Studi sperimentali

Orthorexia nervosa in a sample of Italian university population

L’ortoressia nervosa in un campione di popolazione universitaria italiana

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SUMMARY. Aims. To investigate frequency and characteristics of orthorexic behaviours in a large university population. Methods. A total of 2826 individuals volunteered to complete an on-line anonymous form of ORTO-15 questionnaire, a self-administered questionnaire designed and validated to evaluate orthorexic symptomatology. As made in previous studies, an ORTO-15 total score lower than 35 has been used as an optimal threshold to detect a tendency to orthorexia nervosa. A specifically designed form was also used to collect socio-demographic variables. Results. Overall, 2130 students and 696 university employees belonging to University of Pisa (Italy) were assessed. Orthorexic features had a frequency of 32.7%. Females showed a significantly higher rate of over-threshold scores on ORTO-15, a lower BMI, a higher rate of underweight condition and of vegan/vegetarian nutrition style than males. Discussion. Orthorexia nervosa defined as a “fixation on healthy food”, is not formally present in DSM-5. The emergence of this condition as a new, possible prodromal of a psychological syndrome, has been recently emphasized by an increasing number of scientific articles. From our sample of university population emerged that being vegetarian or vegan, under-weight, female, student and being interested in the present study were significantly predictive of orthorexic tendency. Conclusions. Our data contribute to define the new conceptualization of orthorexia nervosa. Further studies are warranted in order to explore the diagnostic boundaries of this syndrome, its course and outcome, and possible clinical implications.

KEY WORDS: orthorexia nervosa, eating disorders, university population, healthy eating, healthy food.


PAROLE CHIAVE: ortoressia nervosa, disturbi dell’alimentazione, popolazione universitaria, mangiare sano, cibo salutare.

INTRODUCTION

The term orthorexia nervosa (ON) refers to individuals highly concerned with proper, safe, healthy nutrition, and the fact that this eating style can be considered a new psychological syndrome has been emphasized by an increasing number of scientific articles in the last few years1. ON is mainly characterized by highly sensitive cognitions and worries about healthy nutrition leading to such an accurate food selection that a correct diet becomes a very relevant part of life. The term orthorexia nervosa, derived from the Greek words orthos (correct) and orexis (appetite), was coined by Bratman2. Individuals with higher tendency to orthorexic symptoms are primarily characterized by nutrition-
Orthorexia nervosa in a sample of Italian university population

al beliefs leading to a greater importance given to the perceived healthiness and nutritional properties rather than to taste and enjoyment of the foods\textsuperscript{3-5}. In some cases there is a strict focus on biological-non dairy vegetarianism, veganism or raw food. The foods quality, source, packaging and processing are daily carefully checked, due to pervasive preoccupations with health from food and the desire to improve one’s own physical health and well-being, often leading to complex eating behaviours requiring long period of time. Apart from meals, a great amount of time is characterized by intrusive, food-related thoughts, with a chronic worry about food flaws and health threats, resulting in a severe distress or impairment of relational, school and work domains\textsuperscript{5-8}.

This condition is not formally present in DSM-5\textsuperscript{9}, neither in the section on disorders requiring more scientific research nor in ICD-10\textsuperscript{10}. Considering the heterogeneity of features above described, it is still object of debate whether ON can be considered a single, defined syndrome or a variance of other syndromes or merely a behavioral culturally-influenced attitude\textsuperscript{11,12}. Moroze et al.\textsuperscript{13} proposed four diagnostic criteria for ON, based on the review of literature\textsuperscript{2,23,24}, under-scoring the fact that these criteria will have to be corroborated from validation studies along the lines of other DSM-5 diagnostic entities before they could be accepted into a future version of the DSM.

