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Is orthorexia nervosa a feature of obsessive-compulsive disorder? A multicentric, controlled study

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Short title Overlap between orthorexia and obsessive-compulsive symptoms

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Abstract

Purpose The term Orthorexia Nervosa (ON) was coined to describe altered thoughts and behaviours related to healthy eating. The prevalence of ON was found to scale up to almost 90% among high-risk populations (ballet dancers, athletes, health-workers). ON seem to share psychopathological aspects with both eating disorders and obsessive-compulsive disorders (OCD). The aim of the study was to analyse the prevalence of ON among subjects diagnosed with OCD, hypothesising that this would be higher than in two control groups (subjects with anxiety-depressive disorders and general population).

Methods We conducted a multi-centre, observational, controlled study. Subjects filled in a socio-demographic questionnaire including questions related to life-style and two psychometric instruments: ORTO-15, for ON symptoms, and OCI-R, for OCD symptoms.

Results In the final sample of 328 subjects, the overall prevalence of ON as calculated by the ORTO-15 was 59.5%, mean score of 37.9±4.2. No statistically significant differences were found in the prevalence of ON or in the mean ORTO-15 score among the three groups. This was confirmed by the multiple regression analysis. An increased risk of having a positive score at the ORTO-15 was recorded only among subjects following a restrictive dietary regime for weight control reasons.

Conclusions The initial working hypothesis that ON symptoms would be more prevalent among subjects suffering from OCD was disconfirmed. The psychometric properties of instruments available to study ON may also play a role to explain findings in the growing scientific literature related to this topic.

EBM rating level: LEVEL III (Evidence obtained from well-designed cohort or case-control analytic studies)

Key-words Orthorexia nervosa, obsessive-compulsive disorder, eating disorders, psychopathology, diagnostic criteria, ORTO-15

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Declarations

Introduction

The term "Orthorexia" was coined by the American physician Steven Bratman in 1997.

Inspired by anorexia nervosa, the etymology comes from the Greek words "orthos" meaning "proper, correct" and "orexis" meaning "appetite". Orthorexia Nervosa (ON) indicates an 'obsession' for proper nutrition. Affected individuals are typically concerned about the quality, as opposed to the quantity, of food, and are prompted by the need to promote their physical health. Their typical daily routine is characterized by excessive preoccupations about planning of meals, accurate selection of products avoiding food considered impure and unhealthy, spending considerable time controlling and scrutinizing sources, processing and packaging (for example: use of pesticides, hormone supplementation, preservative addition, artificial flavouring, carcinogenic compounds). Furthermore, meal preparation and consumption must strictly respect the principles of healthy eating and satisfaction/frustration rely on the adherence/violations of all these self-imposed rules. Nutritional deficiencies due to elimination of entire food groups, severe weight loss or other medical complications may develop. Educational or occupational impairment and social isolation may also be observed, as a consequence of self-exclusion from social contexts prompted by keeping control of healthy eating [1-7].

After various proposals for ON criteria [1, 4, 8-10], the most recent have been conceptualized by Dunn & Bratman (2016) [11]. Consistently, several psychometric tools were developed to measure ON: the Bratman's Orthorexia Test (BOT) [1], a 10-item questionnaire in a yes/no format, was the first, further developed into the ORTO-15 [12], the most accounted, translated, validated and used in the world [13-16]. The ORTO-15 is described more in details in the Methods section of the present paper. Finally, the ORTO-R is a very recent revision of the ORTO-15, consisting of only 6 items and proposed with the aim to overcome the limitations of ORTO-15 and to allow better cross-cultural comparisons [17].

To date, data on the prevalence of ON vary widely being mainly based on study on high risk populations such as resident physicians, medical students, high school students, artists, opera singers, ballet dancers, musicians, dietitians, nutrition students, yoga practitioners, athletes [11]. Further sources of variability are the lack of a standardized definition of ON, the use of different diagnostic criteria, psychometric instruments or alternative cut-offs. Bearing this in mind, the most recent figures of prevalence range from a minimum of 28-30% [18] to a maximum of 88.7% [19]. In Italy, Donini et al. [12] and Ramacciotti et al. [20] respectively found a prevalence rate of 6.9 and 57.6% in the general population, as measured by ORTO-15, Italian version [12] and assuming a cut-off score of 40. The study by Dell'Osso et al. [21] on a sample of 2130 University students using ORTO-15 (but with a cut-off score of 35) showed a prevalence of 34.9%.

