BRIEF REPORT

Factor Structure and Item Analysis of the Yale Food Addiction Scale in Obese Candidates for Bariatric Surgery

Adrian Meule[1]*, Daniela Heckel[1] & Andrea Kübler[1,2]

[1]Department of Psychology I, University of Würzburg, Würzburg, Germany
[2]Institute of Medical Psychology and Behavioural Neurobiology, University of Tübingen, Tübingen, Germany

Abstract

Converging research suggests phenomenological and neurobiological similarities between excessive food consumption and addictive behaviour in substance dependence. Recently, the *Yale Food Addiction Scale* (YFAS) has been proposed for the assessment of addictive eating behaviour. The German version of the YFAS was administered to obese individuals seeking bariatric surgery ($N = 96$). Factor structure, internal consistency, and item statistics were analysed. Forty participants (41.70%) received a food addiction diagnosis. The one-factorial structure of the YFAS, which has been found in non-clinical samples, could be confirmed. All but three items had factor loadings $>.50$. Internal consistency was $\alpha = .82$. Item analysis revealed that items related to unsuccessful attempts to cut down and consumption despite physical and emotional problems were endorsed by the majority of participants. Findings support the use of the YFAS in clinical populations, while applicability of some items differs between clinical and non-clinical samples. Copyright © 2012 John Wiley & Sons, Ltd and Eating Disorders Association.

*Correspondence

Adrian Meule, Department of Psychology I, University of Würzburg, Marcusstr. 9-11, 97070 Würzburg, Germany. Phone: +49 931 31-808 34; Fax: +49 931 31-8 24 24. Email: adrian.meule@uni-wuerzburg.de

Introduction and aims

Excessive food consumption has been recognized to show features of addictive behaviour. An examination of the diagnostic criteria for substance dependence reveals that many symptoms of drug addiction also apply to individuals with increased or binge-related food intake (Meule & Kübler, 2012a). Particularly, patients with obesity or binge eating disorder (BED) eat larger amounts or over a longer period than intended, have a persistent desire or unsuccessful efforts to eat less, and continue eating despite physical or psychological problems (Gearhardt, Corbin, & Brownell, 2009a; Meule, 2011). A detailed discussion of similarities between substance dependence and excessive eating is beyond the scope of this report, and evidence for and against such a food addiction model has been extensively reviewed elsewhere (e.g. Barry, Clarke, & Petry, 2009; Davis & Carter, 2009; Grosshans, Loeber, & Kiefer, 2011; Pelchat, 2009; Wilson, 2010; Ziauddeen, Farooqi, & Fletcher, 2012).

However, in humans, further evidence is needed to support such a model (Meule, 2011; Meule & Kübler, 2012a). Two studies used structured interviews based on substance dependence criteria or Goodman's addictive disorder criteria and found that patients with BED (Cassin & von Ranson, 2007) and bulimia nervosa (Speranza et al., 2012) experience many addiction-like symptoms in relation to eating behaviour. Some studies report addiction-like symptoms assessed with custom-made questionnaires in children and adults with overweight and obesity (Lent & Swencionis, 2012; Merlo, Klingman, Malasanos, & Silverstein, 2009; Pretlow, 2011).

Recently, the *Yale Food Addiction Scale* (YFAS) has been proposed for the assessment of food addiction symptoms according to the diagnostic criteria for substance dependence (Gearhardt, Corbin, & Brownell, 2009b). The YFAS has a one-factorial structure, and construct validity has been supported in non-clinical and obese samples (see Method section). Moreover, scores on the YFAS correlated with neural activation patterns that are comparable to findings in substance dependence. Specifically, food addiction symptoms were associated with elevated activation in reward circuitry in response to food cues and reduced activation of inhibitory regions in response to food intake (Gearhardt et al., 2011).

The one-factorial solution of the YFAS could be confirmed for its German version in a non-clinical sample (Meule, Vögele, & Kübler, 2012). Three items, however, had low factor loadings ($<.5$) and low item-total correlations, respectively. In the present study, factor structure, internal consistency, and item statistics of the German YFAS were evaluated in a sample of obese individuals seeking bariatric surgery. We expected to replicate its one-factorial solution and explored item difficulties and item-total correlations.

