ORIGINAL ARTICLE

The FODRAT study (FOod addiction, DRugs, Alcohol and Tobacco): first data on food addiction prevalence among patients with addiction to drugs, tobacco and alcohol

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Abstract

Objectives The main focus of this study was to evaluate the prevalence of food addiction (FA) in a population of 575 subjects, all affected by drugs, alcohol and/or tobacco addiction.

Methods Patients were enrolled in Addiction Service Centers and 25 items YFAS questionnaire was administered. Prevalence of FA was studied among patients who already have an addiction and then this prevalence was compared between groups of abusers (by type of substance), comparing mono abusers with polyabusers, as well as regressions by age, BMI, sex, through multiple regression analysis.

Results Prevalence of FA in the sample is 20.17%. Risk of FA increases with the number of substances used (polyabuse). Results show a positive correlation, in addicted people, between BMI values and FA, with significant values (OR 1.08; 95% CI 1.04–1.13; $p = 0.006$). Age is inversely correlated with FA (OR 0.97; 95% CI 0.95–0.99; $p = 0.01$). Female sex is positively associated (OR 2.60; 95% CI 1.59–4.27, $p = 0.000$). No significant association appears with any substance, even if the highest prevalence is recorded among cannabis users (31.03%), and heroin (21.07%), followed by cocaine (18.53%), alcohol (14.49%) and tobacco (11.61%). A comparison between the FA prevalence in our study and that from another study in the Italian general population (11%) shows a significant difference ($p < 0.001$).

Conclusions Prevalence of FA among addicted people is greater than in the general population. Risk of FA increases with the increase in number of used substances (polyabuse). Age is inversely correlated with FA. There is a positive and significant correlation between BMI and FA among substance/tobacco abusers.

Level of evidence Level V, observational cross-sectional descriptive study.

Keywords Food addiction · Bulimia nervosa · Weight · Addiction · Food craving

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This article is part of Topical Collection on Food and addiction.

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Introduction

For a long time, the term "addiction" has referred only to illegal substances and alcohol; recently, however, the concept has been connected also to behavioral disorders, such as gambling [1]. According to West and Brown [2], addiction is a condition of dependence in which individual needs have to be absolutely and immediately satisfied; this strong compulsive need is defined as "craving" and it is an element all addictions share. For many years researchers have hypothesized the existence of an addiction to food (FA), related to an increase in the desire for specific foods to obtain pleasure or arousal or alleviate emotional or physical discomfort [3, 4]. But it is only recently that FA has been taken into consideration as a subject of research [5].

Main critical views on the concept of food addiction are based on difficulty in distinguishing between FA and BED. In addition, some authors argue that nutrition is a physiological behavior and that there is no specific nutrient that is addictive at all times [6, 7].

Today, definition of FA [8–10] stems from that of drug addiction described in the DSM-IV-TR (4th edition of the Diagnostic and Statistical Manual of Mental Disorders) [11]. An important symptom is craving, and Food Craving (FC) is defined as the intense, compelling desire to consume a specific food [12–14].

Although craving has been added to the DSM-5 (5th edition of the Diagnostic and Statistical Manual of Mental Disorders) [15] only recently [16], it has been considered an essential feature of drug addiction since the 1950s [17]; it is a crucial component of FA [18] and it has a strong association with bulimia nervosa (BN) [19–21], anorexia nervosa (AN) [22, 23], overweight and obesity [24], binge eating disorder (BED) [25, 26], night eating syndrome (NES) [27].

Several studies have found various correlations between substance abuse, some eating disorders and food addiction. The correlations are not only neurobiological, but also clinical and epidemiological.

From a psychopathological perspective, FA seems to significantly overlap with other EDs (eating disorders). Indeed, addiction patterns have been demonstrated both in AN and BN [28–30]. However, there are also some crucial differences between FA and Eds. FA diagnostic criteria also include other symptoms such as withdrawal or tolerance, not required for ED diagnosis. Diagnostic tools for BED and FA are not alternative but complementary and intercept significant but not overlapping clinical expressions [31].

