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ORIGINAL RESEARCH

Food Addiction: Association with Attention-Deficit/Hyperactivity Disorder and Impulsivity

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Abstract

Objective: The aim of the present research is to investigate food addiction and its relationship with ADHD symptoms and impulsivity in a non-clinical sample.

Methods: Eight hundred and twenty-six (women: 532; men: 294) university students volunteered and took part in the study. Yale Food Addiction Scale (YFAS), Adult ADHD Self-Report Scale (ASRS-v1.1), Barratt Impulsiveness Scale-11 (BIS-11) scales were applied to the participants and their anthropometric measurements were taken. Analyses were conducted using SPSS version 22.

Results: 109 subjects were classified as food addicts. The food addict group significantly had higher Body Mass Index (BMI) ($p < 0.001$). The subscore of inattentiveness, subscore of hyperactive/impulsiveness and total ASRS scores were significantly higher in food addicted group ($p < 0.001$). BMI was greater in the food addiction and ADHD comorbidity group compared to the food addiction only group ($X2=24.86$; $p=0.003$). The lineer regression analysis revealed that the increased hyperactivity – impulsiveness measured by ASRS (ß=0,027), motor impulsiveness measured by BIS-11 (ß=0.030) and BMI (ß=0.037) found to be correlated with higher YFAS scores ($F=10.384$; $p=0.000$) when age and sex factors are controlled.) YFAS scores were statistically higher in potential ADHD group. (According to the ASRS cut-off score ≥24).

Conclusion: Evaluation of the presence of ADHD might be an important issue in determining treatment for obesity in individuals with food addiction. The clinicians must be aware of the pitfalls associated with the comorbidity and consider screening patients with food addiction for ADHD.

Keywords: Food addiction, Impulsivity, Attention deficit, Hiperactivity

INTRODUCTION

Food addiction is the physical and psychological dependency on highly palatable foods with high fat and high sugar contents. Food addiction, which has attracted growing attention in recent years, is a concept that is thought to share similar dysfunctions of neurotransmitters and neuronal circuitry with other addictions (1). A number of studies revealed biological and behavioral similarities between drug use and food addiction in terms of altered dopamine expression, cravings, relapse to highly palatable food (2). Indeed, the inability to control cravings for food and excessive eating, despite the physical, social and psychological damage, is similar to that observed in other addictions. Even fatty and processed foods with a high content of sugar have been suggested as having addictive properties similar to the other substances and alcohol. In animal studies, investigation of highly palatable food in animal models has been shown to result in an increase in mesolimbic dopamine in a similar manner to the neurobiological reaction to receipt of other addictive substances (3). Recent studies suggest a hyperactive response in neural circuitry that has been associated with encoding food reward in obese subjects (4). Researchers reported that up to 94% of subjects with binge eating described themselves as "food addicts" and fulfill criteria for substance using disorder in Diagnostic and Statistical Manual of Mental Disorders IV edition (DSM-IV) when the term "substance" replaced with "food" (5,6). Although the addictive eating style is not observed in

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all the obese individuals, meeting the criteria for food addiction is reported to be 3-4 times higher in obese populations (7).

Given similarities between addiction-like eating behavior and drug addiction, a broad hypothesis is that similar processes may be operating across the two conditions. In the domain of drug addiction, one major determinant of addictive behavior is impulsivity. BMI is simply a measure of body composition and does not capture motivational aspects of eating behavior. In turn, following the link between impulsivity and drug addiction, impulsivity may be theorized to relate to obesity most directly via a greater addiction-like relationship with food.

ADHD is an underdiagnosed and very often untreated disorder, with serious consequences The most common psychiatric comorbidities that co-occur with ADHD in adults are mood disorders, anxiety disorders, eating disorders and substance-use disorders (8). Beside that recent studies show that ADHD patients are more likely to having obesity, and ADHD prevalence is higher in obese individuals than normal weight individuals (9,10,11,12,13).

Nazar et al. found a significant relationship between ADHD and eating disorders in obese women. That study also showed that the presence of depressive symptoms and inattention was predictive factors for binge eating in this population (14).

