BRIEF REPORT

Orthorexia nervosa: Validation of a diagnosis questionnaire

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ABSTRACT. Aim: *To validate a questionnaire for the diagnosis of orthorexia nervosa, an eating disorder defined as "maniacal obsession for healthy food".* **Materials and Methods:** *525 subjects were enrolled. Then they were randomized into two samples (sample of 404 subjects for the construction of the test for the diagnosis of orthorexia ORTO-15; sample of 121 subjects for the validation of the test). The ORTO-15 questionnaire, validated for the diagnosis of orthorexia, is made-up of 15 multiple-choice items.* **Results and Conclusion:** *The test we proposed for the diagnosis of orthorexia (ORTO 15) showed a good predictive capability at a threshold value of 40 (efficacy 73.8%, sensitivity 55.6% and specificity 75.8%) also on verification with a control sample. However, it has a limit in identifying the obsessive disorder. For this reason we maintain that further investigation is necessary and that new questions useful for the evaluation of the obsessive-compulsive behavior should be added to the ORTO-15 questionnaire.*

(Eating Weight Disord. 10: e28-e32, 2005).

INTRODUCTION

For some time now, the mass-media and experts in the field of nutrition have noticed a new eating behavior disorder not yet recognized as a disease by DSM IV, called "orthorexia nervosa (ON)" (1-5).

Generally, orthorexia can be considered when the eating disorder is long-term and not transitory, and when such behavior has a significant negative impact on the quality of life of the individual (3, 4, 6-9). In extreme cases, orthorexic subjects prefer to starve themselves rather than to eat food they consider "impure" and harmful to their health (3, 6-9).

In view of these considerations, orthorexia may be considered to be a more or less serious personality or behavioral disorder that has very little to do with trends or behaviors linked to religious or philosophical customs.

In a previous work (10) we verified the prevalence of the orthorexia phenomenon diagnosed with a questionnaire on eating habits and the presence of obsessive-phobic personality traits.

Of the 404 subjects examined, 28 were found to suffer from ON (prevalence of 6.9%).

The aim of this work was to validate a questionnaire for the diagnosis of orthorexia nervosa that could be easily administered.

MATERIALS AND METHODS

Sample selection

The study was carried out at the Institute of Food Sciences, University of Rome "La Sapienza", directed by Prof. Carlo Cannella between February and August 2001.

Enrolment of volunteers and the collection of data were both carried out by trained personnel in the field of Food Science and Research on Eating Behavior. 525 subjects were enrolled. Spontaneous enrolment gave us subjects with various different occupational characteristics: employees came from the Institute of Biochemistry "La Sapienza" University, from the Ministry of the Italian Air Force, from the Sat 2000 television channel; students enrolled at the Plinio Scientific High School and at "La Sapienza" University; parents of children in the 4th class of the San Giuseppe Junior School and parents of patients attending the Pediatric Dietetics Service at the Umberto I Hospital in Rome; a group of residents from Frosinone, near Rome, etc, etc.

Subjects under the age of 16 were excluded because they were considered insufficiently autonomous in the choice of their food.

The 525 subjects were divided into two samples upon randomization:
- sample of 404 subjects for the set-up of a

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questionnaire for the diagnosis of orthorexia (ORTO-15);
- sample of 121 subjects for the validation of the ORTO-15 test.

The characteristics of the sample of 404 subjects were described in an earlier prevalence study (10).

In this study, we defined 4 groups of subjects on the basis of their eating behavior (assessed using a questionnaire on eating habits, with special emphasis on the choices between food normally considered "healthy" and unhealthy, done by the subjects) and obsessive-phobic personality traits, using the Minnesota Multiphasic Personality Inventory (11). Based on the concept that ON is a disorder characterized by a combination of eating, behavioural and obsessive-phobic personality traits, we diagnosed ON in the presence of both:

- "health fanatic" eating habits. In particular we emphasized the choice made by the subject of food normally considered "healthy" (fresh, wholemeal, biological produce….) and that not normally considered healthy (frozen, tinned….). To classify each food group selected (cereals, milk, meat, fish, vegetables, fruit, fast-food, snacks, sweets and biscuits, drinks), a points system was used which awarded "0" for eating behaviour considered "healthy" and "1" for "non healthy". The final result was the ratio of the sum of points awarded for each single item with the maximum of points that each subject could obtain without including the items to which we failed to obtain a response. From the distribution of points obtained it was decided to consider those subjects who were classified below the 25th percentile (score <0.57) as "health fanatic"
- obsessive-compulsive traits and phobia linked to the personality of the subject, based on scale 7 of the MMPI test considering a score of >65 for women and >66 for men as modified.

