

## ARTICLE



Phenotyping in clinical nutrition

# Food addiction assessment in a nonclinical sample of the Italian population

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**OBJECTIVE:** Discussion about the potential addictive role of certain types of food and their link with obesity has recently increased. Researchers have developed instruments to specifically assess food addiction (FA). The aim of this pilot study was to investigate the prevalence of food addiction in a nonclinical sample of the Italian population.

**METHODS:** All participants ( $n = 148$ : 46 males, 102 females) completed the Yale Food Addiction Scale 2.0 (YFAS 2.0) and provided self-reported measures and demographic information. They were divided into three age groups.

**RESULTS:** The prevalence of FA was 15.5% of our sample (82.6% of the subjects diagnosed with FA were female). The FA symptoms mean was 1.90 ( $SD = 2.87$ ). In both sexes, participants aged 18–30 had the highest diagnosis of FA, with 52.1% of all FA subjects being females aged 18–30. According to the Body Mass Index (BMI), all the males diagnosed with FA were overweight or obese, as were most (63.2%) of the FA females.

**CONCLUSIONS:** Future food education policies could consider FA assessment together with that of other eating disorders, even among nonclinical subjects in order to anticipate diagnosis and improve treatment.

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## INTRODUCTION

Obesity has become one of the costliest health problems. Its prevalence is increasing in both developed and developing countries, with a total of 2.1 billion individuals considered overweight or obese [1]. Obesity is closely related to several chronic diseases, such as diabetes, hypertension, hyperlipidemia, asthma, arthritis, and poor health conditions [2]. Overweight and obesity occur when excess fat accumulation (regionally, globally or both) increases health risks. As with other chronic diseases, obesity results from an interaction between an individual's genetic predisposition to weight gain and environmental influences [3].

It has been suggested that an addiction to certain types of food, particularly highly processed, hyperpalatable foods, could contribute to overeating and obesity in parallel with dramatic changes in the food environment [4]. Some individuals (both humans and laboratory animals) may eventually override the inhibitory processes that signal satiety and begin to compulsively consume large amounts of food despite nutrition overload and even repulsion at this behavior in the case of humans. This loss of control and compulsive pattern of food intake is reminiscent of the drug intake patterns seen in addiction and has led to the description of obesity as a form of "food addiction" [5]. Recent research has focused on the concept of food addiction (FA) in the attempt to give a generally accepted explanation, but it remains controversial [6].

Since 2009 [7], the Yale Food Addiction Scale (YFAS), a self-reported questionnaire, has been the only method for clinical

assessment of FA. The YFAS was developed by modeling all of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for substance dependence for application to eating behavior. Later, the DSM-5 introduced significant changes to the substance-related and addictive disorders section [8] and a new version was developed, in line with the DSM-5, called the YFAS 2.0 [9].

Publication of the YFAS has contributed to the increasing number of studies regarding FA.

FAs measured by the YFAS have been found to be strongly associated with obesity and with greater psychosocial impairment [10–12]. Since 2013 an emerging literature has also examined rates and correlates of pre- and post-operative FA among bariatric surgery patients [13]. Recently, Penzenstadler et al. [14] noted that FA was associated with higher body mass index (BMI) and eating disorders.

From a neurobiological perspective, several neurotransmitters, including dopamine, as well as hormones and neuropeptides are involved in homeostatic regulation of food intake. In particular, feeding behaviors are influenced by another layer of regulation that involves processing of rewards through dopamine signaling and its ability to condition food-associated stimuli that then will trigger the desire for the associated food [5]. For this reason, it may be appropriate to evaluate also the effect of chronic exposure to highly palatable foods on the reward system in the development of FA and obesity.

Given the increasing interest in this topic, it is important that researchers and clinicians benefit from having a reliable tool to

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evaluate FA. The first version of the YFAS was validated in Italian in 2015 [15], while the second version (YFAS 2.0) was validated on a sample of university students in 2017 [16].

The prevalence of FA according to the YFAS has varied largely among the studied samples. The aim of the present study was to investigate FA assessment and estimate the FA prevalence in a nonclinical sample of men and women residing in Italy. Assessing FA among nonclinical subjects may be a useful strategy for food education policies to prevent obesity and its related comorbidity.

## MATERIALS AND METHODS

The questionnaire was administered on an online survey platform which participants accessed via a designated link. Participants were linked to the survey after reading about FA in a magazine about food and health [17]. Readers of the magazine are people interested in discussions of nutrition topics based on scientific research.

The study was conducted in full agreement with national and international regulations and the Declaration of Helsinki (2000). All participants were fully informed about the study requirements and had to agree to the data sharing and privacy policy before being eligible to take part in the study. Other inclusion criteria were: over 18 years old, Italian speaker, resident in Italy. All data were collected anonymously.

