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ORIGINAL ARTICLE

Can food addiction replace binge eating assessment in obesity clinics?

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Abstract *Introduction:* Food addiction (FA) is a new terminology that uses the similarities between the craving for food and drug addiction. The Yale Food Addiction Scale (YFAS) is a recently developed tool that assesses the various symptomatology of FA and diagnoses FA when there are ⩾3 symptoms with clinically significant functional impairment. As Egypt is one of the highest African countries in obesity prevalence, this study aimed at assessment of the presence of FA in a representative sample of Egyptian adolescents and to compare this new diagnosis to binge eating which has some common features with FA particularly loss of control eating, in order to define the true magnitude of the problem and explore the relationship between both so that preventive measures could be planned to combat the rapidly rising obesity prevalence.

Subjects and methods: A cross section study using a stratified random sampling technique was conducted on 401 adolescents aged 11–18 years chosen from public, distinguished governmental and private schools. All participants had their weight and height measured with calculation of the body mass index and were interviewed to fill in the Binge Eating Scale (BES) and the Yale Food Addiction Scale (YFAS).

Results: The study included 221 females (55.1%) and 180 males (49.9%). Their mean age was 13.98 ± 1.93 years. Clinical BE was present in 77 adolescents (19.2%). FA was diagnosed in 81 subjects (20.2%). Each of BE and FA showed significant differences in the different weight categories. Significant relationships were found between the various symptoms of FA and the scoring of the BE scale.

Conclusion: This study proved a reconciliation between BE and FA in a non-clinical sample of Egyptian adolescents.

1. Introduction

Since the early assumption of the addictive properties of sugars and palatable foods by Dr. Hoebel [1], the concept of craving and tolerance to food which is termed food addiction (FA)

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came in focus [2–4]. The Yale Food Addiction Scale (YFAS) [2] was the first scale to objectively assess the different symptomatology of FA and its associated functional impairment. Individuals with FA have activated brain neuronal circuits similar to those activated by substance dependence [5]. Binge eating (BE) is a term that has been used for decades to describe multiple attacks of uncontrollable food craving resulting in the intake of large amounts of food associated with guilty feeling and embarrassment about not being able to stop. Despite using the term BE for a long time, it has been recently included in the DSM-5 [6]. BE shares many physical, behavioural and neurobiological characteristics with substance dependence similar to FA [7]; however, episodes of BE result in increased dopamine response unlike the repeated exposures to tasty foods which result in a decreased response [1]. Recent research has shown that BE and FA are related but not identical as 57% of obese adults who had BE met the diagnosis of FA [8]. However, individuals with combined BE and FA represent a more severe subtype [8]. The treatment of BE and FA utilise the same principles for cognitive behavioural therapy [7]. An important concept in differentiating the process of BE from the concept of addiction is that strict dietary restraints and avoidance of desired foods may be associated with aggravation of BE risk [9]. However, in drug addiction, abstinence may be a goal [7]. Studies on eating disorders are relatively scarce particularly in adolescents in community samples [10–12] and particularly those on FA [4].

The primary aim of this study was to study the prevalence of BE and FA in a representative sample of Egyptian adolescents and compare between the diagnosis of clinical BE episodes and the diagnosis of FA regarding their relationship to the different weight categories in a sample of adolescents in the community i.e. a non-clinical sample. The secondary aim of the study was to screen for the prevalence of the FA symptomatology in the adolescent community. This may provide better understanding of the functional role played by FA in relation to obesity and may provide the basis for the introduction of FA assessment in obese adolescents to implement better strategies to treat and prevent overweight and obesity which increased dramatically in recent years [13,14].

2. Subjects and methods

2.1. Study design

This was a cross sectional study that used a stratified random sampling technique to identify the randomly selected schools (public, governmental distinguished and private schools) in Cairo, the capital of Egypt. Simple random sample was used for the participant students inside the classes. It was conducted during the school academic year from September 2014 to May 2015.