ON is not (yet) mentioned as such in diagnostic manuals as DSM or ICD, and a fervent debate is ongoing on whether it should be considered as a new independent diagnosis, or a variant/subtype/pre-morbid condition of other disorders. More specifically, ON shares clinical features both with Anorexia Nervosa (AN) and Obsessive-Compulsive Disorder (OCD), conditions that, moreover, may themselves be highly comorbid the one with the other [22].

As to the overlap with OCD, orthorexic subjects manifest recurrent, intrusive thoughts (similar to obsessions) about food, health contamination and impurity, which cause marked anxiety or distress; repetitive and strong needs (similar to compulsions) to prepare and consume food in a ritualized manner. Moreover, orthorexic ruminations and compulsions are time-consuming and cause clinically significant distress or functional impairment. The two disorders share common traits of perfectionism, cognitive rigidity, anxiety traits and an elevated need to control, excessive devotion and hyper-morality.

However, differences between ON e OCD also exist: in OCD, obsessions and compulsions usually extend beyond food and health; also, the individuals realize their behaviours are excessive and unreasonable (the content of obsessions is basically perceived as ego-dystonic); finally, patients are secretive about their behaviours, and may develop depressed mood. On the contrary, in ON, subjects have flaunted behaviours and limited insight about their own condition (the content of obsessions is perceived as ego-syntonic), features suggesting a psychopathological overlap with overvalued ideas [6, 22].

While the clinical and epidemiological overlap between ON and AN has been assessed thoroughly [22], less has been researched so far on the overlap between ON and disorders of the OC spectrum among clinical populations. Most of existing data refer to non-clinical populations or populations at high risk for ON, that were analysed by comparing the concomitant presence of ON and OC symptoms [11].

Therefore, the aim of the present study was to analyse the prevalence of symptoms of ON as measured by the ORTO-15 among subjects diagnosed with OCD, and compare it to the prevalence of ON among two control groups: one composed by patients suffering from other psychiatric conditions, specifically anxiety or depressive disorders; and the other composed by subjects with no psychiatric morbidity. We expected to find a higher prevalence of ON symptoms among individuals with OCD, as a confirmation that, in a psychopathological perspective, ON may share features with disorders of the OC spectrum.

Materials and Methods

Study Design

Observational, multicentric, controlled study.

Population

It consisted of three groups, described as follows.

The first group (the OCD group) consisted of patients with a DSM-5 primary diagnosis of OCD consecutively referred to the psychiatric outpatient service of the San Luigi Gonzaga University Hospital (Turin, Italy) or to the community mental health centres of the Department of Mental Health of Modena, Italy.

The second group (the control group #1) consisted of patients with an established psychiatric diagnosis in the anxiety-depressive spectrum disorder, recruited at various services of the Department of Mental Health of Modena, Italy.

The third group (the control group #2) consisted of people without any psychiatric disorder, recruited as healthy volunteers from the University of Modena and Reggio Emilia (students and employees) and in other non-clinical contexts (e.g. public meetings) in Turin, Modena and Bologna (north of Italy).

Exclusion Criteria

Subjects could not be enrolled if they were:

- aged < 18 or > 70 years;
- suffering from severe psychiatric conditions affecting the understanding of the study or the ability to provide consent or presenting with acute and severe symptoms (such as psychosis, dementia or suicidal ideation) or not fulfilling the conditions to be included in one of the above mentioned research groups;
- insufficient or no understanding of the spoken and written Italian language.

Inclusion Criteria

Subjects could be enrolled:

- in the OCD group, if they had received a primary diagnosis of OCD according to the DSM-5 criteria;
- in the control group #1, if they had received a diagnosis of an anxiety and/or depressive disorder according to the DSM-5 criteria, but not of OCD;
- in the control group #2, if they declared not having received any psychiatric formal diagnosis and/or not receiving any active treatment for that;
- if they provided an informed, written consent to be involved in the study.