In particular, criterion B refers to impairment, caused by obsessional preoccupation of physical health due to an unbalanced diet and specify the severe distress or impairment of social, academic, or vocational functioning owing to obsessional thoughts and behaviors focusing on patient’s beliefs about “healthy eating”. Vandereycken\textsuperscript{13} observed that ON features are a well known diagnostic concept among professional experts in the field of eating disorders, suggesting that ON should be considered as a “genuine syndrome”, worthy of more interest in research and clinical practice. As far as the diagnostic boundaries of ON are concerned, is of note that this condition shows similarities and differences with anorexia nervosa (AN) and obsessive-compulsive disorder (OCD), which are themselves often comorbid\textsuperscript{14,15}. Even if ON and AN share abnormal eating attitudes and behaviours, and ON and AN patients both have a poor insight about the consequences of their disorders\textsuperscript{16,17}, the core beliefs of the two syndromes are different in nature\textsuperscript{18}. As a matter of fact, AN patients are mainly worried about body image, the quantity of food and gaining weight. Their eating pattern is the consequence of the need of losing weight and the self-esteem depends on the weight lost. However, it is of note that severe orthorexic attitude towards food can risk to evolve in AN\textsuperscript{19}. On the other hand, considering OCD, both syndromes share high anxiety traits, need to exert control, perfectionism and concerns about contamination, whereas the most significant difference is the ego-syntonic content of the latter\textsuperscript{18}. As a matter of fact, AN patients are mainly worried about body image, the quantity of food and gaining weight. Their eating pattern is the consequence of the need of losing weight and the self-esteem depends on the weight lost. However, it is of note that severe orthorexic attitude towards food can risk to evolve in AN\textsuperscript{19}. On the other hand, considering OCD, both syndromes share high anxiety traits, need to exert control, perfectionism and concerns about contamination, whereas the most significant difference is the ego-syntonic content of obsessions characterizing individuals with higher tendency to orthorexic symptoms, with a limited insight\textsuperscript{15}.

There is only limited epidemiological information on ON and some methodological problems (small sample size, no data on representative community samples, assessment in high-risk groups) featured these studies, determining as consequence a difficult generalization of the results\textsuperscript{3}. The average prevalence rate of orthorexic symptoms has been found to be 6.9% for the general population and 35-57.8% for high-risk groups (dieticians, nutrition students, other healthcare professionals including medical students, artists, fitness participants and performance artists). To date, very few studies\textsuperscript{10,22} have been carried out to assess prevalence and specific characteristics of orthorexic behaviours in samples of students or of university population. The aim of our study is to investigate frequency and characteristics of tendency to ON in a large university population (students and university employees).

METHODS

This study was conducted form March 2014 to September 2014 upon agreement with University of Pisa Institutional Governance (Rectorate)\textsuperscript{23}. Participants in the study were from Pisa’s Athenaem and were enrolled from the whole students and university employed population. Overall, 2826 individuals volunteered to complete an on-line anonymous form of ORTO-15 questionnaire. The request to participate and the description of purposes of the study were posted on a university web site. Volunteers did not receive any kind of payment or complementary gift for participating in the survey. In addition to the questionnaire, an appropriate self-report form was used to collect socio-demographic variables. An informed consent was obtained textually to the material sent on-line to each participant. Data were retrieved in a database for statistical analyses.

Instruments

The ORTO-15

The ORTO-15 is a questionnaire developed for the assessment of orthorexic symptoms and consists of 15 multiple-choice items\textsuperscript{3}. The test was created starting from a previously existing model used by Bratman on a population in the USA\textsuperscript{23}. Answers that indicated a tendency to ON were given a score of “1”, while the “healthier” ones had a score of “4”. The sum of the scores was the final score of the test. The threshold value of the ORTO-15 questionnaire was based on the study sample (404 subjects)\textsuperscript{12,14}. The total structure of the test and of the single questions was obtained at the end of a series of preliminary questionnaires that were reviewed, after administration to “pilot” samples. The ORTO-15 items aim to investigate typical pathological behavioral patterns as well as cognitive and emotional features of this condition\textsuperscript{12}. Authors proposed different cut-offs (i.e. <35, <40) but an ORTO-15 <35 score has been found to ensure the best predictive capability to correctly identify orthorexic symptoms through the highest sensitivity (86.5%), specificity (94.2%) and negative predictive value (91.1%) among the tested cut-offs\textsuperscript{16,26-28}. Therefore the ORTO-15 showed a good reliability and validity, including internal consistency\textsuperscript{13}. In the present study, according to previous research\textsuperscript{24}, the most restrictive threshold has been adopted (<35), to guarantee the highest specificity for orthorexic behaviours in a population of university students and employees.