2.2. Study setting

Preparatory and secondary schools in Cairo were distributed in its eastern, western, northern and southern parts.

2.3. Sample size justification

The sample size was 400 adolescents which is the maximum number that could be calculated for measuring the prevalence in a cross section study. The sample was estimated based on the formula given in the following equation:

$$n = \frac{z^2 \times (p * 1 - p)}{\delta^2}$$

$Z = Z$ value (e.g. 1.96 for 95% confidence interval). $P =$ Percentage picking a choice. $\delta =$ Error margin $= 0.05$.

2.4. Clinical assessment

All participants were subjected to measuring the weight in kilograms with a digital scale in minimal clothing. Height was measured to the nearest 0.1 cm on a portable stadiometer (Seca stadiometer 213). Weight and height were compared to the norms [15]. The body mass index (BMI) was calculated as weight (kg)/height $(m)^2$ [16]. Obesity was defined as BMI $>$ 2 standard deviations and overweight as BMI $>$ 1 standard deviation for age and sex as the recommendations of the WHO [17].

2.5. Psychiatric interview

All participants were subjected to:

- Assessment of the presence of BED on the Binge Eating Scale (BES) [18]. The BES is a 16-item questionnaire assessing binge eating severity as well as the feelings and thoughts associated with such behaviour. When rating each item, respondents had to choose between three or four response statements of increasing severity. Individuals with scores less than 17 are considered not to have significant binge eating (no BE), individuals with scores in the 18–26 range probably binge eat (probable BE), and individuals with score of 27 and above have clinical-levels of binge eating (clinical BE). The BES has shown to have good internal consistency, reliability and validity.
- Assessment of food addiction by the Yale Food Addiction Scale (YFAS) for children [2] which is a validated 25-item self-report measure of addictive eating behaviour. The YFAS reports the symptomatology of FA and then a diagnosis of FA is made when $\geqslant 3$ symptoms are present in addition to clinically significant impairment or distress. Translation into Arabic was done by an accredited translation office then revised by the researchers and lastly reviewed by three experts to be sure of its validity.

3. Ethical approval

The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments on humans. The study was approved by the local ethics committee of Ain Shams University and the Egyptian Ministry of Education as well as the administrative departments of the involved schools. Verbal assent was obtained from all adolescents participating in the study on the day of the interview.

3.1. Statistical analyses

All analyses were performed with SPSS 20.0 statistical package for the social sciences (IBM, Armonk, NY, USA). Descriptive

Table 1 Anthropometric measures of the studied participants.

Parameter	Mean ± SD
Weight (kg)	63.73 ± 18.03
Weight SDS	1.15 ± 1.54
Height (m)	1.58 ± 0.09
Height SDS	−0.16–1.10
BMI (kg/m^2)	25.38–6.25
BMI SDS	1.48 ± 1.43

data are reported as mean ± SD for continuous data and number and percentage for categorical data. T-tests were used for continuous data and Chi-square test was used for categorical data. Differences between groups were considered significant when p values were <0.05.

4. Results

The study included 401 adolescents, 221 females (55.1%) and 180 males (49.9%). Their mean age was 13.98 ± 1.93 year and ranged from 11–18 years. Public schools students represented 143 adolescents (35.7%), whereas 151 (37.7%) attended distinguished governmental schools and 107 (26.7%) attended private schools.

Their anthropometric measures are shown in Table 1. Regarding their BMI, 133 participants (33.2%) had a BMI between −2 and 1 SD (normal weight), 93 subjects were overweight (+1 to $<+2$ SD), 167 (41.6%) were obese (>2 SD). Only 8 adolescents had BMIs <-2 SD; none of them had binge eating but surprisingly one of them fulfilled the criteria for the diagnosis of FA.

Probable BE was present in 124 participants (30.9%) and clinical BE was present in 77 adolescents (19.2%). BE was not diagnosed in 200 participants (49.9%).

