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Use of online and paper-and-pencil questionnaires to assess the distribution of orthorexia nervosa, muscle dysmorphia and eating disorders among university students: can different approaches lead to different results?

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(Article begins on next page)

Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity

Comparability of online and paper-and-pencil questionnaires administered to university students for assessing the diffusion of orthorexia nervosa, muscle dysmorphia and eating disorders

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Full Title:	Comparability of online and paper-and-pencil questionnaires administered to university students for assessing the diffusion of orthorexia nervosa, muscle dysmorphia and eating disorders
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Abstract:	<p>Purpose</p> <p>Online administration of questionnaires to assess the diffusion of disordered eating behaviours is becoming common today. Web-based surveys offer advantages, such as faster return and lower costs, although the relatively high nonresponse rate can result in selection bias.</p> <p>The aim of this study is to assess whether the administration of a test to assess traits of eating disorders (EDs), orthorexia nervosa (ON) and muscle dysmorphia (MD), via a web-based survey (WBS) and a paper-and-pencil-based survey (PBS) gives different results.</p> <p>Methods</p> <p>During two consecutive academic years, a self-reported questionnaire consisting of a socio-demographic section and three tests validated for the evaluation of ON (ORTO-15), MD (MDDI-ITA), and EDs (EAT-26) were administered to a group of undergraduates using a web-based and a paper-based questionnaire.</p> <p>Results</p> <p>The WBS response rate was 7.9% (N=137), and the PBS response rate was 100% (N=372). The WBS group showed a statistically significant higher prevalence of students with eating disordered behaviours (21.2% vs 5.4%) and registered a higher mean score on the EAT-26 test (13.5 ± 11.1 vs 6.0 ± 8.0); no differences between the two groups emerged for ON and MD prevalence and test scores. Moreover, in the WBS group, the number of students with one or more tests with test scores above the cut-off values was significantly higher (46.0% vs 32.3%).</p> <p>Conclusion</p> <p>The setting of an online survey to assess EDs and related issues must take into account all the factors that can result in selection bias and that can affect the reliability of the results.</p>
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Author Comments:	<p>To the kind attention of Dr. Lorenzo Donini Editor-in-Chief, Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity</p> <p>Dear Dr. Donini,</p> <p>It is a pleasure to submit to your Journal the manuscript entitled "Comparability of online and paper-and-pencil questionnaires administered to university students for assessing the diffusion of orthorexia nervosa, muscle dysmorphia and eating disorders", of the authors: Ilaria Silvia Rossella Gorrasi, Raffaella Degan, Giovanni Abbate Daga, Simona Bo, Anna Tagliabue, Cinzia Ferraris, Monica Guglielmetti, Mattia Roppolo, Giorgio Gilli and Elisabetta Carraro, which I propose you for publication as full length paper.</p> <p>In this study, we aimed to evaluate whether a survey with questionnaires to evaluate the diffusion of traits of eating disorders (EDs), orthorexia nervosa (ON) and muscle dysmorphia (MD), conducted with two different methods that is a web-based survey and a paper-and-pencil-based survey, could give comparable results.</p> <p>The survey was conducted among students attending the first year at the University of Turin, Italy; students in the same university courses were involved for two consecutive academic years.</p> <p>The use of questionnaires administered online for psychological and psychiatric clinical research and other medical applications is becoming important. In situations such as the current COVID-19 pandemic, the importance of using online tools when it is not possible to meet face to face for direct interviews emerges more than ever. It is therefore essential that these tools are valid and representative and it is important to consider the impact that changing the mode of delivery can have on the responses collected.</p> <p>In our study the two different ways of administering the questionnaires gave some different results: students who completed the online questionnaire had a higher prevalence of EDs and presented a higher number of subjects with risk profiles for one or more of the three conditions examined than did students who completed the web-based questionnaire. In our opinion these differences could be due to several aspects, including an effective distinction between the two groups, but the variation in the route of administration can also play a role. The results of online surveys may be affected by bias due for example to low response rates, to a self-selection linked to the salience of a topic, the sponsors, the length of time required to complete the survey, the presentation of the questionnaire, the contact delivery modes, the use of pre-notifications and the presence of incentives. Furthermore, in online surveys, subjects often have greater self-disclosure. We concluded that the results of the web-based surveys must take into account all these aspects to be considered valid and reliable. We are not aware of any conflict of interest regarding this paper. The authors will be glad to answer any questions the reviewers may raise about the study.</p> <p>I thank you very much for your editorial consideration.</p> <p>Best regards.</p> <p>The corresponding author, Ilaria S. R. Gorrasi</p>