Method

Yale Food Addiction Scale

The YFAS measures symptoms of food addiction (Gearhardt et al., 2009b) and its German version was used in the current study (Meule et al., 2012). This 25-item instrument contains different scoring options (dichotomous and frequency scoring)

to indicate experience of addictive eating behaviour within the past 12 months. A symptom count can be calculated, which can range between zero and seven food addiction symptoms. Food addiction is diagnosed if at least three symptoms and a clinically significant impairment or distress (as assessed with two extra items) are present. Positive associations with eating disorder symptomatology, emotional eating, food cravings, binge eating frequency, difficulties in emotion regulation, and impulsivity in non-clinical samples and obese patients indicate validity of the YFAS (Davis et al., 2011; Gearhardt et al., 2009b; Gearhardt et al., 2012; Meule & Kübler, 2012b; Meule et al., 2012). Furthermore, prevalence of YFAS diagnoses was increased in obese patients and even more so in obese patients with BED (see Meule, 2011 for a review). Internal consistency of the YFAS was $\alpha = .86$ (Gearhardt et al., 2009b) for the English version and $\alpha = .81$ (Meule et al., 2012) for the German version in non-clinical samples.

Procedure

Individuals were approached during their first visit at consultation hours for bariatric surgery and asked whether they would like to participate in a questionnaire study that would be unrelated to their eligibility for a later surgery. The study was approved by the ethical review board of the medical faculty, University of Würzburg, Germany. Informed consent was obtained from participants prior to study participation. Then, participants completed the YFAS and other questionnaires. Only results of the YFAS are reported here.

Data analysis

As factor structure might differ between non-clinical and obese samples, we calculated an exploratory factor analysis for dichotomous data with MixFactor version 1.3.75 (Freeware provided by the Department of Psychology, University of Vienna, Austria), which is based on tetrachoric correlation coefficients (Kubinger, 2003). The number of factors for extraction was determined by parallel analysis (Horn, 1965). Internal consistency of the YFAS was evaluated with Kuder–Richardson's α (Kuder & Richardson, 1937). Item analysis was performed by calculating item difficulties (i.e. item means), standard deviations, and item-total correlations (part-whole corrected).

Results

Participant characteristics

A total of $N = 96$ participants completed the YFAS. Participants had a mean age of $M = 39.92$ years ($SD = 11.51$) and a mean body mass index (BMI) of $M = 50.64$ kg/m² ($SD = 8.99$; range: 34.89–73.44). The majority of participants ($n = 88$; 91.70%) had a BMI $\geq$ 40.00 kg/m² (obese class III; World Health Organization, 2000). The sample comprised 63 women (65.60%) and 33 men (34.40%). Mean YFAS symptom count was $M = 3.42$ symptoms ($SD = 1.74$), and $n = 40$ participants (41.70%) received a food addiction diagnosis. Endorsement rates of specific food addiction symptoms are presented in Table 1. A persistent desire or unsuccessful efforts to cut down or control eating was indicated by almost all participants (Table 1).

Table 1 Endorsement rates for food addiction symptoms

$N = 96$	n	%
Persistent desire or unsuccessful effort to cut down or control eating	91	94.8
Continued eating despite physical or psychological problems	72	75.0
Tolerance	52	54.2
Clinically significant impairment or distress	46	47.9
Consumption of large amounts or over a longer period than intended	30	31.2
Spending much time obtaining food or eating or recover from its effects	29	30.2
Giving up social, occupational, or recreational activities	28	29.2
Withdrawal symptoms	26	27.1

### Factor structure and internal consistency

A parallel analysis suggested the extraction of one factor because the eigenvalue of the second factor was beneath the eigenvalue of the random data set (Figure 1). This one-factorial solution explained 49.50% of the variance. As can be seen in Table 2, almost all items had factor loadings >.50, except for items #22, #24, and #25. Internal consistency was $\alpha = .82$.

Item analysis

Inspection of Table 2 reveals that those items with the lowest factor loadings also had highest item difficulties and lowest item-total correlations. Items #22, #24, and #25 were endorsed by 73.0%, 57.0%, and 65.0% of the sample, respectively. Although having a high factor loading, item #19 was another question with high item difficulty and low item-total correlation (Table 2).

Discussion

The one-factorial structure of the German YFAS could be confirmed in a sample of obese individuals seeking bariatric surgery. Internal consistency was good and comparable to findings from non-clinical samples (Gearhardt et al., 2009b; Meule et al., 2012). Three items, however, had low factor loadings (<.5). Item analysis revealed that those items with low factor loadings also had low item-total correlations and high item difficulty (Table 2; items #22, #24, and #25), that is, they were endorsed by the majority of participants. All those items assess a persistent desire or repeated
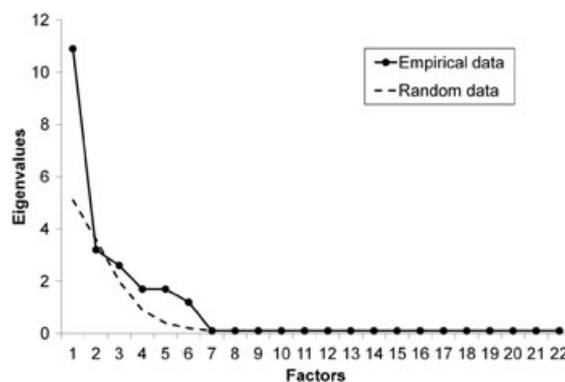
Figure 1 Scree plot and eigenvalues of the parallel analysis