ADHD has been found to be comorbid with eating pathology and binge-eating disorder specifically at rates suggesting shared risk factors (15). In females, ADHD predicted impulsivity related bingeing and purging eating behavior (16). A large epidemiological study in adults suggested that the relationship between adult ADHD and obesity was partially mediated by the presence of binge-eating disorder (12). Similarly, a community-based adult study also reported that the relationship between obesity and ADHD was partially explained by binge-eating (17). A recent study examined the cross-sectional relationship between ADHD and binge-eating in children receiving treatment at two mental health clinics and reported that the relationship between ADHD and binge-eating was significant (18).

ADHD has been shown to be a risk factor for food addiction in previous studies. For example, Davis et al. reported that food addictive subjects, compare to their non-food addiction counterparts, had a significantly higher likelihood of childhood ADHD (19). In the study evaluating the relationship between ADHD and food addiction among university students, Romo et al were found significant relationship between ADHD symptoms and food addiction (20). Similar to that finding Brunault et al. showed that ADHD is associated with both food addiction symptoms and binge eating scores in individuals with clinically diagnosed ADHD (21).

Impulsivity might play a role in food addiction (22). Impulsivity is defined as a predisposition for unintended, fast reactions to stimuli, without concern for the negative consequences (23). A broad range of psychiatric disorders has been related to high level of impulsivity, and it is likely that food addiction and drug use disorders share impulsivity as a common neurobehavioral factor (24). There is a broad literature associating the heterogeneous construct of impulsivity to different expressions of psychopathology, e.g., substance use disorders, attention deficit hyperactivity disorder (ADHD), and binge eating disorder (25). Recently Meule at al reported that higher scores on attentional and motor impulsivity scales predicted food addiction diagnosis (26). It is proposed that the impulsivity that characterizes ADHD could contribute to pathological overeating and obesity (12,17,27). Impulsivity might be a key link between ADHD, obesity and food addiction.

In spite of these potential associations, the relationship between food addiction, impulsivity and ADHD has not been adequately studied. Therefore the aim of the present research is to investigate food addiction and its relationship with ADHD symptoms and impulsivity in a non-clinical sample.

SUBJECTS AND METHODS

Eight hundred and sixty-three university students volunteered and took part in the study. Thirty-seven subjects were not included in the final analyses, due to the incomplete questionnaire. The data of eligible 826 participants (women: 532; men: 294) were analyzed. The institutional ethical board approved the study, and informed consent was obtained from each participant before participation.

Measurements

Body Mass Index (BMI): BMI (weight in kilograms/height in meters-squared) was calculated from self-reported weight and height. Patients were separated into four groups: underweight (BMI <18.5 kg/m^2), normal (BMI between18.5-24.9kg/m^2), overweight (BMI between 25 and 29.9 kg/m^2) and obese (BMI≥30 kg/m_2) (28).

Yale Food Addiction Scale (YFAS): YFAS was developed by Gearhardt and colleagues (29). Single factor validity of

the YFAS has been shown among clinical and nonclinical samples (30). The internal consistency for the scale was found to have an α=0.86 for the English language version. The Turkish adaptation of the YFAS has been found to be reliable and valid, as shown by Bayraktar et al. (31). The validity and reliability of the Turkish YFAS among bariatric surgery patients as was performed by Sevinçer et al. (32). Internal consistency was found to be 0.822, as analyzed by the Kuder Richardson 20 formula. Food addiction is diagnosed if at least three symptoms produce clinically significant impairment or distress (29).

Adult ADHD Self-Report Scale (ASRS-v1.1): ADHD were measured with the ASRS (33), an18-item scale based on DSM-IV – TR criteria (34). Part-A contains 6 items that are consistent with the DSM-IV criteria and address the manifestation of ADHD in adults. Part-B contains 12 additional questions based on DSM-IV criteria. Respondents are required to use a 5-item Likert scale to indicate the frequency of occurrence of symptoms. ASRS cut-off score of 24 and above was considered positive according to the mean of both attention and impulsivity scores. Symptom count has not been done. According to the ASRS cut-off score ≥24, implying a high likelihood of having ADHD, those in the food addiction group presented statistically significantly higher ratios of ADHD. The Turkish translation of ASRS has good reliability and validity with a high level of internal consistency (Cronbach's α=0.88). Cronbach's α coefficients for 'inattention'(r=0.82) and 'hyperactivity / impulsivity' (r=0.78) subscales were also high (35).