Measures

Subjects providing consent to be involved in the study were administered the following measuring tools:

- **Socio-demographic questionnaire**: a questionnaire developed *ad hoc*, including information on age, sex, marital status and living situation, education, occupation, place of residence and domicile, weight, height, level of physical activity, habits related to smoke, alcohol consumption and eating;
- **ORTO-15**: a self-administered questionnaire consisting of 15 items on a 4-point Likert Scale ("always", "often", "sometimes" and "never"), in the Italian validated version [12]. Its questions aim at outlining behaviours, cognitive-rational aspects, and clinical/emotional features suggesting ON. A total score < 40 may suggest the presence of ON [20, 23];
- **OCI-R**: a self-administered questionnaire consisting of 18 items on a 5-point Likert Scale, in its validated Italian version. The questionnaire aims at rating symptoms of OCD. It provides both a total and subscales scores, related to six different clinical components of OCD: washing, obsessing, hoarding, ordering, checking and mental neutralizing. A total score ≥ 21 may suggest the presence of OCD [24].

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[*The questionnaires are available upon request to the corresponding author*].

The questionnaires were distributed in anonymous paper versions during clinical outpatient visits, teaching sessions and other meetings; they required about 15 minutes to be filled in. Data collection occurred between October 2016 and December 2017.

Data from the questionnaires were subsequently included in an electronic database. The paper questionnaires as well as the signed forms for informed consent were stored appropriately.

The study was conducted according to the Good Clinical Practice principles, the Helsinki Declaration's statements and the current legislation regarding observational studies. The study was approved by the local ethics committee (Comitato Etico AVEN, Regione Emilia Romagna, Italy, Cod. 146/16, date of approval 9.9.2016).

Statistical Analysis

Statistical analysis was performed using STATA® software version 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Descriptive statistics were presented for baseline demographic clinical characteristics for the entire group, as well as for the three subgroups. Continuous variables were presented as the number of patients (N), mean, standard deviation (SD), minimum (min), and maximum (max) and compared between subgroups using Unpaired Student's t test for two groups or anova for more than two groups; while categorical variables were presented as frequency (N, percentage [%]) and compared using Pearson's chi-squared test.

A multivariate logistic regression model was carried out using a stepwise selection method to identify the prognostic factors between groups, and specifically the risk to being positive for ON, assuming it to be higher among subjects diagnosed with OCD. In the first step, the intercept-only model was fitted and individual score statistics for the potential variables were evaluated. A significance level of $p < 0.05$ was used to allow a variable into the model. In stepwise selection, an attempt was made to remove any insignificant variables from the model before adding a significant variable to the model. Hosmer and Lemes how test was used to evaluate "goodness of fit" in the selection model. Data from the univariate and multivariate logistic regression analyses were expressed as odds ratio (OR) and 95% confidence interval (CI). A $p < 0.05$ was considered statistically significant.

Results

Description of the sample

A total of 345 people accepted to take part to the study and filled in the questionnaires, of which 50 in the OCD group, 42 in the control group #1 and 253 in the control group #2. Seventeen subjects of the latter group

declared to suffer from a psychiatric disorder and were excluded, resulting in a control group #2 of 236 subjects and in a final sample of 328 people.

Table 1 describes the most relevant characteristics of the total sample and of each group separately, including the scores at the two psychometric tools, ORTO-15 and OCI-R (further details as collected by the socio-demographic questionnaire and not included in the table for brevity are available upon request from the authors).

Include table 1 about here
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As table 1 describes, the prevalence of ON as from a score <40 at the ORTO-15 was similar in the three groups and no significant statistical differences emerged concerning the ORTO-15 total score.

The three groups showed statistically significant differences for the following variables: sex ($p<0.001$), marital status ($p=0.008$), living situation ($p<0.001$), career ($p=0.040$), physical activity ($p=0.017$), alcohol consumption ($p<0.001$), the person who prepares the meals ($p<0.003$).

Features of the total 133 subjects with a negative ORTO-15 score were compared to those of the total 195 subjects with a positive ORTO-15 score. The orthorexic group showed a mean ORTO-15 score of 35.2 ± 3.2 (range 23-39), while the mean score of the non-orthorexic group was 41.8±1.8 (range 40-50). No statistically significant differences between the two groups emerged. Results of this analysis are included in *Table 2*.

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Logistic regression analysis

Table 3 displays the results of the multivariate logistic regression performed for the outcome "ON".

No statistically significant association was found between the risk to score positive at the ORTO-15 and being in any of the three subgroups of subjects. In other words, OCD patients, non-OCD patients and healthy controls did not differ for the risk to have ON symptoms. Among the remaining variables examined, only those who declared to follow a restrictive diet for weight control were found to have an increased risk to also suffer from ON (OR 2.39, IC 1.18-4.82, p=.014).