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6 5 **Title**

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8 7 diffusion of orthorexia nervosa, muscle dysmorphia and eating disorders

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Abstract

Purpose

Online administration of questionnaires to assess the diffusion of disordered eating behaviours is becoming common today. Web-based surveys offer advantages, such as faster return and lower costs, although the relatively high nonresponse rate can result in selection bias.

The aim of this study is to assess whether the administration of a test to assess traits of eating disorders (EDs), orthorexia nervosa (ON) and muscle dysmorphia (MD), via a web-based survey (WBS) and a paper-and-pencil-based survey (PBS) gives different results.

Methods

During two consecutive academic years, a self-reported questionnaire consisting of a socio-demographic section and three tests validated for the evaluation of ON (ORTO-15), MD (MDDI-ITA), and EDs (EAT-26) were administered to a group of undergraduates using a web-based and a paper-based questionnaire.

Results

The WBS response rate was 7.9% (N=137), and the PBS response rate was 100% (N=372). The WBS group showed a statistically significant higher prevalence of students with eating disordered behaviours (21.2% vs 5.4%) and registered a higher mean score on the EAT-26 test (13.5±11.1 vs 6.0±8.0); no differences between the two groups emerged for ON and MD prevalence and test scores. Moreover, in the WBS group, the number of students with one or more tests with test scores above the cut-off values was significantly higher (46.0% vs 32.3%).

Conclusion

The setting of an online survey to assess EDs and related issues must take into account all the factors that can result in selection bias and that can affect the reliability of the results.

Level of Evidence: Level V, descriptive cross-sectional survey.

Keywords

Orthorexia nervosa; muscle dysmorphia; eating disorders; web-based survey; paper and pencil survey; questionnaire.

1 **Introduction**

1 2 Several instruments used for psychological and psychiatric clinical and research applications have been validated for
2 3 administration via the internet [1], and this way of administering questionnaires is becoming important in the research
3 4 field. The preferred mode for collecting survey data in research has traditionally been the paper questionnaire; however,
4 5 in recent years, this way of collecting data has been challenged [2]. The ongoing COVID-19 pandemic for example has
5 6 highlighted the importance of using online tools given the impossibility of meeting in person in several situations.
6 7 For the assessment of eating disorders (EDs), since 2013, five new tools have been developed and validated exclusively
7 8 for online self-report administration or for both online and pencil-and-paper administration [3]. EDs are mental
8 9 disorders described in the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-5).
9 10 Orthorexia nervosa (ON) is not currently recognized as a mental disorder, while muscle dysmorphia (MD) is classified
10 11 in the DSM-5 as a subtype of body dysmorphic disorder. ON and MD are considered close to EDs [4–9]. The term
11 12 orthorexia nervosa, literally meaning “proper appetite”, was first coined by Bratman in 1997 [10] to describe an
12 13 excessive fixation on healthy eating, often associated with significant dietary restrictions and consequent life-
13 14 threatening medical conditions related to malnutrition, disrupted social life and social isolation. Muscle dysmorphia was
14 15 first identified by Pope et al. [11] in a group of bodybuilders and refers to individuals preoccupied with their appearance
15 16 and concerned about not being sufficiently large and muscular, with a life consumed by activities aimed at increasing
16 17 muscularity, such as weightlifting, dieting and using drugs [12, 13].

17 18 The prevalence of ON and MD has been assessed using self-reported questionnaires as screening tools [14–17]
18 19 administered mostly as paper-and-pencil questionnaires [18–25] but more recently as web-based questionnaires [5, 26–
19 20 31] Comparability of the reliability of web-based and paper questionnaires has been supported in some cases [32–34]. It
20 21 is widely accepted that web-based questionnaires offer advantages, although they have not been scientifically confirmed
21 22 [35]. Advantages supported by the literature include more complete data [36], faster return [37, 38], and lower costs
22 23 [39]. Two main disadvantages have been identified: 1) the relatively high nonresponse rate compared with that from
23 24 traditional methods and 2) concerns regarding the reliability and validity of the data obtained [40, 41]. Furthermore,
24 25 when an online test is merely an adaptation of a traditional offline instrument, evidence that the offline version has
25 26 satisfactory psychometric properties is not sufficient to allow one to assume they will apply to the online version as well
26 27 [42].