Statistical analyses

We utilized Chi-square tests to compare rates of: satisfaction, underweight subjects, subjects with ON, vegan and vegetarian subjects observed in the different demographic categories. We utilized T-tests for unpaired data to compare the mean levels of BMI and Orto-15 total score observed in the different demographic
RESULTS

A spontaneous enrollment included a total of 2826 subjects. Of these, 2130 (75.4%) were student and 696 (24.6%) were employees (teachers, technical or office workers). Overall, 82.9% individuals of the whole sample of responders expressed a positive assessment of the project (Table 1).

A 40.6% of males and a 59.4% of females composed our sample. Age ranged from 18 to 70 years, with a mean age of 28.9±11.39 years. To perform statistical analyses with the aim of evaluating possible significant differences depending on age range, we decided to use the third quartile of age distribution as cut-off variable, splitting the sample in subjects with ≤29 years and ≥30 years.

We found that the 78% of the sample previously attended “lyceum” (an university-oriented type of high school), while the 22% attended a professional/technical type of high school. Regarding to parents, 2149 subjects (76%) stated that at least one of their parents attended more than 8 years of school. The mean BMI value among the sample was 22.55±3.63, with a 7.2% of underweight, a 75% of healthy weight and a 17.8% of overweight individuals. The vegetarian/vegan diet seemed to be significantly represented among responders (11.1%). Finally, the ORTO-15 score ranged from 21 to 53 points, with a mean value of 37.3±4.14. According to the <35 threshold, 32.7% presented higher tendency to ON (Table 1).

As previously described, we compared, among demographic categories, rates of response, satisfaction, underweight, presence of orthorexic symptoms, vegan/vegetarian nutrition style rate and the mean levels of BMI and ORTO-15 total score. Females showed a significantly higher rate of vegan/vegetarian nutrition style (13.8% vs 7.1%), a significantly higher rate of <35 score on ORTO-15 (35.3% vs 28.9%) and a significantly lower total mean score on the questionnaire than males (36.96±4.23 vs 37.38±3.98), a lower BMI index (21.91±3.83 vs 23.40±3.07) and a higher rate of underweight condition (10.5% vs 28.9%). Furthermore, among females there was a wider spread of positive assessment for the project (88.1% vs 76.2%) than males (Table 3 and 4). Regarding to age, we found that in the group with ≤29 years of age there was a higher rate of subjects with orthorexic symptoms compared to older ones (34.3% vs 27.9%) and a lower mean score on ORTO-15 (36.99±4.23 vs 37.59±3.80) and BMI index (22.20±3.49 vs 23.65±3.82). Furthermore in this group (≤29 years), underweight individuals were significantly more represented (8.3% vs 3.8%) than older ones (Table 2 and 3).

Regarding to professional role, students showed a higher frequency of orthorexic symptoms compared to university employees (34.9% vs 26.1%) and a lower ORTO-15 score (36.93±4.23 vs 37.74±3.79), as well as a lower BMI (22.5±3.55 vs 22.63±3.65) and a higher percentage of underweight subjects (8.1% vs 4.5%) (Table 2 and 3). We found that subjects who had previously attended “lyceum” or with a parent education level of > 8 school years more frequently showed a lower ORTO-15 score (37.04±4.12 vs 37.46±4.19) and BMI 37.01±4.16 respectively), a lower mean BMI (22.38±3.54 vs 23.15±3.86 and 22.39±3.66 vs 23.07±3.48 respectively) and a higher underweight rate (8.1% vs 4.2% and 7.9% and 5.0% respectively) (Table 2 and 3).