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Discussion

The present study was designed with the purpose to investigate the prevalence of symptoms of ON in patients diagnosed with OCD, in comparison to subjects with disorders of the anxiety-depression spectrum and healthy controls.

The main finding of the study was that we failed to demonstrate the working hypothesis that subjects with OCD would have shown a higher amount of ON symptoms. Rather, we found an increased probability of finding ON symptoms among subjects who declared to follow a restricted dietary regime for weight control. These results seem to support the concept that a correlation may exist between ON and eating disorders, but not between ON and OCD.

Dall'Osso and colleagues [21], while studying a large sample of Italian students, found a prevalence of ON of 34.9% by using a less restrictive cut-off than the one suggested by the developers of the ORTO-15 (35 instead of 40). In our sample, even though adopting the original cut-off of 40, both the overall prevalence of ON (59.5%) and the prevalence of ON among healthy controls (most of them were students – 58.9%) were significantly higher than the one by Dall'Osso and coll. and more in line with what emerged from previous research [19, 20, 25-27]. It should be noticed, though, that most of these studies were conducted on high-risk populations, like a recent Portuguese study by Almeida and colleagues [28] on 193 adult gym members, that estimated a prevalence of 51.8%.

Previous prevalence studies of ON in the general population revealed contradictory results also when discussing the role of age, gender, marital status, education level, BMI, smoking and alcohol consumption [8, 28, 29, 30, 31, 32]. In the present study, no significant associations were found between ON and the different socio-demographic variables analysed. Significant risk factors for ON remain unclear and may require further study.

Moreover, the very high prevalence of ON found in our study contributes to the debate on the psychometric properties of the ORTO-15, and particularly its specificity, particularly when used in the general population rather than on high-risk groups [10, 14, 15, 33]. Further studies are needed to refine specific and clinically significant tools for clinicians.

Subjects with or without ON did not differ in terms of scores at the OCI-R, both considering the total score and scores at the different subtypes of OCD, with the one exception of *ordering*, that was slightly more frequent among ON subjects, though without full statistical significance. The multivariate regression analysis also excluded the diagnosis of OCD as a risk factor for ON.

Limitations of the study

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Some limitations of the present study have to be acknowledged, as they might have an impact on generalizability of results. The first was, as just mentioned, the relatively small sample size of 328 subjects. Considering the increasing impact of ON-related 'styles' and behaviours in the general population, anyway, we hope that the present study may contribute to prompting further clinical research on this topic, on larger samples.

Secondly, the sample was not completely homogenous, with differences about socio-demographic variables, despite our efforts to minimize disparities between the subgroups. One significant discrepancy was already acknowledgeable during recruitment, since most of the OCD subjects were recruited at the Psychiatric Clinic in Turin, where a highly-specialized outpatient clinic for OCD is run. The role of cultural context, e.g. living in big cities vs. in rural surroundings, or level of education, is known to be relevant in the epidemiology and features of ON [10, 27], and further studies should better control this potential bias.

A further limitation may be the choice to use the ORTO-15 questionnaire as a measure for ON symptoms, whose optimal cut off has been debated. Nevertheless, since this is by far the most used psychometric tool when the topic ON is concerned, its use allows the comparison of our findings with the majority of other studies related to this topic. The improved version of the ORTO-15 recently introduced, the ORTO-R, has overcome many of the limitations of ORTO-15 and will hopefully allow an even better understanding of psychopathology and epidemiology of ON [17].

Albeit self-rated tools are more feasible, their use could have limited the reliability of data [34], particularly considering the tendency to secrecy or self-over/under-estimation of behaviours like the ones here investigated, known for being socially criticized or appreciated (attention to the choice of food, to physical shape, to weight, and so on…). For example, habits related to physical activity are overestimated, whereas weight and risk behaviours are underestimated [29, 35]. This bias may have concerned in particular controls in the #2 group, who were defined not suffering from mental conditions only on the basis of self-declaration. Finally, we were unable to control for treatment adherence and effectiveness of both subjects with OCD and subjects with anxiety and depression disorders. Nevertheless, the aim of the assessments employed in this study was to focus on stable, persistent traits and beliefs that tend to be less influenced by medications.

What is already known on this subject?
- The psychopathology of ON as a clinical condition is under study.
- The most common instrument to recognize ON is the ORTO-15.
- ON shares psychopathological features with eating disorders and OCD.