27 28 In the present study, we compare the results of two surveys, an online version and a paper-and-pencil version,
28 29 administered in two consecutive years, using the same questionnaire with tools to rate the presence of ON, MD and ED
29 30 traits. The survey was conducted among students attending the first year at the University of Turin, Italy; students in the
30 31 same university courses were involved for the two years. The aim of the study was to evaluate the comparability of
31 32 results between a web-based questionnaire survey and a paper-based questionnaire survey assessing the presence of
32 33 ON, measured by the ORTO-15 test [14], MD, measured by the MDDI-ITA test [16] and ED, measured by EAT-26
33 34 [43] traits, and the scores obtained for the three tests; the comparison of the survey results was conducted with reference
34 35 to the personal characteristics of students (age, BMI, exercise level, use of supplements, drugs, dieting).

35 36 **Methods**

36 37 **Study design and setting**

37 38 Web-based and paper-based questionnaire surveys were carried out during two consecutive academic years at the
38 39 University of Turin.

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1 For the web-based questionnaire survey (WBS), an online questionnaire was developed using the Lime Survey TM (Fa.
1 2 Carsten Schmitz / Germany). An email invitation (and two reminders), including a link to the website to participate
2 3 anonymously, were sent to the institutional email addresses of the students.

4 4 For the paper-and-pencil-based questionnaire survey (PBS), participants were approached during lessons after
5 5 conferring with professors and were asked to anonymously complete the questionnaire.

7 6 In both years, the survey was presented as an investigation among university students about nutrition habits, approach
8 7 towards physical activity and proper body aspect. This research was reviewed and approved by the Bioethical
9 8 Committee of the University of Turin.

11 9 **Participants**

13 10 The participants were students attending first year courses in medicine, dietetics, physiotherapy, exercise and sport
14 11 science and business administration. To participate in the survey, it was necessary to give informed consent after taking
15 12 note of the informative paper.

17 13 **Measures**

19 14 The questionnaire comprised four sections: (I) socio-demographic section with questions about sex, age, weight, height,
20 15 hours and type of physical exercise, supplements and medicines use, and dieting, (II) the ORTO-15 test [14], which
21 16 identifies individuals with ON traits, (III) the MDDI-ITA test [16], which identifies individuals with MD traits, and (IV)
22 17 the EAT-26 test [43], which identifies individuals with ED.

25 18 **ORTO-15 test**

27 19 The ORTO-15 test was validated for the Italian population by Donini and colleagues [14]; it is composed of 15
28 20 multiple-choice items using a four-point Likert scale (always, often, sometimes, never); answers that indicate ON have
29 21 a score of “1”, while the “healthier” responses receive a score of “4”. The sum of the points is the final score of the test.
30 22 Donini and colleagues [14] selected two threshold values below which a diagnosis of ON could be given: <40 and <35,
31 23 identifying the value of 40 as more predictive of ON. The authors concluded that cut-off point values could be set
32 24 depending on the purpose for which the scale was used. We chose the cut-off <35, which showed a high specificity
33 25 (94,2%) and negative predictive value (91,1%).

37 26 **MDDI-ITA test**

39 27 MDDI-ITA is a test for the presence of MD. It was validated in the Italian language by Santarnecchi and Dettore [16];
40 28 the original English version was developed by Hildebrandt and colleagues [15]. It is composed of 13 multiple-choice
41 29 items rated on a 5-point Likert-type scale (always, often, sometimes, rarely, never) ranging from point “1” for “never”
42 30 to “5” points for always. The sum of the points is the final score of the test. Currently, measurement instruments for MD
43 31 have not established a defined cut-off score that allows for discrimination between healthy and clinically significant
44 32 results [44]. In this study, we used a cut-off of 39 as previously adopted [18, 28, 45] on the basis of Varangis and
45 33 colleagues [46], who reported a specificity of 75% and a sensitivity of 73,7%.

