the physical activity level (active versus sedentary), it was found that, in the active group, individuals with orthorexia consumed more kilocalories, lower percentage of TEV carbohydrates, higher amounts of proteins and lipids, including saturated fat (table 2). In the sedentary group, there were no significant differences between individuals with and without orthorexia (Table 3).

Table 2. Comparison of food consumption between individuals with and without orthorexia in the sample of physically active people in Porto Alegre-RS. 2018.

	Without orthorexia (n = 15)	With orthorexia (n = 46)	P VALUE
ENERGETIC VALUE (KCAL)	1208 (855 – 1329)	1722 (1350 – 2236)	0.019*
CHO (G)	128 (97 – 181)	143 (109 – 231)	0.504
CHO (KCAL)	515 (388 – 727)	574 (437 – 926)	0.504
CHO (% TEV)	51.0 ± 16.3	38.2 ± 12.8	0.050
CHO (G / KG)	2.18 (1.62 – 2.99)	2.15 (1.52 – 2.88)	0.825
PTN (G)	77.3 (33 – 97)	135 (87 – 195)	0.012*
PTN (KCAL)	309 (131 – 388)	542 (351 – 782)	0.012*
PTN (% TEV)	22.8 ± 9.9	31.4 ± 8.9	0.05
PTN / KG	1.13 ± 0.6	1.98 ± 0.8	0.036*
LIP (G)	32.9 ± 14	59.2 ± 22	0.016*
LIP (KCAL)	296.8 ± 127	533 ± 199	0.016*
LIP (% TEV)	26.2 ± 7	30.4 ± 8	0.286
LIP (G / KG)	0.56 (0.31 – 0.78)	0.86 (0.63 - 1.05)	0.066
SATURATED LIP (G)	10.9 ± 6	19 ± 7	0.036*
SATURATED LIP (% TEV)	8.4 ± 3.6	9.9 ± 3.5	0.395
FIBERS (G)	15.7 (14.5 – 18.2)	19.3 (11.7 – 23.3)	0.563

Data presented as median and interquartile range were analyzed using the Mann-Whitney U test. Data presented as mean and standard deviation were analyzed by Student's t test. * Statistical significance was set at p <0.05. Subtitle: CHO: Carbohydrate; PTN: Protein; LIP: Lipid; TEV: total energy value.

Table 3. Comparison of food consumption between individuals with and without orthorexia in the sedentary sample in Porto Alegre-RS. 2018.

	Without orthorexia (n = 15)	With orthorexia (n = 46)	P VALUE
ENERGETIC VALUE (KCAL)	1567 (1286 – 3084)	1617 (1239 – 1755)	0.728
CHO (G)	169 (132 – 435)	153 (95 – 201)	0.357
CHO (KCAL)	676 (531 – 1741)	613 (379 – 806)	0.357
CHO (% TEV)	46.4 ± 7.7	38.9 ± 11.3	0.111
CHO (G / KG)	2.12 (1.76 – 4.99)	2.01 (1.31 – 2.58)	0.238
PTN (G)	105 (94 – 129)	102 (83 – 132)	0.776
PTN (KCAL)	421 (377 – 518)	410 (334 – 531)	0.776
PTN (% TEV)	23.1 ± 7	29.7 ± 10.7	0.134
PTN / KG	1.33 ± 0.4	1.51 ± 0.8	0.592
LIP (G)	64.1 ± 31	52.9 ± 14.1	0.247
LIP (KCAL)	576.9 ± 279	476.8 ± 127	0.247
LIP (% TEV)	30.5 ± 5.2	31.5 ± 5.7	0.677
LIP (G / KG)	0.72 (0.57 – 0.94)	0.63 (0.5 – 0.73)	0.265
SATURATED LIP (G)	22.8 ± 12.5	17.4 ± 5.3	0.157
SATURATED LIP (% TEV)	10.4 ± 1.5	10.5 ± 3	0.915
FIBERS (G)	17.5 (14 - 41)	18.6 (10 – 21)	0.506

Data presented as mean and standard deviation were analyzed by Student's t test. Statistical significance was set at p <0.05. Subtitle: CHO: Carbohydrate; PTN: Protein; LIP: Lipid; TEV: total energy value.

DISCUSSION

The present study aimed to compare food consumption of individuals with and without orthorexia, to find dietary characteristics that were associated with the risk of developing this disorder. The main results indicate that individuals diagnosed with orthorexia consumed more proteins and had low carbohydrate consumption, making their diet a standard known as "*low carb*". It was also found that physically active individuals had a higher prevalence of orthorexia than sedentary ones, and greater differences in food consumption between groups.

Regarding frequency of orthorexia, studies carried out in Italy,[10] Germany,[11] Sweden,[12] Brazil[13,14] and Australia[15] showed high variation, with low frequencies of 6.9%[11] to 87.2%.[13] In Brazil, a study with 141 Nutrition students in Minas Gerais, found an 87.2% prevalence of orthorexia.[13] While in the southwest of Paraná, Nutrition students obtained 80% prevalence of ortorexia.[14]

It is believed that, as orthorexia is the search for correct eating, currently the media and social networks widely disseminate "*low carb*" strategies as a healthy lifestyle. The *low carb* diet is nothing more than reducing carbohydrates consumption and increasing proteins or fats intake. This diet model gained popularity due to its ability to induce weight loss in short term.[16] Long-term effects of low carbohydrate consumption are still controversial.[17-20] Media's appeal for this type of diet and some research groups that sell this proposal appear to be the triggers for this type of behavior.

