**­­­Food Addiction and its Potential Links with Weight Stigma**

Jessica Reid,1 Kerry O’Brien PhD,2 Rebecca Puhl PhD,3 Charlotte A. Hardman PhD,4 Adrian Carter PhD1,5\*

1 Monash Institute of Cognitive and Clinical Neurosciences and the School of Psychological Sciences, Monash University, Australia

2 School of Social Sciences, Monash University, Australia

3 Rudd Center for Food Policy & Obesity; Department of Human Development & Family Studies; University of Connecticut, USA

4 Department of Psychological Sciences, University of Liverpool, UK

5 University of Queensland Centre for Clinical Research, The University of Queensland, Australia

\* Corresponding Author:

Associate Professor Adrian Carter

Monash Institute of Cognitive and Clinical Neurosciences

School of Psychological Sciences

Monash University

770 Blackburn Rd

Clayton Campus, Clayton

VIC 3800, Australia

**Abstract**

**Purpose of review:** Weight stigma and discrimination are significant issues facing people who are overweight. There is growing acceptance that obesity is caused by a neurobiologically-driven addiction to some foods. This review examines the evidence that obesity is due to a food addiction and the impact that this may have on attitudes towards excess weight.

**Recent findings:** There is limited evidence that food addiction explanations may reduce external stigma and self-blame. However, these positives may come at the expense of adverse impacts on overweight person’s self-efficacy and eating. The “addict” label may also further exacerbate weight stigma.

**Summary:** Current research on the topic the impact of food addiction explanations on stigma is scarce and inconsistent. There is almost no research examining the clinical impact of food addiction on self-efficacy, eating or treatment-seeking. More research clarifying these issues is essential given the growing acceptance of “food addiction” explanations in society.

**Keywords**

Food addiction; obesity; stigma; weight-bias; discrimination; self-efficacy.

**Introduction**

There are an estimated 1.9 billion adults worldwide who are overweight or obese [1] translating to approximately 37% of the global population [2]. In developed countries like Australia and the United States, the rates are higher with two thirds of individuals being overweight or obese [3, 4]. The rapid increase in body mass index (BMI) observed over the past two decades has coincided with an increase in fast food outlets [5], portion sizes [6], and the availability of highly-processed hyperpalatable foods, particularly those high in refined sugars and fats [7]. Yet despite the high rates of overweight and obesity, individuals with high body weight remain a common target of significant stigma and discrimination [8, 9]. In addition to the well-established health risks of obesity (e.g. cardiovascular disease, diabetes, and a range of cancers) [10, 11], weight stigma can have a detrimental impact on health [12]. Weight stigma can result in increased physiological stress, maladaptive eating patterns, increased food intake and weight gain, barriers in health care, and can negatively impact psychological wellbeing [13-16]. Weight discrimination by employers, health care professionals and others in society can also undermine quality of life [17]. There is therefore a clear need to reduce the stigma and discrimination experienced by individuals with overweight and obesity.

Despite increased public knowledge about the harms associated with excessive food consumption (volume and frequency) [18], many people still consume large quantities of foods, feel their eating is out of control, and/or engage in binge eating [19]. This evidence has led to the suggestion by some clinicians, neuroscientists, and obesity researchers that many people who struggle with their weight may have an addiction to some foods, or a “food addiction” that contributes to weight gain. It is estimated that between 11-14% of the population [20] and up to a third of people who are obese may be addicted to food [7]. Even though only a minority of people meet the criteria for food addiction, 28-52% of people perceive themselves to be “food addicts” [20-22].