50 34 **EAT-26 test**

51 35 EAT-26 is one of the most used tests for identifying subjects with EDs, and it was validated in Italy by Dotti & Lazzari
52 36 [43]. It is composed of 26 multiple-choice items (always, usually, often, sometimes, rarely, never). The sum of the
53 37 questions yields the total score. The threshold value ≥ 20 identifies subjects at risk.

56 38 **Statistical analysis**

57 39 All data are presented as the mean \pm standard deviation or percentage, except for exercise levels that were not normally
58 40 distributed and are presented as the median (interquartile range). To assess the differences between variables among the
59 41

groups, Student's t-test and the χ^2 test were used. Exercise levels were compared by the Mann-Whitney test. For correlations, we used Pearson-r.

Data were processed using SPSS software, version 24.

Results

Participants

For the WBS, an email invitation was sent to 2,047 students: 180 (8.8%) entered the web page of the questionnaire, 18 did not give their informed consent, 162 agreed to participate, with a response rate of 7.9%, and 137 completed the questionnaire. For the PBS, a questionnaire was administered to 430 students: 100% agreed to participate, and 372 provided a complete questionnaire response. No differences in data completeness emerged between the two methods of administration: 84.6% for the Web-based and 86.5% for the paper-based questionnaire surveys ($\chi^2=0.369$, $p=0.544$).

Sample characteristics and questionnaire results

Descriptive characteristics of the sample are presented in Table 1. Considering personal characteristics and habits, the group of students who filled out the paper-based questionnaire had a statistically significant younger age and engaged in more physical activity than the group who filled out the web-based questionnaire. No statistically significant differences emerged for sex, BMI, supplements and medicines use or dieting. Analysing the results of the three tests that evaluated ON, MD and EDs, a statistically significant difference emerged only for EDs: the WBS group showed a higher prevalence and a higher score in the EAT-26 than did the PBS group; no differences between the two groups of students emerged in terms of the prevalence of ON and MD traits or in terms of the ORTO-15 and MDDI-ITA test scores (Table 1).

Table 1 - Characteristics of participants

	Web-based questionnaire survey (n=137)	Paper-based questionnaire survey (n=372)	p
Males, n (%)	53 (38.7)	160 (43.0)	0.380
Age (years)	20.4±2.8	20.0±1.3	<0.001*
BMI (kg/m ²)	21.4±2.8	22.1±2.8	0.824
Physical activity (h/week)	4.0±4.0	4.5±7.5	0.020*
Supplements use (%)	10.2	16.1	0.093
Medicines use (%)	10.9	11.3	0.914
Dieting (%)	11.7	8.3	0.248
Traits of ON cut-off<35, n (%)	49 (35.8)	105 (28.2)	0.100
Traits of MD cut-off>39, n (%)	10 (7.3)	21 (5.6)	0.489
Traits of EDs cut-off≥20, n (%)	29 (21.2)	20 (5.4)	<0.001*
Score ORTO-15	35.7±3.8	36.5±3.9	0.819
Score MDDI-ITA	28.0±7.3	26.1±7.3	0.922

Score EAT-26	13.5±11.1	6.0±8.0	<0.001*
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Students with test scores above the cut-off and with a co-presence ON, MD and ED traits

The co-presence of a risk factor for two or three simultaneous conditions was registered in both groups. However, for the two groups, the analysis of the distribution of the number of students who had none, one or more test scores above the cut-off values in the three submitted test responses (ORTO-15, MDDI-ITA and EAT-26) showed a statistically significant difference: the number of students without any risk condition was higher in the group that filled out the paper-based questionnaire than that in the web-based questionnaire group, and in the same group, the number of students with one or more test scores above the cut-off values was lower than the number of web-based questionnaire students (Table 2).

Table 2 –Number of students with test scores above the cut-off

Number of tests with scores above the cut-off values	Web-based questionnaire survey (n=137)	Paper-based questionnaire survey (n=372)	p
0	74 (54.0%)	252 (67.7%)	0.002*
1	43 (31.4%)	100 (26.9%)	
2	15 (10.9%)	14 (3.8%)	
3	5 (3.6%)	6 (1.6%)	

Correlations between the three test scores, hours of physical activity and BMI

In the WBS and PBS groups, ON, MD and ED were correlated (Pearson correlation) with each other. In both groups of students, the ORTO-15 scores were negatively associated with the MDDI-ITA and EAT-26 scores; a lower score on the ORTO-15 test corresponded to a greater attitude towards ON: the correlations found suggest that as the orthorexic attitudes increase, attitudes for behaviours typical of MD or EDs also increase. MDDI-ITA scores were associated with EAT-26 scores and with hours of physical activity. Moreover, only in the PBS group was MDDI-ITA also correlated with BMI, and the EAT-26 was negatively correlated with hours of physical activity (Table 3).