Regarding to nutrition styles, vegetarian or vegan subjects showed a lower mean BMI (21.94±3.40 vs 22.63±3.65) and were more frequently underweight (10.2% vs 6.8%) compared with subjects with an omnivorous diet. Moreover, vegetarian or vegan subjects showed lower scores on ORTO-15 (35.23±4.81 vs 37.37±3.98) and a significantly higher rate of orthorexic symptoms (53% vs 30.2%) (Table 3).

Finally, with respect to positive/negative appreciation of the survey, subjects who gave positive judgment reported a higher underweight rate (7.8% vs 4.7%), lower BMI (22.46±3.68 vs 22.96±3.55), a higher rate of orthorexic symp-
Orthorexia nervosa in a sample of Italian university population

Table 2. Categorical outcome variables: groups’ comparisons.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Vegan/vegetarian n (%)</th>
<th>Underweight n (%)</th>
<th>Orthorexia symptoms n (%)</th>
<th>Project appreciated n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤29 years</td>
<td>240 (11.2)</td>
<td>178 (8.3)</td>
<td>734 (34.3)</td>
<td>1777 (83.2)</td>
</tr>
<tr>
<td>&gt;29 years</td>
<td>73 (10.7)</td>
<td>26 (3.8)</td>
<td>191 (27.9)</td>
<td>565 (83.3)</td>
</tr>
<tr>
<td>χ², p</td>
<td>0.11, p=.740</td>
<td>64.75, p&lt;.001</td>
<td>9.37, p=.002</td>
<td>0.00, p=.998</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>82 (7.1)</td>
<td>28 (2.4)</td>
<td>332 (28.9)</td>
<td>872 (76.2)</td>
</tr>
<tr>
<td>Females</td>
<td>231 (13.8)</td>
<td>176 (10.5)</td>
<td>593 (35.3)</td>
<td>1470 (88.1)</td>
</tr>
<tr>
<td>χ², p</td>
<td>29.69, p&lt;.001</td>
<td>64.75, p&lt;.001</td>
<td>12.47, p&lt;.001</td>
<td>68.95, p&lt;.001</td>
</tr>
<tr>
<td>Professional role</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>240 (11.3)</td>
<td>173 (8.1)</td>
<td>743 (34.9)</td>
<td>1780 (83.8)</td>
</tr>
<tr>
<td>University personnel</td>
<td>73 (10.5)</td>
<td>31 (4.5)</td>
<td>182 (26.1)</td>
<td>562 (81.4)</td>
</tr>
<tr>
<td>χ², p</td>
<td>0.25, p=.618</td>
<td>9.99, p=.002</td>
<td>17.78, p&lt;.001</td>
<td>1.97, p=.160</td>
</tr>
<tr>
<td>High schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liceum</td>
<td>231 (10.5)</td>
<td>178 (8.1)</td>
<td>727 (33.0)</td>
<td>1832 (83.5)</td>
</tr>
<tr>
<td>Technical/professional</td>
<td>82 (13.2)</td>
<td>26 (4.2)</td>
<td>196 (31.8)</td>
<td>510 (82.4)</td>
</tr>
<tr>
<td>χ², p</td>
<td>3.33, p=.068</td>
<td>10.42, p=.001</td>
<td>0.24, p=.622</td>
<td>0.35, p=.554</td>
</tr>
<tr>
<td>Parents’ educational level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤8 years</td>
<td>84 (12.4)</td>
<td>34 (5.0)</td>
<td>205 (30.3)</td>
<td>571 (84.8)</td>
</tr>
<tr>
<td>&gt;8 years</td>
<td>229 (10.7)</td>
<td>170 (7.9)</td>
<td>720 (33.5)</td>
<td>1771 (82.8)</td>
</tr>
<tr>
<td>χ², p</td>
<td>1.43, p=.232</td>
<td>5.99, p=.014</td>
<td>2.29, p=.131</td>
<td>1.45, p=.228</td>
</tr>
</tbody>
</table>