Food addiction has received increasing attention in the scientific literature and mass media [23-27]. In recent years there have been a series of award winning documentaries, including “*Fed Up”* (2014) and “*Hungry for Change”* (2012), exploring the concept of food addiction. These initiatives have led to increased public acceptance of the food addiction concept [28]. It is not clear, however, what impact food addiction messages will have on internal perceptions and societal views of people who are overweight or obese. Proponents of the food addiction model (FAM) of obesity argue that recognition of the addictive nature of hyper-palatable foods may reduce self-blame and increase treatment seeking among people who are obese or overweight and reduce stigma and discrimination directed towards them. Critics argue that it may undermine individuals’ belief in their ability to control their weight, encouraging the fatalistic view that there is nothing that they can do about it. It may also have unpredictable impacts on weight stigma, including discrimination, internalised stigma, and body dissatisfaction; all of which are key factors of eating, weight-gain and well-being. Given the prevalence of overweight and obesity, it is important to ensure that clinical messages and health promotion materials about food addiction do not further exacerbate both internal and external weight stigma.

As the links between food addiction and weight stigma have received little attention, this review brings together several relevant literatures and summarizes recent evidence on: 1) food addiction; 2) stigma of individuals with obesity; 3) associations documented between food addiction and weight stigma; and 4) potential applications of a FAM of obesity to stigma. We conclude with an analysis of the implications of this research for public health policy, health promotion and clinical treatment and identify gaps in the literature for future research.

**Support for Food Addiction**

Emerging neuroscience research suggests that chronic consumption of energy dense foods causes changes in the brain’s reward pathway that undermine people’s ability to control food intake, similar to that seen drug addiction [25, 29, 30]. Neuroimaging studies have shown that hyperpalatable foods (those high in refined sugar and fats) increase dopamine (DA) release in the nucleus accumbens (NAc), a key structure in the reward pathway [25, 30, 23, 31-33]. Similar changes are seen following the use of many substances of abuse (e.g. stimulants, nicotine, alcohol and marijuana). The size of this DA release correlates with the self-rated rewarding effect of either food or drug consumption [34]. The sights and smells associated with hyperpalatable foods can also cause an increase in DA activity that correlates with the self-reported level of craving that can drive the overconsumption of energy dense foods [30].

The chronic consumption of hyperpalatable foods, however, causes a reduction in dopamine activity through a loss of dopamine 2 receptors (D2R) in the striatum that is also seen in people with addictions [30]. The loss of striatal D2Rs in humans is negatively correlated with BMI [35].This loss of striatal dopamine activity is associated with a loss of self-reported reward following the consumption of hyperpalatable foods or drugs. These changes are thought to explain the emergence of withdrawal symptoms and the development of tolerance that drives the consumption of greater quantities of refined foods in order to achieve the same rewarding effect. Structural and functional neuroimaging studies have shown that obese individuals have deficits in frontal-striatal systems that overlap with those seen in cocaine users [36]. The frontal regions of the brain are responsible for executive control and impulse inhibition. Deficits in these regions may explain the loss of control over food intake seen in some people with obesity.

Animal studies provide a similar picture. Animals fed a diet high in refined sugars and fat will develop an addiction-like pattern of behaviour that includes binge-eating, compulsive food seeking and withdrawal [37, 31]. These animals will also over-consume hyperpalatable food in the face of aversive events such as electrical foot shock [31], much like animals exposed to the chronic use of addictive drugs [38]. Like overweight humans, animals fed a diet of hyperpalatable foods show diminished striatal D2R expression [37] and reduced DA signalling in the NAc [39]. Obese rats also exhibit more compulsive-like eating and reduced striatal D2Rs compared to lean rats [37].

People who are overweight and obese also display patterns of eating that resemble the ways in which addicted individuals consume drugs [19]. Ifland et al. [26] adapted the structured clinical interview for substance dependence (DSM-IV) to investigate experiences of eating amongst self-identified “food addicts”. Participants reported requiring greater amounts of hyperpalatable foods progressively over time to reach the desired reward and satiation. Participants also reported using food to resolve anxiety or depressive symptoms, eating more than intended, having failed attempts to cut back or stop eating refined foods, missing social, occupational or recreational activities because of their eating, and continuing to eat refined hyperpalatable foods despite knowledge of negative consequences such as weight gain and fatigue [26]. DSM-IV criteria for substance dependence have been used to develop the Yale Food Addiction Scale (YFAS), which has been shown to possess good predictive qualities in populations with obesity and binge eating pathology [40]. Though the extent to which the YFAS predicts variability in weight and BMI beyond existing measures of problematic eating has been questioned [41]. A recent study further assessed public understanding of food addiction [22], identifying six themes that individuals use to define themselves as either food-addicted or not. These were: 1) eating for pleasure/reward rather than hunger; 2) preoccupation with food; 3) inability to exert self-control over food intake; 4) experience of food cravings; 5) being overweight or eating an unhealthy diet; and 6) having a specific problem food.