By this way we found 4 groups of subjects:

1. normal eating behavior and MMPI
2. normal eating behavior and pathological MMPI
3. "healthy" eating behavior and normal MMPI
4. "orthorexic" in which "healthy" eating behavior is associated with a pathological MMPI

The ORTO-15 questionnaire for the diagnosis of orthorexia

The ORTO-15 questionnaire, a tool for the diagnosis of orthorexia and made-up of 15 multiple-choice items, was constructed. The test was created starting from a previously existing model used by Bratman on a population in the U.S.A. (3). 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 (Table 1).

Answers that indicated orthorexia 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.

We defined the threshold value of the ORTO-15 questionnaire based on the study sample (404 subjects). This value could give a diagnosis of orthorexia comparing the score of the four groups of subjects defined on the basis of their eating behavior and the MMPI score.

Validation of the ORTO-15 test

Thus, we validated the ORTO-15 test on the sample of 121 subjects and the related threshold value identifying agreement with the results with the diagnosis of orthorexia (true positives, true negatives, false positives, false negatives). We measured the predictive capability for diagnosing orthorexia through the calculation of efficacy (agreement between the response to the test and the "truth"), sensitivity (incidence of true positives on the totality of the positives: capability of the test to single out the orthorexic subjects identifying the positive cases and avoiding the false negatives), specificity (incidence of true negatives on the totality of the negatives: capability of the test to identify healthy subjects considering only the true positives as positive and avoiding false positives), positive predictive value (probability of being sick in presence of a positive test) and negative (the probability that the subject has not got the disorder when the test is negative).

Elaboration of data

Student t test and ANOVA were used to assess differences in group means. Statistical significance was set at the $p<0.05$ level. To identify optimal threshold values for predicting Orthorexia, receiver-operating-characteristics (ROC) curve analysis was performed by computing the sensitivity and 1-specificity of the test at various cut-off levels. The area under the ROC curve was evaluated. A value of 0.5 under the ROC curve indicates that the variable performs no better than chance while a value of 1.0 indicates perfect discrimination (12, 13). Data were collected and analysed using SPSS software for Windows 10.0 (SPSS Inc 1989-1999) and Win Episcope 2.0 [Facultad de Veterinaria de Zaragoza (E) Wageningen University (N), University of Edinburgh (GB)].

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TABLE 1
Test for the diagnosis of orthorexia nervosa.

ORTO-15	Always	Often	Sometimes	Never
1) When eating, do you pay attention to the calories of the food?	O	O	O	O
2) When you go in a food shop do you feel confused?	O	O	O	O
3) In the last 3 months, did the thought of food worry you?	O	O	O	O
4) Are your eating choices conditioned by your worry about your health status?	O	O	O	O
5) Is the taste of food more important than the quality when you evaluate food?	O	O	O	O
6) Are you willing to spend more money to have healthier food?	O	O	O	O
7) Does the thought about food worry you for more than three hours a day?	O	O	O	O
8) Do you allow yourself any eating transgressions ?	O	O	O	O
9) Do you think your mood affects your eating behavior?	O	O	O	O
10) Do you think that the conviction to eat only healthy food increases self-esteem?	O	O	O	O
11) Do you think that eating healthy food changes your life-style (frequency of eating out, friends, ...)?	O	O	O	O
12) Do you think that cosuming healthy food may improve your appearance?	O	O	O	O
13) Do you feel guilty when transgressing ?	O	O	O	O
14) Do you think that on the market there is also unhealthy food?	O	O	O	O
15) At present, are you alone when having meals?	O	O	O	O

SCORING GRID FOR ORTO-15 TEST RESPONSES

ITEMS	RESPONSES			
	Always	Often	Sometimes	Never
2-5-8-9	4	3	2	1
3-4-6-7-10-11-12-14-15	1	2	3	4
1-13	2	4	3	1

RESULTS

Identification of a threshold value and of the predictive value of the ORTO-15 test

The variance analysis showed a statistically significant difference in the ORTO-15 score between the different groups of subjects (F=11.9, p=0.000) (Table 2).