Participants completed a battery of self-reported measures. Demographic factors assessed included: sex, age, education, and area of residence. Participants reported current weight and height, which was used to calculate BMI ( $\text{kg}/\text{m}^2$ ). They were classified as: underweight (BMI < 18.5  $\text{kg}/\text{m}^2$ ), healthy weight (BMI 18.5–24.99  $\text{kg}/\text{m}^2$ ), overweight (BMI 25.0–29.99  $\text{kg}/\text{m}^2$ ) and obese (BMI  $\geq 30$   $\text{kg}/\text{m}^2$ ).

### Yale Food Addiction Scale 2.0

The Italian version of the YFAS 2.0 is a self-reported questionnaire to assess addiction-like eating behavior during the past 12 months. Items were developed in correspondence with substance-dependence criteria from the DSM-5.

The scale consists of 35 items scored on an eight-point scale ranging from never (score = 0) to every day (score = 7). The YFAS 2.0 symptom count is calculated as the sum of the number of fulfilling diagnostic criteria (ranging from 0 to 11). FA diagnosis also requires the presence of the impairment/distress criteria. The severity level of FA is calculated as:

Mild FA (with 2–3 symptoms and impairment/distress criteria).

Moderate FA (with 4–5 symptoms and impairment/distress criteria).

Severe FA (with  $\geq 6$  symptoms and impairment/distress criteria).

## RESULTS

### Subjects

One hundred fifty six people completed the survey, but eight did not satisfy the inclusion criteria and were not included in the study. Thus, 148 participants completed all the questions and were included in the analysis: males  $n = 46$  (31.1%), females  $n = 102$  (68.9%); mean age 35.66 (SD = 13.73), range 18–68 years, mean BMI 24.57 (SD = 4.56), range 17.85–47.45 (Table 1). Most of the participants were in the healthy weight BMI range, were university graduates and lived in urban areas.

### FA in the sample

Participants who met the YFAS 2.0 criteria for “food addiction” were classified as having either mild (2–3 symptoms), moderate (4–5 symptoms) or severe (6 or more symptoms) FA.

Twenty-three subjects (15.5%) were positive for at least two symptoms of the scale with clinically significant impairment or distress (Table 2): 4 males (17.4%) and 19 (82.6%) females. FA diagnosis was higher in the female group: 18.6% of females vs. 8.7% of males. Severe FA was the most common diagnosis in both males and females.

Both males and females were divided into three age groups: group 1 aged 18–30, group 2 aged 31–49, and group 3 aged 50 years old and over. In both sexes, participants aged 18–30 (group 1) had the highest diagnosis of FA (18.4%) (Table 3). Group 1 had

50% of the FA diagnosis in the male group, while in the female group 1 the percentage was 63.2%.

Most of the FA subjects (84.2%) were classified as overweight or obese (Table 4). This included all the FA males, while 63.2% of the FA females were overweight or obese and only 7 (36.8%) were in the healthy weight range. The majority of the FA group (89.5%) were university graduates, while the remaining 10.5% had attended high school. All the FA males lived in urban areas in contrast to 68.4% of the FA females.

### Symptoms

The symptom count scoring option for the YFAS 2.0 was computed by summing the 11 diagnostic criteria (scores ranging from 0 to 11). Each of the 11 diagnostic criteria was considered to be satisfied if one or more of the relevant questions for each criterion met the threshold.

The mean number of reported YFAS FA symptoms was 1.90 (SD = 2.87) among all participants and the percentage of participants who met the threshold for each diagnostic criterion ranged from 8.8 to 26.4%. Frequencies of the eleven symptoms on the YFAS 2.0 are reported in Table 5. Across all participants, YFAS 2.0 symptoms had the following frequencies: 20.9% ( $n = 31$ ) reported food consumed in larger quantities or over a longer period than intended; 25.7% ( $n = 38$ ) reported persistent desire or unsuccessful efforts to cut down or control consumption of certain foods; 19.6% ( $n = 29$ ) reported considerable time spent to obtain, consume or recover from effects of food; 12.8% ( $n = 19$ ) reported giving up important social, occupational or recreational activities because of food consumption; 17.6% ( $n = 26$ ) reported continuing to eat certain foods despite physical or psychological problems; 13.5% ( $n = 20$ ) reported tolerance; 26.4% ( $n = 39$ ) reported