From a neurobiological point of view, the first study was conducted by Wang [32]; a lower expression of striatal D2 receptors was reported in obese subjects with respect to controls. This condition, described as a "reward deficiency syndrome", is similar to what happens in individuals with SUD (Substance Use Disorder). Since then, a large number of studies have been conducted on this subject, most of which found a neurobiological link between substance addiction and uncontrolled food consumption [33–37]. Consumption of alcohol and food, particularly foods with high sugar content, seems to cause the release of endogenous opioids in the central nervous system [38]; opioid blockers, such as naloxone, reduce the reinforcement power and craving for alcohol in abusers [39]. In addition, naloxone reduces the drive for and the consequent consumption of sweet foods rich in fat both in normal-weight and in obese subjects [40].

Regarding clinical aspects, on the other hand, studies show several correlations between food addiction, substance use, eating disorders. Some research pointed out that 50% of women affected by an eating disorder concomitantly suffer from substance abuse or dependence [41]. Prevalence of EDs among alcohol abusers in comparison to the general population, for example, seems to be 35% and 3% respectively [41]. Between 17 and 46% of teenagers do suffer from an ED and, among these, 20–40% are substance abusers [42, 43]. In the spectrum of EDs, bulimia nervosa is the one with the strongest correlation with substance abuse [44–47]: the highest prevalence of substance abuse is reported in BN with purging and BED. On the contrary, patients with AN do not differ from healthy controls in terms of substance abuse prevalence [48]. Symptoms of food addiction were positively associated with smoking, alcohol use, cannabis use and sugar intake in adolescents [43, 49]. An higher prevalence of FA has been demonstrated among gamblers [50]. Overweight and dysfunctional eating patterns have been observed specifically among people in recovery from drug and alcohol addictions [51, 52]. Strong significant relationships were found between FA and EXD (exercise dependence) [53]. Reductions in addiction-like food behaviors and increases in alcohol intake have been reported after weight loss surgery [54].

From an epidemiological perspective, several people and in different regions seem to meet the FA criteria [55, 56]. In a sample of American students, 11.4% of them met the criteria set by the YFAS. In a sample selected from the general population, the prevalence was 7.8% and 8.8% in France and Germany respectively; in a Canadian study on 652 adults, it was 5.4%. To our knowledge, the largest Italian study counts a sample of 300 people [57]; they were selected from the general population as a control group of a psychometric study on obese and overweight patients. In that group the prevalence of FA was 11% and the controls subjects were 300 people (231 women and 69 men). The mean age was

41.74 years (SD = 13.27, 22–81 years), the average BMI was 23.13 kg/m^2 (SD = 6.46, 16–38.05).

The main descriptive objective of the FODRAT study is to assess the prevalence of FA among patients of services for addiction treatment. The study uses the YFAS questionnaire and focuses on subgroups stratified according to substance type, age, body weight and sex. One hypothesis that motivated the study was that, among people with addiction, there is a higher prevalence of FA than in the general population, and that among polyabusers there is a greater prevalence than in mono-abusers.

Materials and methods

Sampling

827 patients were enrolled by 17 different addiction treatment services (SerD) for legal or illegal substances; in other cases, the subjects were enrolled in smoking cessation services. The centers included in the study were: Ass2 Isontina Bassa Friulana, Carate, Seregno, Monza, Dolo, SMI of Brescia (The Wizard of Oz), Dependence Medicine of Verona, Nicosia, Vimercate, Rovigo and Badia, Treviso Nord, Rimini, Forlì, ULSS Serenissima, USLL 9 Scaligera, Verona.

Subjects aged ≥ 18 who abuse psychotropic substances or suffer from any form of addiction to legal or illegal substances. Due to the high prevalence of psychiatric morbidity among patients with drug addiction, only patients with severe psychiatric illnesses (i.e. schizophrenia undergoing decompensation, ongoing major depression) were excluded from the study, such as not to allow regular attendance at service. Patients with personality disorders or psychiatric illnesses were enrolled in good clinical compensation with or without concomitant drug treatment.

Patients were enrolled only on the basis of the inclusion criteria, without any previous selection. The enrolment was on a voluntary basis. The questionnaires were anonymous and listed according to an ID code specific for every field office. Database was developed using company servers only, equipped with IT protection tools, in accordance with the legislation in force. At the time of the start of the study the DSM-IV criteria were the most used in addiction services in Italy. Only those patients meeting at least 3 DSM-IV criteria out of 7 for the diagnosis of addiction were selected. The participation in the study was free of charge.

Instruments

The questionnaire consisted of the YFAS test (Yale Food Addiction Scale), a further section for personal data (age, height, weight, sex, type of addictive substance).