What this study adds?
1) A very high prevalence of ON, both in the total sample and in all the three subgroups under comparison;

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2) No elements supporting a strong psychopathological connection between ON and OCD.

Conclusions

Bratman himself, the author who introduced the term "orthorexia" about 20 years ago, declared to be surprised of the increased attention from researchers for ON. The number of scientific papers dedicated to ON, as recently searched on PubMed using the key-word "orthorexia" raised from 57 to 135 in the last 3 years, suggesting the growing interest of the scientific community over this topic, with specific reference to the status, or not, of ON as a full-blown syndrome. The ORTO-R was recently introduced, with the aim to support further the most correct clinical and nosographical definition of ON [17].

Findings from the present paper contribute to such debate, specifically by stressing the role of potential relevant psychopathological mechanisms, useful to support clinicians in the choice of therapeutic options and prognostic evaluations. A very high prevalence of ON was found, both in the total sample and in all the three subgroups here compared, supporting the impression that the continuous emphasis on health and wellness of western societies, though virtuous and effective as a prevention tool, may have also negative effects when combined to other elements of individual or social vulnerability.

Existing literature and clinical observation have suggested that ON may share significant characteristics with both eating disorders and OCD. This study tried to test the hypothesis of a connection between symptoms of ON and OCD, but this was not confirmed by our data.

Future studies are needed to better understand the underlying psychopathological mechanisms of ON, and to confirm the relevance and reliability of raising this set of behaviours to the status of a bona fide mental disorder.

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Table 1: Socio-demographic description of the sample.

		OCD group N=50		Control group #1 N=42		Control group #2 N=236		Total N=328		p-value
		Mean±SD (range)								
Age		38.3±12.7 (19-69)		46.2 ±13.7 (22-69)		34.5 ±13.5 (19-65)		36.5 ±13.8 (19-69)		n.s.
		N	%#	N	%	N	%	N	%	
Sex	M	34	68.0	7	16.7	101	42.8	142	43.3	<0.001
	F	16	32.0	35	83.3	135	57.2	186	56.7	
Marital status	Single	28	56.0	11	26.2	106	44.9	145	44.2	0.008
	With partner	20	40.0	25	59.5	117	49.6	162	49.4	
	Divorced/separated	2	4.0	3	7.1	9	3.8	14	4.3	
	Widower	0	0.0	3	7.1	2	0.8	5	1.5	
Area of residence	Lowland (<200 mt a.s.l.)	43	86	33	78.6	221	93.6	297	90.5	0.007
	Hill (200-600 mt a.s.l.)	7	14	8	19	11	4.7	26	7.9	
	Mountain (>600 mt a.s.l.)	0	0	1	2.4	4	1.7	5	1.5	
Living situation	With parents	24	48.0	9	21.4	92	39	125	38.1	<0.001
	With partner/children	16	32	24	57.1	72	30.5	112	34.1	
	Alone	9	18	8	19	28	11.9	45	13.7	
	With roommates	1	2	1	2.4	44	18.6	46	14	
Degree of study *(students excluded)*	Middle school	12	24	9	21.4		0.0	21	6.4	n.s
	High school	25	50	22	52.4		0.0	47	14.3	
	Bachelor's degree	3	6	3	7.1		0.0	6	1.8	
	Graduation degree	7	14	5	11.9		0.0	12	3.7	
	Post-graduation degree	2	4	2	4.8		0.0Missing	4	1.2	
Occupation	Full-time job	21	42	22	52.4		0.0	43	13.1	0.040
	Part-time job	4	8	6	14.3		0.0	10	3	
	Student	8	16	4	9.5		0.0	12	3.7	
	Housewife	4	8	5	11.9		0.0	9	2.7	
	Unemployed	10	20	0	0		0.0	10	3	
	Disable	0	0	0	0		0.0	0	0	
	Retired	1	2	4	9.5		0.0	5	1.5	
	Other	1	2	1	2.4		0.0Missing	2	0.6	
		Mean ± SD (range)								
Weight (kg)		76.3 ±16.9(30-110)		66.9 ±12.9(47-99)		69.2 ±15.6(38-165)		70.0 ±15.7(30-165)		n.s.
Height (cm)		1.71 ±0.9(1.43-1.89)		1.66 ±0.09(1-55-1.88)		1.70 ±0.09(1.48-1.96)		1.70 ±0.9(1.43-1.96)		0.053
BMI		25.2 ±4.7(0-36.3)		24.2 ±4.9(17-38.1)		23.5 ±4.8(16.3-57.7)		23.8 ±5.0(0-57.7)		n.s.
		N	%	N	%	N	%	N	%	
Satisfied with own physical condition?	Yes	22	44.0	19	45.2	137	58.1	178	54.3	0.088
	No	28	56.0	23	54.8	99	41.9	150	45.7	
Practicing physical activity?	Yes	21	42.0	21	50	147	62.3	189	57.6	0.017
	No	29	58.0	21	50	89	37.7	139	42.4	
Smoking	Yes (less than 10 cigarettes)	2	4.0	4	9.5	34	14.4	40	12.2	n.s.
	Yes (10-20 cigarettes)	4	8.0	4	9.5	22	9.3	30	9.1	