**Table 1.** Patient demographics.

	All ( $n = 148$ )	Males ( $n = 46$ )	Females ( $n = 102$ )
Age	35.66 $\pm$ 13.73	36.18 $\pm$ 13.95	35.38 $\pm$ 13.69
Height (centimeters)	167.32 $\pm$ 8.94	177.39 $\pm$ 7.08	162.77 $\pm$ 5.19
Weight (kg)	68.97 $\pm$ 14.47	77.93 $\pm$ 11.63	64.93 $\pm$ 13.76
BMI	24.57 $\pm$ 4.56	24.72 $\pm$ 3.20	24.50 $\pm$ 5.06
BMI category			
Underweight	4	0	4
Healthy weight	94	29	65
Overweight	35	12	23
Obese	15	5	10
Education			
University graduate	90	30	60
High school	57	16	41
No grade	1	0	1
Urban area	114	36	78
Suburban area	34	10	24

Data are reported as mean  $\pm$  standard deviation (SD).

**Table 2.** Food addiction diagnosis in the sample.

	All	Males	Females
Positive	23	4	19
Diagnosis			
Mild FA	3	1	2
Moderate FA	1	0	1
Severe FA	19	3	16

**Table 3.** FA diagnosis in the sample divided by sex and age group.

	Percentage of FA subjects ( <i>n</i> = 23)	Diagnosis		
		Mild ( <i>n</i> = 3)	Moderate ( <i>n</i> = 1)	Severe ( <i>n</i> = 19)
<b>Males</b>	<b>17.4 (4)</b>	<b>1</b>	<b>0</b>	<b>3</b>
Group 1 (aged 18–30)	8.7 (2)	1	0	1
Group 2 (aged 31–49)	4.3 (1)	0	0	1
Group 3 (≥50 years old)	4.3 (1)	0	0	1
<b>Females</b>	<b>82.6 (19)</b>	<b>2</b>	<b>1</b>	<b>16</b>
Group 1 (aged 18–30)	52.2 (12)	1	0	11
Group 2 (aged 31–49)	21.7 (5)	1	0	4
Group 3 (≥50 years old)	8.7 (5)	0	1	1

The bold values refer to the total number of the females and to the total number of the males in the sample.

**Table 4.** BMI classification of the food addiction group.

BMI category	All ( <i>n</i> = 23)	Males ( <i>n</i> = 4)	Females ( <i>n</i> = 19)
Underweight	0	0	0
Healthy weight	7	0	7
Overweight	9	2	7
Obese	7	2	5

withdrawal; 14.9% (*n* = 22) reported continued use despite social or interpersonal problems; 8.8% (*n* = 13) reported failure to fulfill major role obligations; 13.5% (*n* = 20) reported eating certain foods in physically hazardous situations; 16.9% (*n* = 25) reported a craving or strong desire or urge to eat a certain food; 18.2% (*n* = 27) reported significant impairment/distress.

## DISCUSSION

Most studies in Italy have been conducted to validate or assess the psychometric properties of the different versions of the YFAS questionnaire, including YFAS, YFAS 2.0, and modified YFAS 2.0 [16, 18, 19]. However, there is a lack of knowledge about results of the YFAS 2.0 in the general population.

In the present study, the frequency of FA was evaluated in a nonclinical sample of the Italian population. The main finding is the high FA diagnosis among young adults, with a frequency of 15.5%. Interestingly, our diagnosis of FA is higher than that found by Imperatori et al. in a sample of 262 Italian adults with the modified Yale Food Addiction Scale 2.0 (mYFAS 2.0) [19] and by Aloisi et al. in a sample of 574 Italian university students [16]; however, it is similar to the FA prevalence estimated by Yekaninejad et al. [20] in a systematic review and meta-analysis on children and adolescents. Moreover, Pursey et al. [21] showed that FA was higher in adults aged >35 years, in females and in overweight/obese participants, confirming that it may be important to investigate the relationship of FA with specific age-related groups in order to improve diagnosis and treatment.

Eating disorders are common among adolescents and their presence has been attributed mainly to the family environment and exposure to the media [22]. In 2016, Keski-Rahkonen and Mustelin [23] found the following frequencies reported by European women: anorexia nervosa <1–4%, bulimia nervosa (BN) <1–2%, binge-eating disorder <1–4%, and subthreshold eating disorders 2–3%; instead only 0.3–7% of European men reported eating disorders. They identified parental psychiatric disorders, prenatal maternal stress, various family factors, childhood overweight, and body dissatisfaction in adolescence as risk factors of eating disorders. Given that adolescence and young adulthood are stressful stages, it is very likely that stress may

influence food choices and body weight. Wei et al. [24] demonstrated that chronic stress increased the FA score in mice. Chronic stress not only aggravated the binge-eating behaviors but also compulsive eating behaviors and contributed to the development of stress-related obesity.