The absence of BE, probable BE and clinical BE didn't show significant differences in relation to gender ($p = 0.110$), mean age of the three groups ($p = 0.402$) or type of school ($p = 0.125$). FA was diagnosed in 81 subjects (20.2%). Similar to BE, the presence or absence of FA didn't differ according to gender ($p = 0.246$), mean age of both groups; with and without FA ($p = 0.777$) or type of school ($p = 0.283$).

The relationship of BE and FA with the different weight categories is shown in Table 2 which shows significant differences in the different weight categories with each of BE and FA.

There was a significant difference between those diagnosed with FA/no FA and those with no BE, probable BE and clinical BE as shown in Table 3.

The relationships between absence of BE, probable BE and clinical BE groups regarding the different symptomatology of food addiction FA is shown in Table 4.

Table 3 Relationship between binge eating (BE) and food addiction (FA).

FA	No BE ($n = 200$) Number (%)	Probable BE ($n = 124$) Number (%)	Clinical BE ($n = 77$) Number (%)	p
No FA	179 (89.5)	90 (72.6)	51 (66.2)	0.000
FA	21 (10.5)	34 (27.4)	26 (33.8)	

5. Discussion

This study shows that BE and FA are significant problems in Egyptian adolescents as clinical BE and FA each was diagnosed in nearly one fifth of the studied sample. This may explain the fact that Egypt has the highest rates of overweight and obesity (31.4 and 9.3% respectively) among 7 African countries according to a recent survey [14]. This study pointed to the possible roles played by BE and FA in the development of obesity as they differed significantly in the different age categories which has been shown in previous studies [4,19]. However, not all subjects diagnosed with FA were obese as one of them was thin and 12 were of normal weight which was similar to previous studies [20,21]. This may indicate that the neural circuits that control the intake of food [21] and the calories taken represent only one side in determining the multifaceted nature of the BMI of an individual. Other factors involved in shaping the BMI include the genetic make-up [22] that controls body fat distribution and the secretion of the hunger and satiety signals [23].

We couldn't find significant differences in gender regarding either BE or FA. Similarly a recent study showed no differences in binge eating episodes despite the significant differences in other eating disorders [24]. No similar data regarding the gender differences in FA in community samples are currently available. There were no differences in either BE or FA in relation to the type of school as a rough indicator of the socioeconomic condition which was similar to other case control studies on eating disorders [25].

BE and FA differed significantly in the different weight categories in our community based sample similar to results in a cohort of middle aged and older women which showed that BMI $\geqslant 35$ kg/m^2 was associated with FA [26]. Surprisingly, studies in obese individuals with and without FA didn't show a difference regarding the BMI [4]. High BMI proved to be a risk factor for BE in previous studies in a college student sample [19].

The most frequent symptoms of FA in our study were withdrawal symptoms due to lack of food and the symptom that

Table 2 Binge eating (BE) and food addiction (FA) in the different weight categories.

	No BE Number (%)	Probable BE Number (%)	Clinical BE Number (%)	p	No FA Number (%)	FA Number (%)	p
Normal	94 (47.2)	30 (24.0)	9 (11.7)	0.000	121 (37.8)	12 (14.8)	0.000
Overweight	53 (26.6)	28 (22.4)	12 (15.6)		77 (24.1)	16 (19.8)	
Obesity	44 (22.1)	67 (53.6)	56 (72.7)		115 (35.9)	52 (64.2)	
Thin	8 (4.0)	0 (0.0)	0 (0.0)		7 (2.2)	1 (1.2)	
Total	199 (100)	125 (100.0)	77 (100.0)		320 (100.0)	81 (100.0)	

Table 4 Relationships between absence of binge eating (BE), probable BE and clinical BE groups regarding the different symptomatology of food addiction (FA).