The YFAS is a test made up of 25 items; it can be easily self-administered and analyzes data from the previous 12 months, in accordance with the seven DSM-IV criteria for the diagnosis of substance addiction [5]. To score the dichotomous version, a variable must be calculated in which the clinical meaning must = 1 (elements 15 or 16 = 1) and the symptom count should be > 3.

Validation of the English version was characterized by a good convergence, internal consistency, and predictive power for BED detection. The Italian translation of the YFAS was validated by a bilingual study group (SISDCA members, the Italian society for the study of eating disorders) and used in a later study [58, 59]. The preliminary study was presented at the ANDID National Congress. Italian version of YFAS was administered to 78 adult subjects (18 males and 60 females), consecutively enrolled, that required treatment for an eating disorder and/or body weight correction. The following self-completed questionnaires were associated: BDI, BES and TFEQ. The authors considered that the congruence and the comprehensibility of the 25 questions was satisfactory, the consensus, the feasibility and the acceptance of the questionnaires was good, everyone carried out the instructions without difficulty. This version of 25 questions was the only one available at the time the study was designed, so it was used. The Italian YFAS 2.0 and Italian 19-item YFAS (in postgraduate students) was subsequently validated [60].

Statistical analysis

For the multiple regression model the following variables were considered: number of substances consumed (categorical variable: 1 substance, 2, 3, more than 3); age in completed years (discrete variable from 14 to 76); sex (dichotomous variable: male = 1; female = 2); Body Mass Index (discrete variable consisting of whole numbers from 13 to 62). Stata version 10 software was used for statistical analysis.

Results

602 out of 827 patients answered the YFAS questionnaire accurately. Only 575 patients provided the additional data required by the study (age, gender, body weight, height, substance of abuse). Patients could insert up to 5 substances or behavioural indicators of abuse: it was possible to identify the primary substances, the subjects who abused one substance (mono-drug addicts) and those who abused two or more substances (polydrug addicts).

Table 1 Absolute numbers and percentages of subjects according to the primary substance

	N. of subjects	%
Heroin	280	48.6
Alcohol	138	24
Cocaine	65	11.3
Tobacco	62	10.7
THC	29	5
Others	1	0.4
	575	100

Table 2 Absolute numbers and percentages of polyabusers, according to the primary (prevailing) substance

	N. of subjects	%
Heroin	229	66.38
Alcohol	53	15.36
Cocaine	39	11.30
THC	19	5.51
Tobacco	5	1.45
	345	100

Gender, age and BMI

Sample consists of 452 males (78.61%) and 123 females (21.39%). The average age is 42.8 years, with a minimum of 14 and a maximum of 76 years (SD 11.4). The average age of females is 44.4 years (14–71; SD 12.6) and is on average 2.2 years older than males (42.3 years; 16–76; SD 11.0). The most represented age group is 40–44 years (92 people), followed by 50–54 (89 people), 45–49 (84 people), 35–39 (81 people), 25–29 (56 people), 30–34 (57 people), 55–59 (45 people), 18–24 (31 people), 60–64 (25 people), $\geq$ 65 (15 people). The average BMI is 25.2 (12.7–62.1); the average BMI of males is 26.1 (SD 10.0) while that of females is 24.2 (SD 6.1).

Use of substances

Table 1 shows that heroin addiction is the most common in the population examined (48.6%), followed by alcohol

(24.0%), cocaine (11.3%), tobacco (10.7%), THC (5.0%) and others (0.4%).

The number of subjects with abuse of a single substance was 230 (40%), while number of subjects who reported the use of multiple substances was 345 (60%). The numbers and rates of primary substances among multi-drug addicts (2 or more substances) are described in Table 2.

There were 116 patients with a positive questionnaire outcome, with a sample prevalence of 20.17%; the prevalence was higher in females (29.3%) than in males (17.7%). FA-positive patients were on average 2.6 years younger (40.6 vs 43.3) and had higher BMI by 1.8 points (26.7 vs 24.9). They were also more often polyabusers (71.6% vs 57%).

An Italian study [41] found a prevalence in the general population of 11%, while in our sample it was 20.17%, this shows a significant difference ($p < 0.001$).

By applying a logistic regression model and inserting the variables sex, number of substances (dichotomous: mono/polyabuse), age (in completed years) and BMI variables, it was concluded that all variables are related to the outcome (positive result to the questionnaire for food addiction, see Table 3).