Barratt Impulsiveness Scale-11 (BIS-11): The 30 item BIS-11was used to measure impulsivity and three subscales of Attentional Impulsiveness (8 items), Motor Impulsiveness (11 items), and Non-Planning Impulsiveness (11 items) (36). Items are rated on a 4-point scale. Possible scores for the entire scale range 30-120, with a higher score reflecting a higher level of impulsivity. Turkish validity and reliability of the version have been established. Internal consistency is α = 0.78 for university student sample and α =0.81 for clinical samples (37).

Statistical Analyses

Analyses were conducted using SPSS version 22 (NY: IBM Corp.). Mean comparison tests (Mann-Whitney U test or Student's test) were used based on the assumption of normality of the variables. Chi-square and Fischer exact tests were conducted to examine group differences. We adjusted the regression analyses for age and sex factors included in the definition of food addiction. Lineer regression analyses were also performed in order to analyze predictors of YFAS scores and BMI as dependent factors. p <0.05 was set as a statistical significance value.

RESULTS

Applying the YFAS diagnostic scoring procedure, 109 subjects (female = 72; male = 37) were classified as food addicts. Compared to their non-food addict group (female = 460; male = 257), the group of food addicts did not differ significantly in gender ratio and age. The food addict group significantly had higher Body Mass Index (BMI) (p <0.001) (see Table 1). Overweight and obese subjects rates were significantly higher in food addicted group (p <0.001)

Table 1. Comparisons of variables between the participants who screened positive and negative for food addiction

		Non-food addict (n=717)	Food addict (n=109)	p
Gender	Male	257(%35,8)	37(%33,9)	0,393
	Female	460(%64,2)	72(%66,1)	
Age		21,230±2,361	20,820±1,811	0,077
BMI		21,652±3,247	23,615±4,147	**0,000**
BMI Group	underweight	103(%14,4)	12(%11,0)	**0,000**
	Normal	506(%70,6)	61(%56,0)	
	overweight	95(%13,2)	32(%29,4)	
	obese	13(%1,8)	4(%3,7)	
ASRS-Inattention Score	<24	566(%78,9)	68(%62,4)	**0,000**
	≥24	151(%21,1)	41(%37,6)	
ASRS-Hyperactivity / Impulsivity Score	<24	537(%74,9)	62(%56,9)	**0,000**
	≥24	180(%25,1)	47(%43,1)	
ASRS subscores				
ASRS – Inattention score		12,626±5,017	14,945±5,897	**0,000**
ASRS-Hyperactivity/Impulsivity score		13,526±5,002	15,330±5,126	**0,000**
ADHD Total Score		26,152±8,692	30,275±9,171	**0,000**
BIS-11 subscales				
Attentional Impulsiveness		16,554±3,587	18,385±3,442	**0,000**
Motor Impulsiveness		20,211±4,401	22,477±5,138	**0,000**
Non-Planning Impulsiveness		25,276±4,453	27,046±4,417	**0,000**
BIS-11 Total		62,040±9,725	67,908±9,979	**0,000**

BMI; Body Mass Index, ASRS; Adult ADHD Self-Report Scale, BIS-11; Barratt Impulsiveness Scale-11

The subscore of inattentiveness, subscore of hyperactive/impulsiveness and total ASRS scores were significantly higher in food addicted group. (p <0.001) The food addict group had significantly higher mean scores than the non-food addict group on the Barratt impulsivity scale all subscores and total scores (p <0.001) (Table 1).

BMI was greater in the food addiction and ADHD comorbidity group compared to the food addiction only group (X2=24.86; p=0.003) (Table 2). According to the ASRS cut-off score ≥24, categorized as having a potential ADHD, those in the food addiction group presented statistically significantly higher ratios of ADHD. YFAS scores were statistically higher in ADHD inattentiveness group (ASRS inattentiveness score ≥24) and hyperactive/impulsiveness group (ASRS hyperactive/impulsiveness score ≥24) when compared with groups which are below cut-off scores (p <0.001) (Table 3).