Table 3 – Correlations among test scores, BMI and physical activity

	Web-based questionnaire survey (n=137)			Paper-based questionnaire survey (n=372)		
	ORTO-15	MDDI-ITA	EAT-26	ORTO-15	MDDI-ITA	EAT-26
Physical activity (h/week), r	-0.104 (0.225)	0.152*(0.038)	-0.11 (0.902)	-0.037 (0.478)	0.117*(<0.001)	-0.141* (0.006)
BMI, r (sig.)	-0.017 (0.841)	0.152 (0.077)	-0.013 (0.876)	0.084 (0.108)	0.172* (0.001)	-0.024 (0.647)
ORTO-15, r (sig.)	-	-0.283* (0.001)	-0.362* (<0.001)	-	-.269*(<0.001)	-.307* (<0.001)
MDDI-ITA, r (sig.)	-	-	0.594* (<0.001)	-	-	0.420*(<0.001)

r= Spearman's rank correlation coefficient

1 **Discussion**

1 2 In this study, we assessed the comparability of the results obtained from two surveys carried out among students at the
2 3 University of Turin to evaluate the prevalence of ON, MD and ED traits using different methods of administering the
3 4 questionnaire: online and paper-and-pencil. Surveys were carried out in two consecutive academic years and involved
4 5 students attending their first year in degree courses of medicine, dietetics, physiotherapy, exercise and sport science and
5 6 business administration; the number of students enrolled in university courses in the two academic years was
6 7 comparable.
7 8

10 8 In the web-based questionnaire survey (WBS), 2,047 students were invited to participate via email, and the response
11 9 rate was very low, with only 162 acceptances (7.9%); the data completeness was 84.6%. In the paper-and-pencil-based
12 10 questionnaire survey (PBS), the number of students approached and invited to participate in the survey was lower,
13 11 totalling 430 students, but all agreed to participate (100%), and the data completeness was comparable to that of the
14 12 WBS, 86.5%. There were two reasons that fewer students were approached during lessons than were invited via email:
15 13 1) courses with a large number of students enrolled (i.e., business administration and exercise and sport science) divide
16 14 students into more than one class, and we did not have the personnel or sufficient time to administer questionnaires in
17 15 all the classes; and 2) since mandatory attendance is not required for all university courses, it is difficult to reach all
18 16 students during lessons.

21 17 Comparing the results for the WBS and PBS groups, some statistically significant differences emerged. In terms of
22 18 personal characteristics, participants in the WBS were older and spent less time in a week engaged in physical activity.
23 19 Regarding the evaluation of ON, MD and EDs, the WBS participants had higher scores on the EAT-26 test and a
24 20 greater number of subjects with EDs than did the PBS participants. No statistically significant differences in terms of
25 21 sex, BMI, supplement, drug use and dieting were observed in relation to the ORTO-15 and MDDI-ITA scores or in the
26 22 number of subjects with ON and MD traits. Compared to the WBS group, in the PBS group, the number of students
27 23 with no tests with scores above the cut-off values was significantly greater, and the number of students with one or
28 24 more tests with score above the cut-off was significantly lower.

31 25 These results indicate that in the WBS group, there was a major prevalence of EDs, and more generally, considering the
32 26 number of tests with scores above the cut-off values, there were more students with a risk profile for the conditions
33 27 examined than in the PBS group. Web-based administration may yield slightly different results compared with those
34 28 obtained from paper-and-pencil assessments [47, 48], and it has been documented that the mode of test administration
35 29 affects the expected score distributions [42]. Web-based questionnaires have been concerned about the reliability and
36 30 validity of the data obtained. Studies in various areas of health research have shown that traditional epidemiologic risk
37 31 factors, such as perceived health status, anthropometry data, and smoking and alcohol use, can be collected with equal
38 32 or even better reliability in web-based questionnaires than with traditional approaches [40, 49].