We noted particularly how in groups with "healthy" eating behavior the ORTO-15 score is significantly lower (39.3±4 vs 42.3±4; t=5.9, p=0.000), while the differences are less marked and not statistically significant as a function of the MMPI class (pathological 41.1±5, non pathological 41.7±4; t=1.1, p=0.3).

We tested three different threshold values for ORTO-15 as a function of the scores obtained by the different groups of subjects: <35, <40, <45. Below these cut-offs the test is supposed to give a diagnosis of orthorexia (Table 3).

We calculated the predictive value of the test in differentiating the orthorexic subjects from healthy ones as a function of those threshold values (Table 4).

At a threshold value of 35 points the test has an efficacy of 86.5%, with a high specificity (94.2%) and a high negative predictive value (91.1%). When the threshold value increases, the sensitivity increases too (55.6% at 40 points and 85.2% at 45 points), while specificity and efficacy decrease. At the cut-

TABLE 2
Mean of scores on the ORTO-15 test for the different groups of subjects of the study sample.

	Score of ORTO-15 (Mean±SD)
Orthorexic	39.4±4
Normal eating behavior and pathological MMPI	41.9±4
"Healthy" eating behavior and normal MMPI	39.3±4
Normal eating behavior and normal MMPI	42.4±4

TABLE 3
Distribution of orthorexic and non-orthorexic subjects, according to ORTO-15 with different threshold values, in study and validation samples.

	Study Sample		Validation Sample	
	Positive	**Negative**	**Positive**	**Negative**
Threshold Value Orto-15: <35				
Orthorexic	5	22	0	3
Normal eating behavior and pathological MMPI	5	57	2	25
Pathological eating behavior and normal MMPI	11	53	4	32
Normal eating behavior and normal MMPI	14	226	3	50
Threshold Value Orto-15: <40				
Orthorexic	15	12	3	0
Normal eating behavior and pathological MMPI	15	47	8	19
Pathological eating behavior and normal MMPI	30	34	11	25
Normal eating behavior and normal MMPI	58	182	14	39
Threshold Value Orto-15: <45				
Orthorexic	23	4		
Normal eating behavior and pathological MMPI	44	18		
Pathological eating behavior and normal MMPI	58	6		
Normal eating behavior and normal MMPI	164	76		

Note: 11 subjects of the study sample did not complete the ORTO-15 test

off point of 45 the test becomes unreliable since its efficacy is of 37.4%.

Validation of the ORTO-15 test

The ORTO-15 test and the previously selected threshold values (<35 ed <40), were applied to the validation sample (Table 3). The results confirmed the substantial validity of the test only for the threshold value of 40 points (sensitivity 100.0%, specificity 73.6%, positive predictive value 17.6%, negative predictive value 100%) (Table 4).

Instead, at a threshold value of 35 the test had a sensitivity and a positive predictive value of 0%.

The area under the ROC curve, representing the overall accuracy of the ORTHO-15 test as a test for the diagnosis of ON was found to be 0.696 (95% CI: 0.585-0.807).

DISCUSSION

The first to speak out about orthorexia was Dr. Steven Bratman, author of the book "Health–Food Junkies"(3).

The desire to eat healthy foods is not a disorder in itself, but an obsession for these foods, along with a loss of moderation and balance and the withdrawal from life caused by this food habit, may then lead to orthorexia.