The lineer regression analysis revealed that the increased hyperactivity–impulsiveness measured by ASRS (ß=0,027), motor impulsiveness measured by BIS-11 (ß=0.030) and BMI (ß=0.037) found to be correlated with higher YFAS scores (F=10.384; p=0.000) when age and sex factors are controlled (Table 4). The lineer regression analysis was performed to determine the relationship between BMI and attention deficit, hyperactivity, impulsivity and YFAS score also revealed statistically significant results (F=2.532; p=0.039). The higher YFAS scores were found to be related to increased BMI values (ß=0.243) (Table 4).

Table 2. BMI differences between groups regarding presence of ADHD and FA diagnoses

		ADHD (–) and FA (–)	ADHD (–) and FA (+)	ADHD (+) and FA (–)	ADHD (+) and FA(+)	p
		n(%)	n(%)	n(%)	n(%)	
BMI Group	underweight	77(%13,6)	9(%13,2)	26(%17,2)	3(%7,3)	X^2=24,862 p=0,003
	Normal	403(%71,2)	38(%55,9)	103(%68,2)	23(%56,1)	
	overweight	75(%13,3)	18(%26,5)	20(%13,2)	14(%34,1)	
	obese	11(%1,9)	3(%4,4)	2(%1,3)	1(%2,4)	

BMI; Body Mass Index, ADHD; Attention Deficit Hyperactivity Disorder, FA; Food Addiction

Table 3. Comparison of YFAS Scores of Groups According to ASRS Subscale Scores

		YFAS Score **Mean±SD**	t	p
ASRS Hyperactivity/Impulsivity Score	<24 (n=599)	3,30±1,30	-4,210	**0,000**
	≥24 (n=227)	3,74±1,46		
ASRS-Inattention Score	<24 (n=634)	3,31±1,31	-4,516	**0,000**
	≥24 (n=192)	3,81±1,46		

ASRS: Adult ADHD Self-Report Scale; YFAS: Yale Food Addiction Scale; SD: Standart Deviation

Table 4. Lineer Regresyon Analysis with BIS-11 subscale scores, ASRS scores to predict YFAS scores and BMI

Dependent variable	Independent variables	ß	t	p	F	Model (p)	R^2
YFAS Score	Constant	0,944	2,313	0,021	10,384	0,000	0,064
	ASRS-Attention Deficit	0,018	1,711	0,087			
	ASRS-Hyperactivity/Impulsivity	0,027	2,411	**0,016**			
	BSI-11 Inattantiveness	0,022	1,337	0,182			
	BSI-11 **Motor Impulsivity**	0,030	2,461	**0,014**			
	BSI-11 Non-planning	0,003	0,259	0,796			
	BMI	0,037	2,747	**0,006**			
BMI	Constant	20,292	26,113	0,000	2,532	0,039	0,007
	ASRS-Attention Deficit	0,006	0,215	0,830			
	ASRS-Hyperactivity/Impulsivity	-0,016	-0,575	0,565			
	Impulsivity Total	0,015	1,100	0,272			
	YFAS Score	0,243	2,697	**0,007**			

BIS-11; Barratt Impulsiveness Scale-11, YFAS; Yale Food Addiction Scale, BMI; Body Mass Index, ASRS; Adult ADHD Self-Report Scale

DISCUSSION

The purpose of the present study was to investigate the association between ADHD symptoms, impulsivity, and food addiction.

In the present study, according to the YFAS, 13.2% of the participants could be classified as having a food addiction. In previous studies with clinical samples, 15 to 25% of obese individuals (19,38), 30–58% of bariatric surgery patients (6,32,39), and in nonclinical samples, 4.5–10% of community or students (20,40,41,42), meet criteria for food addiction.

The group meeting criteria for food addiction did not differ as to gender ratios or age when compared to not addictive subjects in our study. Davis et al. found that compare to their non-food addiction counterparts the food addiction group did not present significant differences in age (19).