41 33 We attribute differences in the scores in our study to three main aspects: the low response rate in the WBS and a
42 34 possible resulting selection bias, the absence of a validation of the online versions of the three test, and a different
43 35 approach of participants towards online questionnaires vs paper-and-pencil questionnaires.

46 36 Low response rates represent a major concern that threatens the quality of the web surveys [50], and self-selection is a
47 37 common cause of selection bias [40]. Traditional modes of data collection, such as paper-and-pencil questionnaires,
48 38 have shown little bias resulting from non-participation [40, 51, 52]. Actual data on the response rate to web-based
49 39 surveys range from 53% to 92% [2], though the response rate in our study and in other studies of online assessments of
50 40 ON and EDs [30, 53, 54] are generally inferior, and a low response rate is considered to be a limitation.

1 A rate response of 18.4% was obtained from 11,828 students at two universities in the USA after sending an email
2 invitation to complete the EDE-Q test for assessing the prevalence of EDs [53]. Tremelling and colleagues [54]
3 obtained a response rate of 27.4% among a sample of 2,500 dietitian nutritionists invited via email to complete the
4 ORTO-15 and EDE-Q tests in Texas, concluding that choosing to participate or not could influence results regarding
5 the presence of ON traits among respondents [54]. Dell’Osso and colleagues [30] sent an email invitation to the whole
6 student population at the University of Pisa, Italy, (51,609 subjects) to fill out the ORTO-15, and the response rate was
7 4.13%, a factor that reduced the generalizability of the study results according to the authors. A higher rate was
8 obtained by Parra-Fernandez and colleagues [55]: on 640 university students who were asked to complete an online
9 questionnaire through the JotForm platform, they had a response rate of 70.28%.

10 Among the factors that can influence the response rate in web surveys are the sponsors, the topic, the length of time
11 required to complete the survey, the presentation of the questionnaire, the contact delivery modes, the use of pre-
12 notifications and the presence of incentives [50].

13 According to a review of web surveys [50], several meta-analyses have shown that the salience of a topic is one of the
14 most important factors that influences response rates to both mail and web surveys [56–58]. When the topic is of high
15 salience (i.e., the topic is of high interest to some surveyees), potential respondents are more likely to respond to the
16 survey [50].

17 We hypothesize that in our study, the topic of the survey presented in the WBS attracted a high number of subjects
18 interested in personal and pathological involvement in issues related to nutrition, body aspect and physical activity, but
19 this could be true only for the presence of EDs and not for ON or MD. In the PBS, all students approached in class
20 agreed to participate, reducing the self-selection bias of the sample.

21 To our knowledge, there is no validation of the online version of MDDI-ITA or of the EAT-26 test. The validity of an
22 online version of the ORTO-15 translated into Portuguese was tested among a sample of Brazilian dieticians, but no
23 evidence was found of its validity and reliability with the initial psychometric evaluation performed [59]. Some studies
24 used online adaptations of ORTO-15 [26, 27, 30, 54, 60, 61], MDDI-ITA [28] or its original English version [62] and
25 EAT-26 [5, 62–64]. While most of the evidence to date indicates that online adaptations of offline tests usually address
26 the expected constructs, there have been sufficient indications of (usually small) differences (e.g., in factor structure,
27 score distributions) to advocate caution, especially in instances where test use has real implications for people’s well-
28 being [42]. According to Buchanan, when an online test is an adaptation of a traditional offline instrument, evidence
29 that the offline version has satisfactory psychometric properties is not sufficient to allow one to assume they will apply
30 to the online version as well [42]. In our study, the use of tools not even validated for psychometric properties for online
31 administration can be a limitation in the results obtain ed.

32 A strong candidate for explaining the reasons behind the differences in the scores between online and paper-and-pencil
33 surveys is increased self-disclosure [1]. There is compelling evidence that people may disclose more about themselves
34 when communicating via computers than via face-to-face interactions [65], a phenomenon that appears to extend to
35 internet-mediated communication [66]. This has actually been one of the possible advantages suggested for online
36 clinical work and has also led to the suggestion that online psychological questionnaires will actually give a better
37 picture of the individual’s real personality than traditional measures would [1]. Electronic administration of
38 questionnaires can affect the responses given to self-administered survey questionnaires through direct influence on the
39 respondents [67]. For example, concerns about privacy, anonymity and confidentiality might influence the accuracy of
40 the answers to certain items, and social and cultural beliefs can influence the acceptability of the response [67, 68].