The food addiction concept of obesity is not without its critics. Some academics and clinicians point out important differences between obesity and food addiction [42, 43]. Firstly, only a minority of people who are obese meet the diagnostic criteria for food addiction, whereas some normal and underweight individuals do. Secondly, it is not clear whether changes in the brain are a cause or a consequence of food consumption. Thirdly, obesity is a complex multifactorial and heterogeneous condition that can arise from sedentary lifestyles or other hormonal or thyroid conditions; there is no equivalent feature of drug addiction. Similarly, unlike drugs, food is essential for survival.

Despite critiques of the diagnostic validity of food addiction, food addiction models and explanations for eating and obesity are pervasive in mainstream media and society [44, 45] and have influenced the thinking and behaviour of overweight individuals, clinicians, and the general public [28]. Media coverage of “food addiction” has had a significant influence on public attitudes. A recent study found that among 479 Australian and American participants, 86% believed that certain foods (e.g. those high in refined sugars and fats) were addictive, and 72% accepted the view that obesity may be due to a food addiction [28].The personal, health and societal implications of perceiving others or oneself as a “food addict” are not well understood.

**Stigma and obesity**

Weight-based stigma and discrimination have increased in recent decades. For women, weight stigma has been found to be as prevalent as race-based discrimination [46]. Common societal stereotypes of people with obesity include views that they are lazy, unmotivated, and lacking will-power or self-discipline [17]. Societal stereotypes and stigma can lead to overt forms of discrimination and unfair treatment, such as limited opportunities for employment [47]. People who are overweight and obese are, respectively, 12 and 37 times more likely to experience weight stigma in the workplace than their lean counterparts [48]. People with obesity are also rated as poorer candidates for managerial positions and are often offered lower starting salaries than people without obesity [49].

Weight stigma is also prominent among health care providers in medical settings. In a recent review, Phelan et al. [15], showed that many health practitioners hold negative stereotypes of overweight and obese persons that adversely affects the quality of service provided. Such anti-fat attitudes have been observed at both an implicit and explicit level, with medical professionals expressing greater liking for thin, rather than overweight, persons [50]. This is particularly concerning as experiencing weight stigma may lead overweight and obese persons to stop engaging in a range of health services. For example, physical educators, who often play a central role in promoting participation in sport and physical activity, have been found to have higher levels of implicit and explicit bias against obesity [51].

Weight stigma can have adverse consequences for both psychological wellbeing and physical health. Considerable evidence shows that weight stigma is associated with greater depression, anxiety, substance use, poor self-esteem, lower body image, and suicidal ideation [52, 16, 53-55]. Research also suggests that experiences of weight stigma are an important mediator of the relationship between higher BMI and lower psychological wellbeing [56, 57]. This relationship may be partially explained by the interaction between psychological and physiological mechanisms, with weight stigma related to increased physiological stress (e.g. cortisol reactivity) in overweight individuals [58-60]. Aside from its association with cardiovascular disease and cancers, chronic cortisol levels have been shown to be associated with stress-induced eating and significant cravings for high fat and sugary foods [61].Weight stigma has also been found to increase calorie consumption and lower perceptions of control over one’s weight [62], leading to binge eating and unhealthy weight control behaviours and interfering with weight loss efforts and increased weight gain over time [63, 14, 13].