In a recent study, VanderBroek-Stice et al. (43) reported two aspects of impulsivity to be associated with food addiction: (a) Positive and Negative Urgency, indicating risk of impulsively during intense mood states, and (b) disregarding delayed rewards. Their results imply that food addiction might be an etiological pathway to obesity for individuals exhibiting impulsivity. In concordance with their results, our results provide preliminary evidence linking impulsivity to food addiction.

Studies looking at the relationship between ADHD symptoms, impulsivity, and BMI have conflicting results (44,45,46). Gerhardt et al. (41) also reported that “food addiction” was associated with higher BMI in a sample of 1141 volunteers. However, some other studies found no difference in BMI among those with food addiction compared to those without food addiction (47). In the current study, we found that rates of overweight and according to BMI were significantly higher in food addiction group. Moreover, in the present study as a remarkable finding, BMI was greater in the food addiction and ADHD comorbidity group compared to the food addiction only group. Searcing for the presence of food addiction in obese individiuals with ADHD may be important for clinical administration.

The prevalence of comorbidity of eating disorders and ADHD has found to be higher than the general population, independent of BMI (39). Also, other research has found that women with bulimia nervosa are more likely also to experience ADHD symptoms than controls, and those women with both disorders presented more impulsivity than individuals with only bulimia nervosa (40). Gearhardt et al. and Pagoto et al. reported that remitted ADHD did not significantly correlate with current obesity, although persistent ADHD was (12,41). Brunault et al. found that obese patients with a diagnosis of adult ADHD have higher risk for food addiction and binge eating than patients without ADHD (21). Food addiction and binge eating may be important variables implicated in the association between ADHD and obesity. Future longitudinal studies should determine whether food addiction and/or binge eating could best explain the over – representation of obesity in ADHD patients. Recent evidence also implies that the treatment of ADHD may also be useful for weight reduction in subjects with ADHD and obesity (15).

Our results demonstrating higher BIS scores among food addict group, and higher YFAS scores among having a potential ADHD group suggest that ADHD is related to both impulsivity and food addiction. Presumably, food addiction, characterized by overeating highly palatable foods in an uncontrolled manner moderated by the impulsivity, may help to compensate for dopamine deficiency in ADHD subjects (43). The stimulant medications utilized for the treatment of ADHD also reduce impulsivity suppresses appetite and increases synaptic dopamine availability (47).

This preliminary investigation has several limitations. The main limitation is that our sample was a nonclinical and relatively small number of obese subjects participating in the study. We used self-reported weight and height to calculate BMI. It might, however, associated with limitations such as bias as a result of social desirability or difficulties with recall. Although we didn’t have the diagnostic interviews to more thoroughly evaluate ADHD symptomatology and used self-report measures that have been employed with nonclinical populations in past studies and found a reasonable amount of variance on these scales, we did not consider individuals with clinical diagnoses. Also, the age range of our sample prevents us from generalizing our results to adolescents. The results may in part reveal an influence of consequences of depression or anxiety, which are common in ADHD.

Food addiction remains a relatively new construct, and further study is needed. The mean BMI of this sample fell within the normal-weight range. This might reduce the number of cases of food addiction. Replicating and extending these findings in overweight clinical samples may be beneficial. Also extending these findings to diverse groups and with a more gender-balanced sample would be useful. As the design of the present study was cross-sectional, it is not possible to show that

ADHD and impulsivity precede food addiction symptoms temporally. Future research with longitudinal design will be relevant to demonstrate the possible temporal relation of childhood ADHD, higher levels of impulsivity and food addiction as it is a risk factor for substance use disorders.

CONCLUSION

While results of the present study suggest that food addiction might be related to impulsivity and other ADHD symptoms, its contributions must be viewed within the context of the study's strengths and limitations. Evaluation of the presence of ADHD might be an important issue in determining treatment for obesity in individuals with food addiction. The clinicians must be aware of the pitfalls associated with the comorbidity and consider screening patients with food addiction for ADHD. However, we must be aware that many controversial issues remain to be resolved in the future. Such longitudinal studies should also assess whether an adequate and early management of ADHD could prevent obesity or delay the onset of obesity in these patients, paving the way for evidence-based therapeutic interventions for these patients.