The orthorexic sufferer spends a great deal of his time thinking about food, frequently dedicating his whole existence to the planning, purchase, preparation and consumption of the food that he considers healthy. His eating behavior becomes the only one possible, and generates a feeling of superiority over the lifestyle and eating habits of others.

Selection of sample subjects

As far as the subjects for the study are concerned, a defect in the selection method must be pointed out, since the subjects completed the questionnaire only on the basis of voluntary enrolment. This could limit the possibility of extending the results to apply to the entire population, and consequently implies the necessity of further studies.

TABLE 4
Predictive value of ORTO-15 in giving the diagnosis of orthorexia in the validation and study samples.

	Study Sample					Validation Sample				
Threshold Values Orto-15:	**Efficacy**	**Sensitivity**	**Specificity**	**Positive predictive value**	**Negative predictive value**	**Efficacy**	**Sensitivity**	**Specificity**	**Positive predictive value**	**Negative predictive value**
	%	%	%	%	%	%	%	%	%	%
<35	86.5	18.5	94.2	26.3	91.1	89.3	0.0	94.3	0	94.3
<40	73.8	55.6	75.8	20.5	93.8	75.0	100.0	73.6	17.6	100.0
<45	37.4	85.2	31.7	12.3	95.0					

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The test for the diagnosis of orthorexia: ORTO-15

To construct the test for the diagnosis of orthorexia we started with the study of Bratman on the US population (3). The test done by Bratman is made up of 10 items with a dichotomous choice (YES/NO). The number of YES answers increases with the degree of orthorexia.

Instead, our test was made-up of 15 closed multiple choice items (always, often, sometimes, never). The items investigate the obsessive attitude of the subjects in choosing, buying, preparing and consuming food they consider to be healthy.

We kept some items from Bratman's test (1, 3, 7, 8, 9, 10) even though some verbal aspects of them were modified. We disguised some excessive assertiveness since, in our opinion, they could induce obvious answers.

For example, item 10 of Bratman that states: "when eating in a correct way do you feel a sense of total control?", could imply an affirmative answer, but also a negative one for opposition. Our reformulation of the question ("do you allow yourself any eating transgressions?") asks the subject a definition of his/her behavior in a less rigid form and gives him/her a scale of values that goes from "always" to "never".

In our opinion, this makes the test responses more truthful. Also the rigidity of the response (YES/NO) of Bratman's test did not appear to be useful for us for our Latin sample, that is socially more dialectic and, therefore, more prone to modulate the behavior in a scale of value that goes from "always" to "never", than an Anglo-Saxon one.

We wanted to use the test to investigate both the emotional and the rational aspects of the subjects to whom it was administered: some items keep to the cognitive-rational area (1, 5, 6, 11, 12, 14), other ones to the clinical area (3, 7-9, 15), and others to the emotional area (2, 4, 10 and 13).

We then gave a score of "1" to the response that was more indicative of orthorexia and that of "4" to those that indicated a normal eating behavior. We added everything up to obtain the final test score and, as predictable, subjects with healthy eating behavior had a lower score.

Then we identified the threshold value below which the diagnosis of orthorexia could be given. A cut-off of 40 was considered to be more predictive either in the study sample (sensitivity 55.6%, specificity 75.8%, positive predictive value 20.5%, negative predictive value 93.8%) or in the validation one (sensitivity 100.0%, specificity 73.6%, positive predictive value 17.6%, negative predictive value 100.0%). Cut-off point values can be set depending on the purpose for which the scales are used. For diagnosis purposes, as it is in this case, a high specificity is generally required whereas screening purposes require a high sensitivity.

We found that the test has a threshold value of 40 points and a notable predictive capability concerning healthy eating behavior, while it is less efficient in discriminating the other component in the diagnosis of orthorexia, that is the presence of obsessive traits. In fact, the mean score of the test does not vary significantly as a function of the MMPI class (pathological/non pathological).

Therefore, we maintain that further investigation is necessary and that new questions useful for the evaluation of the obsessive-compulsive behavior should be added to the ORTO-15 questionnaire.

Please note that the original test validated is in Italian and the present version was translated into English for editorial purposes. This version needs further validation in an Anglo-Saxon population.

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