1 A correlation among the three test scores was identified between both the WBS and PBS groups: the increase in
2 attitudes towards one of the conditions examined also implies an increase in attitudes towards the other two conditions.
3 This is in line with the literature: a correlation between ON and ED traits emerged in some studies [6, 60, 69, 70] as
4 well as a correlation between MD and EDs [71–73]. This result is also in line with the studies in which a proximity of
5 features between ON and MD with EDs is considered [4–9, 25].

6 The use of electronic self-administered survey questionnaires has become common in several research areas [74]. In
7 situations such as the current COVID-19 pandemic, the importance of using online tools when it is not possible to meet
8 face to face emerges more than ever. It is therefore essential that these tools are valid and representative and it is
9 important to consider the impact that changing the mode of delivery can have on the responses collected [67]. In this
10 study, the same questionnaire for evaluating the prevalence of ON, MD and ED traits administered in two consecutive
11 years to an analogous group of undergraduates online and via paper-and-pencil gave some different results: students
12 who completed the online questionnaire had a higher prevalence of EDs and presented a higher number of subjects with
13 risk profiles for one or more of the three conditions examined than did students who completed the web-based
14 questionnaire. These differences could be due to several aspects, including an effective distinction between the two
15 groups, but the variation in the route of administration can also play a role. It is important to address correctly online
16 surveys, preferably requiring instruments specifically validated for that use.

17 **What is already know on the subject?**

18 Online surveys to assess the diffusion of eating disorders, both classified and emerging as orthorexia nervosa and
19 muscle dysmorphia have been widely used in recent years, however, the questionnaires used are not generally validated
20 for online administration. The results of online surveys may be affected by bias due for example to low response rates,
21 to a self-selection linked to the salience of a topic, the sponsors, the length of time required to complete the survey, the
22 presentation of the questionnaire, the contact delivery modes, the use of pre-notifications and the presence of incentives.
23 Furthermore, in online surveys, subjects often have greater self-disclosure. The results of the web-based surveys must
24 take into account all these aspects to be considered valid and reliable.

25 **What your study adds?**

26 This study, for the first time to our knowledge, compares the results obtained with the online and paper administration
27 of questionnaires for the evaluation of the diffusion of EDs, ON and MD on analogous groups of university students.
28 Differences between the groups have been identified. The results highlight the need for an adequate design of web-
29 based surveys and the importance of using validated questionnaires for this type of administration.

30 **Declarations**

31 **Funding:** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-
32 profit sectors.

33 **Conflict of Interest:** The authors declare that they have no conflict of interest.

34 **Ethics approval:** All procedures performed in this study were in accordance with the ethical standards of the national
35 ethics committee and with the 1964 Declaration of Helsinki. The study was approved by the bioethical committees of
36 University of Turin.

1 **Consent to participate:** Informed consent was obtained from all participants included in the study.
2 **Consent for publication:** not applicable.
3
4 **Availability of data and material:** The dataset generated and analysed during the current study are available from the
5
6 corresponding author on reasonable request.
7
8 **Code availability:** not applicable.
9
10 **Author's contributions: Conceptualization:** Iaria Silvia Rossella Gorrasi, Giovanni Abbate Daga, Simona Bo,
11
12 Elisabetta Carraro; **Methodology:** Iaria Silvia Rossella Gorrasi, Giovanni Abbate Daga, Simona Bo, Elisabetta
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14 Carraro, Anna Tagliabue; **Formal analysis and investigation:** Iaria Silvia Rossella Gorrasi, Raffaella Degan, Mattia
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16 Roppolo, Cinzia Ferraris, Monica Guglielmetti; **Writing – original draft preparation:** Iaria Silvia Rossella Gorrasi,
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18 Raffaella Degan, Elisabetta Carraro, Cinzia Ferraris, Monica Guglielmetti; **Writing – review and editing:** Iaria Silvia
19
20 Rossella Gorrasi, Giovanni Abbate Daga, Simona Bo, Elisabetta Carraro, Anna Tagliabue, Cinzia Ferraris, Monica
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22 Guglielmetti; **Supervision:** Giorgio Gilli, Elisabetta Carraro.
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