REFERENCES

[1] Johnson PM, Kenny PJ. Dopamine D2 receptors in addiction-like reward dysfunction and compulsive eating in obese rats. Nat Neurosci. 2010;13(5):635-641. doi: 10.1038/nn.2519.

[2] Gordon EL, Ariel-Donges AH, Bauman V, Merlo LJ. What Is the Evidence for "Food Addiction?" A Systematic Review. Nutrients. 2018;10(4):477. doi: 10.3390/nu10040477.

[3] Volkow ND, Wise RA. How can drug addiction help us understand obesity? Nat Neurosci. 2005;8(5):555-60. doi: 10.1038/nn1452.

[4] Stice E, Spoor S, Bohon C, Veldhuizen MG, Small DM. Relation of reward from food intake and anticipated food intake to obesity: a functional magnetic resonance imaging study. J Abnorm Psychol. 2008;117(4):924-935. doi: 10.1037/a0013600.

[5] Cassin SE, von Ranson KM. Is binge eating experienced as an addiction? Appetite 2007;49(3):687-690. doi: 10.1016/j.appet.2007.06.012.

[6] Gearhardt AN, White MA, Masheb RM, Grilo CM. An examination of food addiction in a racially diverse sample of obese patients with binge eating disorder in primary care settings. Compr Psychiatry. 2013;54(5):500-505. doi: 10.1016/j.comppsych.2012.12.009.

[7] Avena NM. Food and addiction: implications and relevance to eating disorders and obesity. Curr Drug Abuse Rev. 2011;4(3):131-2. doi: 10.2174/187.447.3711104030131.

[8] Fayyad J, Sampson NA, Hwang I, Adamowski T, Aguilar-Gaxiola S, Al-Hamzawi A, Andrade LH, Borges G, de Girolamo G, Florescu S, Gureje O, Haro JM, Hu C, Karam EG, Lee S, Navarro-Mateu F, O'Neill S, Pennell BE, Piazza M, Posada-Villa J, Ten Have M, Torres Y, Xavier M, Zaslavsky AM, Kessler RC; WHO World Mental Health Survey Collaborators. The descriptive epidemiology of DSM-IV Adult ADHD in the World Health Organization World Mental Health Surveys. Atten Defic Hyperact Disord. 2017;9(1):47-65. doi: 10.1007/s12402.016.0208-3.

[9] Altfas JR. Prevalence of attention deficit/hyperactivity disorder among adults in obesity treatment. BMC Psychiatry. 2002; 2:9. doi: 10.1186/1471-244x-2-9.

[10] Nazar BP, Bernardes C, Peachey G, Sergeant J, Mattos P, Treasure J. The risk of eating disorders comorbid with attention-deficit/hyperactivity disorder: A systematic review and meta-analysis. Int J Eat Disord. 2016;49(12):1045-1057. doi: 10.1002/eat.22643.

[11] Nigg JT, Johnstone JM, Musser ED, Long HG, Willoughby MT, Shannon J. Attention-deficit/hyperactivity disorder (ADHD) and being overweight/obesity: New data and meta-analysis. Clin Psychol Rev. 2016; 43:67-79. doi: 10.1016/j.cpr.2015.11.005.

[12] Pagoto SL, Curtin C, Lemon SC, Bandini LG, Schneider KL, Bodenlos JS, Ma Y. Association between adult attention deficit/hyperactivity disorder and obesity in the US population. Obesity (Silver Spring). 2009;17(3):539-544. doi: 10.1038/oby.2008.587.

[13] van Egmond-Fröhlich AW, Widhalm K, de Zwaan M. Association of symptoms of attention-deficit/hyperactivity disorder with childhood overweight adjusted for confounding parental variables. Int J Obes (Lond). 2012;36(7):963-968. doi: 10.1038/ijo.2012.78.

[14] Nazar BP, Suwwan R, de Sousa Pinna CM, Duchesne M, Freitas SR, Sergeant J, Mattos P. Influence of attention-deficit/hyperactivity disorder on binge eating behaviors and psychiatric comorbidity profile of obese women. Compr Psychiatry. 2014;55(3):572-578. doi: 10.1016/j.comppsych.2013.09.015.