In the literature, there is no agreement in ascribing ON to a specific gender. Some studies reported a significant gender differences whereas others showed a higher prevalence of orthorexic symptoms among males. Our data are aligned to those studies indicating a higher frequency of orthorexic features in females than in males, with a frequency of 43.6% among undergraduate students. However, males’ prevalence was still high, with a rate of 21.7% using a more stringent cut-off of <40 and a rate of 21% using a cut-off of <50 at the ORTO-15. Moreover, Segura-Garcia et al. found a prevalence rate of orthorexic symptoms of 28% in an athlete’s sample, whereas Bo et al. reported a rate of 34% in a sample of university students. In our study, the prevalence rate of orthorexic symptoms was 34% in a sample of university students.

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DISCUSSION

This study evaluated the frequency of ON in a large university population, including students from all Degree Courses, as well as university personnel (teachers and technical-administrative). We collected data that were heterogeneous in terms of type of degree courses, age range, educational level and other demographic variables, with respect to previous studies carried out among university students from health education faculties (Medicine, Nutritional Science, Biology, Sport Sciences) or on specific high-risk populations (dietitians, yoga practitioners, athletes, performing artists, fitness participants). Overall, in our study, 32.7% of participants presented symptoms of ON using a cut-off point <35 at the ORTO-15 total score. Donini et al. found that using a threshold score of 35 points, the questionnaire had an efficacy of 86.5%, with a high specificity (94.2%) and a high negative predictive value (91.1%). Ranci et al. in a study on general population, found a frequency rate of orthorexic behaviours of 57.6% using a cut-off of <40 and a rate of 21% using a more stringent cut-off of <35 at the ORTO-15. Moreover, Segura-Garcia et al. found a prevalence rate of orthorexic symptoms of 28% in an athlete’s sample, whereas Bo et al. reported a rate of 34% in a sample of university students. In our study, the prevalence rate of orthorexic symptoms was 34% in a sample of university students.
Table 3. Quantitative outcome variables: groups’ comparisons.

<table>
<thead>
<tr>
<th>Groups</th>
<th>BMI mean±SD</th>
<th>ORTO-15 Total score mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age classes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤29 years</td>
<td>22.70±3.49</td>
<td>36.99±4.23</td>
</tr>
<tr>
<td>&gt;29 years t, p</td>
<td>23.65±3.82</td>
<td>37.59±3.80</td>
</tr>
<tr>
<td></td>
<td>-8.85, p&lt;.001</td>
<td>-3.50, p&lt;.001</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>23.40±3.07</td>
<td>37.38±4.98</td>
</tr>
<tr>
<td>Females</td>
<td>21.91±3.83</td>
<td>36.96±4.23</td>
</tr>
<tr>
<td></td>
<td>12.18, p&lt;.001</td>
<td>2.70, p=.007</td>
</tr>
<tr>
<td>Professional role</td>
<td></td>
<td></td>
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<tr>
<td>Students University personnel</td>
<td>22.25±3.55</td>
<td>36.93±4.23</td>
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<td>23.47±3.70</td>
<td>37.74±3.79</td>
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<td>-7.59, p&lt;.001</td>
<td>-4.76, p&lt;.001</td>
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<tr>
<td>High schools</td>
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<td>Licent</td>
<td>22.38±3.54</td>
<td>37.04±4.12</td>
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<tr>
<td>Technical/professional</td>
<td>23.15±3.86</td>
<td>37.46±4.19</td>
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<td>-4.48, p&lt;.001</td>
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<td>Parents’ educational level</td>
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<tr>
<td>≤8 years</td>
<td>23.07±3.48</td>
<td>37.53±4.16</td>
</tr>
<tr>
<td>&gt;8 years</td>
<td>22.39±3.66</td>
<td>37.01±4.12</td>
</tr>
<tr>
<td></td>
<td>4.29, p&lt;.001</td>
<td>2.85, p=.004</td>
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<tr>
<td>Type of diet</td>
<td></td>
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<tr>
<td>Standard vegan/vegetarian</td>
<td>22.63±3.65</td>
<td>37.37±3.98</td>
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<td></td>
<td>21.94±3.40</td>
<td>35.23±4.81</td>
</tr>
<tr>
<td></td>
<td>3.13, p=.002</td>
<td>7.55, p&lt;.001</td>
</tr>
<tr>
<td>Weight</td>
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<tr>
<td>Underweight</td>
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<td>Normal weight</td>
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</tr>
<tr>
<td>Orthorexia symptoms*</td>
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<tr>
<td>Present</td>
<td>22.54±3.61</td>
<td>-36.38±4.36</td>
</tr>
<tr>
<td>Absent</td>
<td>22.65±3.63</td>
<td>37.19±4.11</td>
</tr>
<tr>
<td></td>
<td>-2.13, p=.033</td>
<td>-2.69, p=.007</td>
</tr>
<tr>
<td>Appreciation of the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22.46±3.68</td>
<td>36.95±4.11</td>
</tr>
<tr>
<td>No</td>
<td>22.96±3.55</td>
<td>38.01±4.19</td>
</tr>
<tr>
<td></td>
<td>-2.73, p&lt;.001</td>
<td>-5.10, p&lt;.001</td>
</tr>
</tbody>
</table>