There is still no consensus in the literature regarding a low carbohydrate diet as a recommendation for the general population. The PURE study, by the group of Dehghan et al.,[20] evaluated 135,335 individuals aged 35 to 70 years, from 18 countries. It showed that high carbohydrate consumption, from 60% to 70% of TEV, was associated with higher risk of total mortality and non-cardiovascular disease; and total fat consumption was associated with lower mortality risks. By substituting energy derived from carbohydrates for polyunsaturated acids (PUFA), 11% lower risk of mortality was associated; carbohydrates replacement by saturated fatty acids was associated with 20% lower risk of stroke; and finally, replacing carbohydrates by PUFA was associated with 16% lower risk of mortality from cardiovascular disease. Animal protein consumption was associated with lower risk of total mortality; and no significance was found between vegetable protein and total mortality risk. This study's findings indicated that limiting fat consumption is unlikely to improve populations' health; and total fat intake about 35% of TEV, with a concomitant reduction in carbohydrate intake, may decrease the risk of total mortality. Finally, this study addressed that high carbohydrate intake was associated with higher risk of total mortality, while fats, such as saturated and unsaturated fatty acids, were associated with lower risk of total mortality and stroke.[20]

In addition, it was recently published a study,[21] in which 15,428 adults aged 45-64 years from the Atherosclerosis Risk in Communities (ARIC) cohort were followed for 25 years. It was identified that consuming 50-55% percentage of TEV carbohydrates was associated with lower risk of mortality, and the greatest risk was observed with lower consumption of carbohydrates. Mortality risk may also be associated with the type of fat and protein consumed. Individuals who had low carbohydrate consumption along with animal proteins and fats consumption were associated with higher risk of mortality; those who had low carbohydrate intake along with fat and proteins of plant origin consumption were associated with lower risk of mortality.[21]

In another study, there was an association between low carbohydrate intake and higher risk of mortality, in which 42,237 women, aged 30-49 years, in 12-year follow-up.[22] It was found that low carbohydrate consumption and high protein consumption were positively associated with overall mortality, corresponding to an 11% increase. This increase in overall mortality was explained by a 37% raise in cardiovascular mortality associated with total intake of saturated fat, derived from proteins of animal origin.[22]

It can be highlighted that, despite being followed as a dietary pattern considered “healthy” by the lay population and, as found in the present study, performed in individuals with orthorexia, it was observed that in the scientific literature both high and low carbohydrate consumption present mortality risks,[21] being strictly associated with the high consumption of animal proteins and saturated fat.

A recent research with 1,120 Polish university students, aiming to explore people’s eating patterns who are prone to orthorexia, eating disorder symptoms, joint conditions, as well as those who also do not have these conditions.[23] This way, they identified five dietary patterns, as follows: "products with high sugar content and refined products", "meat and meat products", "alcohol", "products with high fiber content and oilseeds" and " meals with dairy products and whole grain bread ". Thus, in agreement with the present study, students described as “with orthorexia and without symptoms of an eating disorder” and “with orthorexia and with an eating disorder” groups were characterized by less frequent consumption of products with a high sugar and refined content.[23]

A cross-sectional survey in northern Italy with 549 subjects found that participants who practiced sport more than 150 minutes a week reported having done or being on a “diet” more expressive, and significant compared to those who did less exercise. However, no differences in food consumption were identified. Prevalence of orthorexia around 70% was found in this study, in which women were more affected than men and people who practiced more minutes per week of sport also.[24]

When assessing presence of orthorexia in physically active individuals, this percentage seems to increase, as identified in the present study. A study with 193 participants carried out in gym, in Portugal, showed a prevalence of orthorexia of 51.8% affecting mainly men.[25] A study by Oberle et al.[26] with 411 university students identified a link between obsession with healthy eating and physical activities in individuals with orthorexia, which is associated with greater time spent on aerobic and strength exercises, and also with higher scores on addiction and compulsion measures. This finding reinforces that individuals with orthorexia are more frequent in those who practice physical activities.[26]

It is important to note that, to the best of our knowledge, this is the first study to assess food consumption and orthorexia in individuals, according to their level of physical activity. Still, it is worth paying attention to the application of the habitual consumption record, which, despite being practical and simpler to analyze, may be a limitation of the study, as the record was self-applicable and reflects only the report of what individuals consider to be the most common of their routines, and there may be underreporting or confusion of information. However, to date, information on food consumption of individuals with orthorexia or at risk for their development is scarce.

This is probably due to the fact that orthorexia is not yet a disorder recognized by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and there is a limited amount of information about it. Further studies are needed to determine the precise characteristics of these individuals' food consumption. Still, it is emphasized that there may be an overestimation of orthorexia, with regard to its cut-off diagnosis, which is already being investigated by recent scientific literature.[11,27]

CONCLUSION

The results of this study suggest that orthorexia may be associated with the practice of physical exercise and eating behavior with greater consumption of proteins and low in carbohydrates. There are still few studies that deal with food consumption of individuals at risk for orthorexia nervosa development. This shows

that more research is needed to identify changes in patients' obsessive-compulsive behavior, which can change the pattern of food consumption and endanger individuals' health.

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dos Santos SK, responsible for project design, article writing, data collection and approval of the final version; D'Avila HF, responsible for the writing, review and approval of the final version; Alves FD, responsible for project design, article writing, statistical analysis and approval of the final version.

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