FA symptomatology		No BE (n = 200)		Probable BE (n = 124)		Clinical BE (n = 77)		p
		N	%	N	%	N	%	
Tolerance	Negative	115	57.5%	51	41.1%	31	40.3%	0.004
	Positive	85	42.5%	73	58.9%	46	59.7%	
Withdrawal	Negative	90	45.0%	41	33.1%	20	26.0%	0.006
	Positive	110	55.0%	83	66.9%	57	74.0%	
Loss of control	Negative	119	59.5%	56	45.2%	36	46.8%	0.022
	Positive	81	40.5%	68	54.8%	41	53.2%	
Repeated unsuccessful attempts to quit	Negative	156	78.0%	74	59.7%	37	48.1%	0.000
	Positive	44	22.0%	50	40.3%	40	51.9%	
Large amount of time spent to obtain food	Negative	150	75.0%	81	65.3%	43	55.8%	0.006
	Positive	50	25.0%	43	34.7%	34	44.2%	
Important activities given up	Negative	95	47.5%	42	33.9%	19	24.7%	0.001
	Positive	105	52.5%	82	66.1%	58	75.3%	
Continued use despite problems	Negative	184	92.0%	92	74.2%	41	53.2%	0.000
	Positive	16	8.0%	32	25.8%	36	46.8%	
Clinically significant impairment	Negative	164	82.0%	76	61.3%	46	59.7%	0.000
	Positive	36	18.0%	48	38.7%	31	40.3%	

N = number.

outlines that important activities were given up or reduced. In middle aged and older women, the most common symptomatology was persistent desire or unsuccessful efforts to cut down or control eating [26]. However, in a study of 50 adolescents seeking weight loss, FA was present in 38% of their sample and the commonest symptoms were unsuccessful attempts to cut down consumption followed by tolerance [4]. Whether the symptomatology of FA differs in a community sample from that reported in obese subjects and the effect of the different age groups on the expression of FA symptoms remains to be determined.

A study assessed only one symptom of the FA scale which is loss of control eating among other scales for other psychopathology in adolescents who underwent bariatric surgery and showed that the most common problem was the loss of control eating which was detected in 26.9% of the sample. In the same study, BE disorder was assessed by Questionnaire of Eating and Weight Patterns–Revised (QEWP-R) and current BE disorder was diagnosed in 6.6% of their sample [27]. This raises the question whether assessment of FA may be more important in obese subjects than the evaluation of BE disorder.

This study explored the relationship between BE and FA and proved a highly significant relationship between both in a community sample. This relationship was demonstrated before in obese subjects [8]. This study filled the knowledge gap about the relationship between both in an adolescent community sample and showed that all the symptomatology of FA as assessed by the YFAS differed significantly between the different BE categories; those with clinical BE had the highest proportions of all symptoms of FA. This represents a strong argument for the assessment of FA in all clinical settings which aim at intervention for paediatric and adolescent obesity. The YFAS covers various aspects related to loss of control as well as the undesirable physical effects of tolerances and withdrawal when not getting the required amount of the desired food with only one item evaluating the worries in relation to FA. The BES evaluates lack of control over eating in common with FA but on the contrary evaluates the behavioural and cognitive aspects and feelings associating these episodes.

6. Conclusion

This study proved a significant relationship between BE and FA in a community sample of Egyptian adolescents. FA covers broader aspects when assessing the hijacking power of food over obese subjects and not only loss of control eating. FA exists in Egyptian adolescents who have high prevalence of obesity as well. Therefore, the authors suggest the evaluation of FA in obese adolescents. We also recommend the conductance of longitudinal studies to assess those subjects with FA who are not obese to explore whether or not they will develop obesity as this may add to the current knowledge of the operational mechanisms underlying obesity.

7. Limitations of the study

The cross sectional nature of the study limited the exploration of the sequential relationship between BE and FA particularly in those affected by both disorders. However, to the best of our knowledge, this was the first study to assess the relationship between both in a random representative sample of Egyptian adolescents.

Conflict of interest

The authors have no conflict of interest to declare.

Compliance with Ethical Standards

No conflicts of interest and no funding sources regarding any of the authors.

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The study was approved by the local Ethics Committee of Ain Shams University.

This manuscript has not been published previously (partly or in full) and is not currently under consideration by any other journal.

All authors have read and approved the final article.

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