*pThe presence of orthorexia symptoms was based on the ORTO-15 test using 35-score threshold.

Table 4. Binary logistic regression analysis to predict presence of Orthorexia symptoms based on ORTO-15 test using 35-score threshold.

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>Odds ratio</th>
<th>C.I. 95%</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.175</td>
<td>1.191</td>
<td>1.004-1.412</td>
<td>.044</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.001</td>
<td>0.999</td>
<td>0.987-1.011</td>
<td>.880</td>
</tr>
<tr>
<td>Type of diet</td>
<td>0.922</td>
<td>2.514</td>
<td>1.975-3.201</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>High schools</td>
<td>-0.020</td>
<td>0.980</td>
<td>0.800-1.201</td>
<td>.849</td>
</tr>
<tr>
<td>Professional role</td>
<td>-0.365</td>
<td>1.440</td>
<td>1.058-1.960</td>
<td>.020</td>
</tr>
<tr>
<td>Parents’ educational Level</td>
<td>0.106</td>
<td>1.112</td>
<td>0.910-1.359</td>
<td>.300</td>
</tr>
<tr>
<td>Appreciation of the project</td>
<td>0.352</td>
<td>1.422</td>
<td>1.130-1.789</td>
<td>.003</td>
</tr>
<tr>
<td>Weight categories*</td>
<td>0.330</td>
<td>1.391</td>
<td>1.031-1.876</td>
<td>.031</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.213</td>
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<td></td>
<td>.227</td>
</tr>
</tbody>
</table>

*munderweight vs normal weight

less caloric food, and are, on average, more influenced by the media. As a confirm of these observations, Brytek-Matera et al.22, in a sample of university students, indicated that in females a strong preoccupation with healthy eating was positively correlated with appearance evaluation and body areas satisfaction. This relationship could indicate that as female student’s satisfaction with the size and physical attractiveness is improved, their preoccupation with healthy food increases.

Notwithstanding, the fact that ON was present among male university population deserves some comments. Raccagni et al.16 hypothesized that ON in men may be apparently related to issues regarded health. Indeed, men take care of themselves healthfully, following socially and culturally accepted terms of beauty. A different, but not alternative hypothesis is that orthorexic behaviors in males, especially in youngsters, is associated to an attitude with obsessive-compulsive personality features and polarization to “male ideals” as muscularity, strength, power and athleticism24.