[15] Cortese S, Bernardina BD, Mouren MC. Attention-deficit/hyperactivity disorder (ADHD) and binge eating. Nutr Rev. 2007;65(9):404-411. doi: 10.1111/j.1753-4887.2007.tb00318.x.

[16] Bleck J, DeBate RD. Exploring the co-morbidity of attention-deficit/hyperactivity disorder with eating disorders and disordered eating behaviors in a nationally representative community-based sample. Eat Behav. 2013;14(3):390-393. doi: 10.1016/j.eatbeh.2013.05.009.

[17] de Zwaan M, Gruss B, Müller A, Philipsen A, Graap H, Martin A, Glaesmer H, Hilbert A. Association between obesity and adult attention-deficit/hyperactivity disorder in a German community-based sample. Obes Facts. 2011;4(3):204-211. doi: 10.1159/000329565.

[18] Reinblatt SP, Leoutsakos JM, Mahone EM, Forrester S, Wilcox HC, Riddle MA. Association between binge eating and attention-deficit/hyperactivity disorder in two pediatric community mental health clinics. Int J Eat Disord. 2015;48(5):505-511. doi: 10.1002/eat.22342.

[19] Davis C, Curtis C, Levitan RD, Carter JC, Kaplan AS, Kennedy JL. Evidence that 'food addiction' is a valid phenotype of obesity. Appetite 2011;57(3):711-717. doi: 10.1016/j.appet.2011.08.017.

[20] Romo L, Ladner J, Kotbagi G, Morvan Y, Saleh D, Tavolacci MP, Kern L. Attention-deficit hyperactivity disorder and addictions (substance and behavioral): Prevalence and characteristics in a multicenter study in France. J Behav Addict. 2018;7(3):743-751. doi: 10.1556/2006.7.2018.58.

[21] Brunault P, Frammery J, Montaudon P, De Luca A, Hankard R, Ducluzeau PH, Cortese S, Ballon N. Adulthood and childhood ADHD in patients consulting for obesity is associated with food addiction and binge eating, but not sleep apnea syndrome. Appetite. 2019; 136:25-32. doi: 10.1016/j.appet.2019.01.013.

[22] Murphy CM, Stojek MK, MacKillop J. Interrelationships among impulsive personality traits, food addiction, and Body Mass Index. Appetite 2014; 73:45-50. doi: 10.1016/j.appet.2013.10.008.

[23] Solanto MV, Abikoff H, Sonuga-Barke E, Schachar R, Logan GD, Wigal T, Hechtman L, Hinshaw S, Turkel E. The ecological validity of delay aversion and response inhibition as measures of impulsivity in AD/HD: a supplement to the NIMH multimodal treatment study of AD/HD. J Abnorm Child Psychol. 2001;29(3):215-228. doi: 10.1023/a:101.032.9714819.

[24] Dick DM, Smith G, Olausson P, Mitchell SH, Leeman RF, O'Malley SS, Sher K. Understanding the construct of impulsivity and its relationship to alcohol use disorders. Addict Biol. 2010;15(2):217-226. doi: 10.1111/j.1369-1600.2009.00190.x.

[25] Nasser JA, Gluck ME, Geliebter A. Impulsivity and test meal intake in obese binge eating women. Appetite 2004;43(3):303-307. doi: 10.1016/j.appet.2004.04.006.

[26] Meule A, de Zwaan M, Müller A. Attentional and motor impulsivity interactively predict 'food addiction' in obese individuals. Compr Psychiatry. 2017; 72:83-87. doi: 10.1016/j.comppsych.2016.10.001.

[27] Cortese S, Faraone SV, Bernardi S, Wang S, Blanco C. Adult attention-deficit hyperactivity disorder and obesity: epidemiological study. Br J Psychiatry 2013;203(1):24-34. doi: 10.1192/bjp.bp.112.123299.

[28] Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser. 2000;894: i-xii, 1-253.

[29] Gearhardt AN, Corbin WR, Brownell KD. Preliminary validation of the Yale Food Addiction Scale. Appetite. 2009;52(2):430-436. doi: 10.1016/j.appet.2008.12.003.