Table 2 Factor loadings and item statistics of the Yale Food Addiction Scale

Item	Factor loading	M	SD	r_{itc}
1. I find that when I start eating certain foods, I end up eating much more than planned.	.77	.15	.36	.47
2. I find myself continuing to consume certain foods even though I am no longer hungry.	.54	.18	.38	.34
3. I eat to the point where I feel physically ill.	.73	.19	.39	.49
4. Not eating certain types of food or cutting down on certain types of food is something I worry about.	.64	.04	.20	.23
5. I spend a lot of time feeling sluggish or fatigued from overeating.	.75	.23	.42	.50
6. I find myself constantly eating certain foods throughout the day.	.79	.14	.34	.51
7. I find that when certain foods are not available, I will go out of my way to obtain them.	.75	.10	.31	.40
8. There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	.57	.19	.39	.36
9. There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	.88	.13	.33	.55
10. There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.	.85	.13	.33	.51
11. There have been times when I avoided professional or social situations because I was not able to consume certain foods there.	.75	.09	.29	.38
12. I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods.	.99	.06	.24	.51
13. I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing.	.82	.14	.34	.53
14. I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.	.62	.19	.40	.40
15. My behavior with respect to food and eating causes significant distress.	.80	.41	.49	.56
16. I experience significant problems in my ability to function effectively because of food and eating.	.62	.32	.47	.42
17. My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.	—	—	—	—
18. My food consumption has caused significant physical problems or made a physical problem worse.	—	—	—	—
19. I kept consuming the same types of food or the same amount of food even though I was having emotional and/or physical problems.	.70	.75	.44	.28
20. Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions or increased pleasure.	.80	.43	.50	.52
21. I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.	.65	.37	.48	.44
22. I want to cut down or stop eating certain kinds of food.	.36	.73	.45	.15
23. I have tried to cut down or stop eating certain kinds of food.	—	—	—	—
24. I have been successful at cutting down or not eating these kinds of food.	.09	.57	.50	.06
25. How many times in the past year did you try to cut down or stop eating certain foods altogether?	.29	.65	.48	.11

Note. Some items include additional instructions that are not displayed here for the sake of clarity. Items 17, 18, and 23 are primers and are not scored. Response formats vary between items, and therefore, all parameters were calculated with the dichotomized item responses. r_{itc} = item-total correlation (part-whole corrected).

unsuccessful attempts to cut down. Hence, those items do not differentiate sufficiently between food-addicted and non-addicted obese individuals. Accordingly, 94.8% of the sample met this criterion (compared with 71.3% in a non-clinical sample; Gearhardt, Corbin, & Brownell, 2008). Future investigations may consider eliminating items #22 and #24 from the questionnaire because of low psychometric qualities in both clinical and non-clinical samples.

Another item, which had high item difficulty, assesses continued eating despite knowledge of adverse consequences (item #19). This item was endorsed by 75.0% of the sample, which is also remarkably higher compared with non-clinical samples (28.3%; Gearhardt et al., 2008).

An item that had a low factor loading and was rarely endorsed in a non-clinical sample (Meule et al., 2012) assesses giving up

important activities because of eating (item #11). This item was not problematic in the current sample, and accordingly, the criterion of important activities given up was met by 29.2% (compared with 10.3% in a non-clinical sample; Gearhardt et al., 2008).

A limitation of this study is that there were no diagnoses of relevant mental disorders available, BED in particular, which have been found to be closely related to scores on the YFAS (Gearhardt et al., 2012; Davis et al., 2011). Another limitation is that although we could replicate the factorial structure of the YFAS with exploratory factor analysis, the sample size was not sufficient for further validating this finding with confirmatory factor analysis.

In sum, factor structure of the YFAS could be confirmed in a sample of obese individuals seeking bariatric surgery. Items assessing unsuccessful attempts to quit overeating did not differentiate

between food-addicted and non-addicted individuals because almost all obese participants experienced this problem. Item responses further revealed that some items that have poor item characteristics and are rarely endorsed in healthy samples are more appropriate in obese samples. Hence, results support the applicability of the YFAS in obese individuals and highlight the importance of discriminating between clinically relevant subtypes of obesity by taking several food addiction symptoms into account.

Acknowledgement

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