The presence in our sample of a lower BMI index and a higher rate of underweight in females, as compared to males, raises a more specific question on whether ON may have a “common core” with anorexia. Phenomenology of eating disorders has been changing over time and concerning this, Segura-García et al.27 reported that orthorexic prodromal symptoms were highly prevalent among patients with anorexia or bulimia and tended to increase after treatment. These authors warrant further studies to clarify whether ON may be associated with clinical improvement of anorexia or bulimia or represents residual symptomatology responsible for a greater number of relapses and recurrences of eating disorders. In our sample, most subjects with higher tendency to orthorexic symptoms showed a lower BMI than those
Orthorexia nervosa in a sample of Italian university population

without ON. One reason explaining this association might be that subjects with obsession for healthy foods, loose moderation and balance in their feeding, ending up to present loss of body weight and reduction of their BMI. These individuals might seem generally less concerned about their weight, appearing more interested in food quality rather than in food quantity, if compared to subjects with anorexia. However, it has been noted that, in some cases, weight loss could become a significant feature, with the possible risk of shifting towards spurious forms of anorexia. In this regard, Vandereycken et al. described some cases arrived to malnutrition and sometimes to underweight, resembling this clinical picture similar to anorexia, after a selective and restrictive eating pattern.

The relationship between specific nutrition styles and development of ON has been described in literature. Some studies reported correlations with being generically on a diet or seeking healthy food or showing restrictive behaviors and weight control tendency. Interestingly, recent models of eating disorders emphasize the importance of rumination thinking in the occurrence of unhealthy eating behavior. Rudiger and Winstead have demonstrated body-related co-rumination to be related to body-related cognitive distortions and disordered eating in 203 young adult women. Most recently, Naumann et al. showed that rumination led to a significant increase of desire to abstain from eating in a group of patients with anorexia and of desire to binge in patients with bulimia nervosa. These studies suggest a detrimental effect of rumination on eating-related symptoms in eating disorders that we argue should be further addressed in ON.

In our study, we found a rate of vegetarians and vegans of 6.9% and of 1.7%, respectively. These rates are similar to those found in general population (6.5% and 0.6%). These two styles were more widely represented in students and administrative/technical employees than in academic groups. In addition, vegetarian/vegan subjects showed a higher rate of orthorexic symptoms and underweight, than the omnivorous individuals. Data from our survey, confirm previous results concerning an association between ON and specific nutrition styles (vegetarianism, veganism, raw foodists and macrobiotics).

As mentioned above, we splitted the sample in two ranges of age (subjects with ≤29 years and ≥30 years). Our data suggest that symptoms of ON are more common among individuals with less than 30 years of age who are mainly students, characterized by a high level of education. We, therefore, agree with previous studies suggesting a correlation between tendency to ON, young age and good level of schooling. Other studies showed no significant differences in distribution of ON depending on age only one study, to our knowledge, found a higher prevalence of ON in older age (36–47). Despite several strengths of our study, there are some unavoidable limitations. First, this is not an epidemiological study and, therefore, our data are not representative of the general population. Furthermore the fact that this study was carried out in a single university could restrict the generalizability of our results to the entire Italian university population. The study may contain a selection bias due to the higher appreciation of the project (overall 82.9% of individuals of the whole sample of responders expressed a positive assessment) and therefore possible greater sensibility and interest to orthorexia showed by responders with respect to non-responders. A further limitation is that the use of only one questionnaire evaluating orthorexic features, did not permit us to evaluate the relationship between ON and other psychopathological dimensions, as obsessive-compulsive disorder and AN. Indeed, preoccupations with food in individuals with higher tendency to orthorexic symptoms has been reported to be associated to the presence of obsessive-compulsive symptoms, whereas eating concerns and restraint, adherence to the diet as a value for self-esteem, deviation from the diet as an index of relevant loss of control have been considered shared features by AN and ON individuals.

In conclusion, most striking results of our study are provided by logistic regression analysis showing that female gender, younger age range, being student, being vegetarian/vegan and underweight, were the factors significantly predictive of ON.

Further studies are warranted in order to explore the diagnostic boundaries of this syndrome, its course and outcome, and the possible therapeutic strategies.

Conflict of interest: the authors report no conflicts of interest in this work.

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