Our data are in agreement with other findings about FA and disordered eating behaviors which showed a higher diagnosis in women than in men at college age (18–25 years old), with a prevalence of FA in young woman of 12.3% [25].

FA seems to have significant psychopathological overlaps with other eating disorders. For example, reduced control overeating, continued use despite negative consequences, elevated levels of impulsivity and psychopathology are several overlaps between FA and both binge-eating disorder (BED) and BN [11, 26].

BED is associated with elevated concerns about body shape or weight [26], and BN and AN are characterized by body image disturbance that drives dysfunctional eating and related behaviors [8], factors that are not considered in patients with FA. Nevertheless, a recent study of a sample of Italian adolescents with eating disorder found that 53.7% of those diagnosed with restrictive AN were also food addicted according to the YFAS 2.0 [27].

Tran et al. [28] found that FA was significantly associated and positively correlated with the binge-eating/purging subtype of AN, higher levels of depression and anxiety, and greater eating psychopathology. They suggested that the presence of FA may represent a more severe variant of AN.

In our sample, participants with FA had a higher BMI. It has been suggested that FA contributes to the severity of obesity, with higher rates in women than in men [29], because of the high caloric content of the foods involved. However, at the same time it may lead to a purging subtype of AN, explaining the high rate of FA also among healthy weight and underweight people.

Therefore, a multidisciplinary approach is important to treat FA, and future food education policies should consider treatment of FA and its link with the development of obesity and disordered eating behaviors, particularly among young adults and adolescents.

The distribution of FA across various BMI classifications suggests the need for greater generalizability in FA research.

The present findings should be seen in the context of the study limitations. The results were obtained from a convenience sample of individuals interested in online research with access to the internet. However, online surveys are gaining popularity and are widely used in research on eating and weight [30] and FA [9].

Given the growing interest in FA and the addictive potential of certain types of food, clinicians may find it appropriate to use the YFAS 2.0 to investigate the presence of FA also in nonclinical populations for the purpose of screening and anticipating treatment, in particular among young individuals who seem to

**Table 5.** Frequencies of the Yale Food Addiction Scale 2.0 criteria.

Criteria	All (n = 148)	Males (n = 46)	Females (n = 102)
Food consumed in larger quantities or over a longer period than intended	31 (20.9%)	8 (17.4%)	23 (22.5%)
Persistent desire or unsuccessful efforts to cut down or control consumption of certain foods	38 (25.7%)	6 (13%)	32 (31.4%)
Considerable time spent to obtain, consume or recover from effects of food	29 (19.6%)	9 (19.6%)	20 (19.6%)
Giving up important social, occupational or recreational activities because of food consumption	19 (12.8%)	6 (13%)	13 (12.7%)
Continuing to eat certain foods despite physical or psychological problems	26 (17.6%)	5 (10.9%)	21 (20.6%)
Tolerance (marked increase in amount; marked decrease in effect)	20 (13.5%)	5 (10.9%)	15 (14.7%)
Characteristic withdrawal symptoms; substance taken to relieve withdrawal	39 (26.4%)	7 (15.2%)	32 (31.4%)
Continued use despite social or interpersonal problems	22 (14.9%)	6 (13%)	16 (15.7%)
Failure to fulfill major role obligations	13 (8.8%)	4 (8.7%)	9 (8.8%)
Eating certain foods in physically hazardous situations	20 (13.5%)	4 (8.7%)	16 (15.7%)
A craving or strong desire or urge to eat a certain food	25 (16.9%)	6 (13%)	19 (18.6%)
Impairment/distress	27 (18.2%)	6 (13%)	21 (20.6%)

Percentages in brackets refer to the number of subjects presenting the symptoms with respect the total number of subjects.

be more susceptible to developing eating disorders. Future prospective studies with larger samples are also warranted to examine directionality between FA and associated features.

#### DATA AVAILABILITY

The data presented in this study are available in this published article.

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#### AUTHOR CONTRIBUTIONS

AMA and ER contributed equally to this paper.

### COMPETING INTERESTS

The authors declare no competing interests.

### INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki. Ethical review and approval were waived for this study, since the anonymous nature of the web survey does not allow the tracing of sensitive personal data. Participants were fully informed about the study requirements and had to agree to the data sharing and privacy policy before participating in the study. The study was not a clinical trial on drugs, supplements or foods, but a survey of the population's habits. All the participants gave their consent to the data treatment at the beginning of the web survey. If any participant did not give his/her consent, the web survey automatically stopped.

### INFORMED CONSENT

Informed consent was obtained from all subjects involved in the study.

### ADDITIONAL INFORMATION

**Correspondence** and requests for materials should be addressed to A.M.A.

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