		n	%	n	%	n	%	n	%	p
	Yes (more than 20 cigarettes)	1	2.0	0	0,0	1	0.4	2	0.6	
	No	43	86.0	34	81	179	75.8	256	78	
Alcohol consumption	Yes (every day or almost every day)	6	12.0	5	11.9	20	8.5	31	9.5	<0.001
	Sometimes (max 1-2 times a week)	14	28.0	10	23.8	131	55.5	155	47.3	
	Never or almost never	29	58.0	27	64.3	84	35.6	140	42.7	
	Missing values	1	2.0	0	0	1		2	0.6	
Who prepares your meals?	You	22	44.0	30	71.4	160	67.8	212	64.6	<0.003
	Others	28	56.0	12	28.6	75	31.8	115	35.1	
Dietary regime	Free	40	80.0	34	81	172	72.9	246	75	n.s.
	Controlled (lose weight)	5	10.0	7	16.7	36	15.3	48	14.6	
	Controlled (other causes)	5	10.0	1	2.4	28	11.9	34	10.4	
OCI-R total score	Positive (≥ 21)	30	60.0	18	42.9	56	23.7	104	31.7	**<0.001**
	Negative	20	40.0	24	57.1	180	76.3	224	68.3	
ORTO-15 total score	Positive (<40)	32	64.0	24	57.1	139	58.9	195	59.5	n.s.
	Negative	18	36.0	18	42.9	97	41.1	133	40.5	

		Mean ± SD (range)				
OCI-R total score		26.9±15.7(0-59)	19.7±10.4 (5-48)	14.9±9.7 (0-55)	17.3±11.7 (0-59)	**<0.05**
	OCI-R hoarding	3.5±3.4 (0-12)	4.5±3.0 (0-11)	3.5±2.6 (0-12)	3.6±2.8 (0-12)	n.s.
	OCI-R checking	5.2±3.8 (0-12)	2.6±2.4 (0-12)	2.3±2.2 (0-12)	2.8±2.7 (0-12)	**<0.05***
	OCI-R ordering	4.1±3.5 (0-12)	3.7±2.9 (0-12)	3.3±2.7 (0-12)	3.5±2.9 (0-12)	n.s.
	OCI-R mental neutralizing	2.8±34 (0-12)	1.0±1.5 (0-6)	0.8±1.5 (0-9)	1.1±2.1 (0-12)	**<0.05****
	OCI-R washing	3.7±3.5 (0-11)	2.1±2.5 (0-12)	1.8±2.3 (0-12)	2.1±2.6 (0-12)	**<0.05*****
	OCI-R obsessing	7.4±3.5 (0-12)	5.5±3.3 (0-12)	2.9±2.9 (0-12)	3.9±3.6 (0-12)	**<0.05**
ORTO-15 total score		36.8±5.5 (23-45)	38.1±5.1 (25-50)	38.1±3.7 (28-47)	37.9±4.2 (23-50)	n.s.

sums of frequencies not equal to 100 are due to missing values

* p<0.005 for non-OCD group vs OCD group and OCD vs students
**p<0.005 for non-OCD group vs OCD group and OCD vs students

*** p<0.005 for non-OCD group vs OCD group and OCD vs students

Table 2: Comparison between subjects with a positive vs. negative ORTO-15 score.