[30] Gearhardt AN, Corbin WR, Brownell KD. Food addiction: an examination of the diagnostic criteria for dependence. J Addict Med. 2009;3(1):1-7. doi: 10.1097/ADM.0b013e318193c993.

[31] Bayraktar F, Erkman F, Kurtuluş E. Adaptation Study of Yale Food Addiction Scale. Bulletin of Clinical Psychopharmacology 2012;22(suppl 1): 38.

[32] Sevincer G.M., Konuk N., Bozkurt S., Saracli O., Coskun H. Psychometric properties of the Turkish version of the Yale food addiction scale among bariatric surgery patients. Anadolu Psikiyatri Dergisi 2015;16:44-53.

[33] Kessler RC, Adler L, Ames M, Demler O, Faraone S, Hiripi E, Howes MJ, Jin R, Secnik K, Spencer T, Ustun TB, Walters EE. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. Psychol Med. 2005;35(2):245-256. doi: 10.1017/s003.329.1704002892.

[34] Vahia VN. Diagnostic and statistical manual of mental disorders 5: A quick glance. Indian J Psychiatry 2013;55(3):220-223. doi: 10.4103/0019-5545.117131.

[35] Dogan S, Öncü B, Varol S, Kucukgoncu S. [Validity and reliability of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1.1)]. Anadolu Psikiyatri Dergisi 2009;10:77-87.

[36] Patton JH, Stanford MS, Barratt ES. Factor structure of the Barratt impulsiveness scale. J Clin Psychol. 1995;51(6):768-774. doi: 10.1002/1097-4679(199511)51:6<768: aid-jclp227.051.0607>3.0.

[37] Güleç H, Tamam L, Yazici M, Turhan M, Karakuş G, Zengin M, Stanford M. Psychometric Properties of the Turkish Version of the Barratt Impulsiveness Scale-11. Bulletin of Clinical Psychopharmacology 2008;18. 251-258.

[38] Davis C. From passive overeating to "food addiction": A spectrum of compulsion and severity. ISRN Obes. 2013;435027.

[39] Meule A, Heckel D, Kübler A. Factor structure and item analysis of the Yale Food Addiction Scale in obese candidates for bariatric surgery. Eur Eat Disord Rev. 2012;20(5):419-422. doi: 10.1002/erv.2189.

[40] Flint AJ, Gearhardt AN, Corbin WR, Brownell KD, Field AE, Rimm EB. Food-addiction scale measurement in 2 cohorts of middle-aged and older women. Am J Clin Nutr. 2014;99(3):578-586. doi: 10.3945/ajcn.113.068965.

[41] Gearhardt AN, Boswell RG, White MA. The association of "food addiction" with disordered eating and body mass index. Eat Behav, 2014;15(3): 427-433.

[42] Pursey KM, Stanwell P, Gearhardt AN, Collins CE, Burrows TL. The prevalence of food addiction as assessed by the Yale Food Addiction Scale: a systematic review. Nutrients. 2014 Oct 21;6(10):4552-90. doi: 10.3390/nu6104552.

[43] VanderBroek-Stice L, Stojek MK, Beach SRH, vanDellen MR, MacKillop J. Multidimensional assessment of impulsivity in relation to obesity and food addiction. Appetite. 2017 May 1; 112:59-68. doi: 10.1016/j.appet.2017.01.009.

[44] Bauer LO, Yang BZ, Houston RJ, Kranzler HR, Gelernter J. GABRA2 genotype, impulsivity, and body mass. Am J Addict. 2012 Sep-Oct;21(5):404-10. doi: 10.1111/j.1521-0391.2012.00252.x.

[45] Fleming JP, Levy LD, Levitan RD. Symptoms of attention deficit hyperactivity disorder in severely obese women. Eat Weight Disord. 2005;10(1):e10-3. doi: 10.1007/BF03354661.

[46] Mobbs O, Crépin C, Thiéry C, Golay A, Van der Linden M. Obesity and the four facets of impulsivity. Patient Educ Couns. 2010;79(3):372-7. doi: 10.1016/j.pec.2010.03.003.

[47] Meule A. Food addiction and body-mass-index: a non-linear relationship. Med Hypotheses 2012;79(4):508-511. doi: 10.1016/j.mehy.2012.07.005.