A positive correlation was observed between BMI values and food addiction (OR 1.08; 95% CI 1.04–1.13; $p = 0.000$). Age, on the other hand, has a negative correlation with FA with food addiction risk that decreases slightly with increasing age (OR 0.97; 95% CI 0.95–0.99; $p = 0.01$).

The female sex is instead strongly associated with FA with a relative risk of 2.6 times higher than the male sex (OR 2.60; 95% CI 1.59–4.27, $p = 0.000$). Finally, the risk of addiction to food is about double in polyabuse subjects compared to consumers of a single substance (OR 1.93; 95% CI 1.20–3.11, $p = 0.006$). Prevalence in mono-abusers is 14.78%, in polyabusers is 23.76%. The YFAS score in food addicted patients is 5.47.

By inserting in the model dichotomous variables relating to the consumption of individual substances (1 = non-consumption, 2 = consumption), no significant associations are evident for specific substances, even if the highest prevalence was recorded in cannabis (31.03%) and heroin users

Table 3 Logistic regression analysis for variables sex, number of substances (categorical), age and BMI variables

Food add	Odds ratio	SE	z	$p > |z|$	95% CI	
Num_sos_dic	1.937522	0.4707689	2.72	0.006	1.203445	3.119372
Age_years	0.976573	0.0098542	− 2.35	0.019	0.9574661	0.9960612
Sex_n	2.60849	0.6587048	3.80	0.000	1.59016	4.278953
BMI	1.088071	0.0233344	3.94	0.000	1.043284	1.13478
Logistic regression				Number of obs = 574		
				LR $\chi^2(4) = 38.06$		
				Prob > $\chi^2 = 0.0000$		
Log likelihood = − 269.85426				Pseudo $R^2 = 0.0659$		

(21.07%), followed by cocaine (18.53%), alcohol (14.49%) and tobacco (11.61%) consumers.

Discussion

This study estimated the prevalence of food addiction among addiction services patients in Italy on an unselected sample. It reveal a greater risk (approximately double) of food addiction for subjects with polyabuse than compared to mono-abusers: the risk of having FA increases with the number of substances used, but the sample size is not sufficient to show associations with specific substances abuse. As in other studies, positive correlation has been confirmed between the female sex, BMI and food addiction. Age appears to have a protective effect on the onset of FA.

A first explanation can be found in the fact that polydrug addicts generally show a more serious clinical status and a worse behavioral profile than mono-drug addicts. Although an appropriate control group was not enrolled (due to the difficulty of detecting the real prevalence of substance abuse), a significant difference was found with the general population, as described in an other Italian study.

The largest subgroup was made up of heroin users, followed by alcohol, cocaine and tobacco. This study shows some limitations. It does not take into account the possible coexistence of eating disorders, does not examine the clinical evolution of addiction and does not discriminate between patients with active abuse and those who are abstinent, but our clinical experience shows that most of them are abstinent from substances or have greatly reduced their use, because they are following treatments in addiction services.

The presence of psychiatric disorders was also not taken into consideration. Only patients with severe psychiatric illnesses were excluded from the study.

Conclusions

The study shows a greater risk of food addiction for polyabuser subjects than for mono-abuser subjects, correcting for the other associated variables examined in the study: risk of having FA increases with the number of substances used, but we did not find significant associations with the abuse of specific substances. There is a small but significant positive correlation between BMI and food addiction in this population. A strong positive correlation between female sex and food addiction was found, while age appears to have a small protective effect on the onset of FA.

The prevalence of FA in our sample of addicted subject is 20.17%. This data seems to suggest that the prevalence of FA among drug addicts may be higher than in the general population especially for some substances. But these hypotheses require further studies, with control group and more numerous samples for each group of substances.

What is already known on this subject?

Correlation between use of alcohol, gambling, substances and FA is already known, as well as the correlation between eating disorders and addictions.

What does this study add?

This study shows that subjects with polyabuse have higher FA prevalence than mono-abusers, and that FA rate among addicted patients in Italy is significantly higher than in the general population.

Compliance with ethical standards

Conflict of interest The authors declare they have not conflict of interest.

Ethical approval The study was approved by the ethical committee of the province of Monza and Brianza (San Gerardo Hospital, Monza).

Informed consent Patients were asked to sign informed consent for the scientific study and publication. All data has been processed anonymously

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