		ORTO-15				*p*-value
		Negative **N = 133**		**Positive** **N = 195**		
		Mean ± SD (range)				
Age		37.2±14 (19-69)		36.1±13.9 (19-49)		n.s.
		N	%#	N	%	
Sex	M	58	43.6	84	43.1	
	F	75	56.4	111	56.9	
Marital Status	Single	60	45.1	85	43.6	n.s.
	With partner	65	48.9	97	49.7	
	Divorced/separated	7	5.3	7	3.6	
	Widower	0	0.0	5	2.6	
Area of residence	Lowland (< 200 mt a.s.l.)	122	91.7	175	89.7	n.s.
	Hill (200-600 mt a.s.l.)	9	6.8	17	8.7	
	Mountain (> 600 mt a.s.l.)	2	1.5	3	1.5	
Living situation	With parents	55	41.4	70	35.9	n.s.
	With partner/children	49	36.8	63	32.3	
	Alone	18	13.5	27	13.8	
	With roommates	11	8.3	35	17.9	
	Other (specify)	0	0.0	0	0.0	
Degree of study ~~*(students excluded)*~~	Middle school	6	4.5	15	7.7	n.s.
	High school	18	13.5	2	1.0	
	Bachelor's degree	5	3.8	1	0.5	
	Graduation degree	4	3.0	8	4.1	
	Post-graduation degree	2	1.5	2	1.0	
Occupation	Full-time job	18	13.5	25	12.8	n.s.
	Part-time job	2	1.5	8	4.1	
	Student	4	3.0	8	4.1	
	Housewife	5	3.8	4	2.1	
	Unemployed	5	3.8	5	2.6	
	Disable	0	0.0	0	0.0	
	Retired	2	1.5	3	1.5	
	Other	0	0.0	2	1.0	
		Mean ± SD (range)				
Weight (Kg)		70.4±15.5 (45-109)		69.6±15.8 (30-165)		n.s.
Height (cm)		1.70±0.9 (1.5-1.96)		1.70±0.9 (1.43-1.94)		n.s.
BMI		23.9±4.8 (0-41)		23.8±5.2 (0-57.7)		n.s.
		N	%	N	%	
Satisfied with own physical condition?	Yes	76	57.1	102	52.3	n.s.
	No	57	42.9	93	47.7	
Practicing physical activity?	Yes	80	60.2	109	55.9	n.s.
	No	53	39.8	86	44.1	
Smoking	Yes (less than 10 cigarettes)	15	11.3	25	12.8	n.s.
	Yes (10-20 cigarettes)	16	12.0	14	7.2	

	Yes (more than 20 cigarettes)	1	0.8	1	0.5	
	No	101	75.9	155	79.5	
Alcohol consumption	Yes, every day or almost every day	13	9.8	18	9.2	n.s.
	Sometimes (max 1-2 times a week)	68	51.1	87	44.6	
	Never or almost never	51	38.3	89	45.6	
Who prepares your meals?	You	80	60.2	132	67.7	n.s.
	Others	53	39.8	62	31.8	
Dietary regime	Free	107	80.5	139	71.3	n.s.
	Controlled (lose weight)	13	9.8	35	17.9	
	Controlled (other causes)	13	9.8	21	10.8	
		Mean ± SD (range)				
OCI-R total score		16.5±10.9 (0-53)		17.9 ±1.3 (0-59)		n.s.
	OCI-R hoarding	3.4±2.6(0-11)		3.7±2.9(0-12)		n.s.
	OCI-R checking	2.6±2.7(0-12)		2.9±2.7(0-12)		n.s.
	OCI-R ordering	3.1±2.5(0-12)		3.7±3.1(0-12)		0.069
	OCI-R mental neutralizing	1.2±2.0(0-11)		1.1±2.1(0-12)		n.s.
	OCI-R washing	2.1±2.5(0-12)		2.2±2.7(0-12)		n.s.
	OCI-R obsessing	3.8±3.5(0-12)		4.0±3.6(0-12)		n.s.
ORTO-15 total score		41.8±1.8 (40-50)		35.2±3.2 (23-39)		**<0.001**

sums of frequencies not equal to 100 are due to missing values

Table 3: multivariate logistic regression for the outcome "ON".

Variable	Multivariate analysis		
	OR	95% CI	p-value
OCD group vs. control group #2	1.51	0.79-2.90	0.211
Control group #1 vs. control group #2	1.09	0.54-2.19	0.806
Age (years)	0.99	0.97-1.02	0.940
Sex, Male	1.18	0.73-1.92	0.492
Living with roommates	2.90	1.32-6.37	0.008
Being on a controlled dietary regime (to lose weight)	2.39	1.18-4.82	0.014