**Internalised Weight Bias**

Being the target of weight stigma can lead individuals to direct negative stereotypes and blame toward themselves, referred to as internalised weight bias. Internalised weight bias is associated with increased depression, body dissatisfaction and anxiety [64, 65]. Adverse consequences of internalising weight bias may be distinct from those resulting from experiences of weight stigma alone [66], and may be associated with a range of negative physical health indices including cardiovascular risk factors [67]. In addition, weight bias internalisation has been found to mediate the relationship between BMI, eating behaviour, health-related quality of life and emotional wellbeing [68-70], and is associated with a higher likelihood of engaging in emotional binge eating, perpetuating a cycle of weight gain, stigma, and overeating [69, 71].

**Reducing Weight Stigma**

Despite evidence documenting the severity and prevalence of weight stigma and its adverse consequences, there is insufficient research identifying effective strategies to reduce weight stigma [72, 73]. Methods that have been employed include evoking empathy and positive emotion towards overweight persons, changing views about controllability and responsibility for weight, adjusting social norms for weight, and increasing awareness of one’s own biases [73, 72]. Though the scarcity and inconsistency of the existing literature makes it difficult to draw conclusions about the effectiveness of any one strategy, both Alberga et al. [73], and Daníelsdóttir et al. [72] highlight the promising effects of changing causal attributions of obesity. For example, medical students exposed to a genetic explanation of obesity (i.e implying eating and weight is outside of one’s control) will elicit less negative stereotypes towards a virtual overweight patient than students who receive a behavioural, or non-causal explanation [74].

Whilst it remains to be seen whether short-term changes in attitudes result in sustainable reductions in weight bias or prejudice, studies suggest that attributing excess weight to a neurobioloigcally-driven food addiction that impairs decisions about eating and weight may similarly reduce anti-fat attitudes [75, 76]. However, given that people with overweight or obesity are already a vulnerable group for societal stigma and internalised weight bias, research is warranted to identify whether a diagnosis of food addiction further reinforces societal stereotypes and/or increased internalization and self-blame.

**How Might Food Addiction Messages Affect Weight Stigma?**

Some researchers have argued that attributing obesity to factors beyond one’s control, as suggested by a FAM of obesity, may help to reduce the negative attitudes and stigma directed towards people who are overweight or obese [77, 24]. This plausible suggestion is consistent with established theories of stigma such as Attribution Theory [78], which states that illnesses or conditions viewed to be within one’s personal control (e.g. obesity) are more likely to be stigmatised and resistant to prejudice reduction compared to conditions viewed to be outside of personal control (e.g. addiction). For example, research shows that stronger attributions regarding personal controllability and responsibility of weight is associated with higher levels of prejudice toward people who are overweight or obese [79]. In contrast, others have argued that the “addict” label may increase stigma [80, 81]. Drug addictions are some of the most stigmatized conditions within health and medicine [82]. According to attribution theory, a FAM could also have adverse impacts on overweight individual’s belief in their ability to control their eating (or self-efficacy) and their motivation or willingness to lose weight or seek assistance. These contrasting possibilities highlight the need to carefully consider the potential influence of food addiction messages on these key outcomes, especially in the context of clinical treatment and health promotion.

**What does the evidence say?**

Despite growing public awareness and acceptance of food addiction, there has been little research examining its relationship to societal stigma and discrimination, or to individual self-understanding, body image, or self-efficacy.A systematic search of the literature across three databases (PubMed, PSYCINFO, and SCOPUS) conducted in December 2017 identified only nine studies examining links between food addiction messages and weight stigma (see Table 1). A search combining the keywords: “food addict\* OR “eating addict\*” with stigma related concepts: “stigma” OR “bias” OR “prejudice” OR “blame” OR “body image” OR “dislike” returned 46 articles, 37 of which were excluded for being review articles, not in English, or unrelated to stigma.

**Table 1.** Summary of research detailing the effects of food addiction messages on internalised and externalized weight stigma

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reference** | **Sample** | **N** | **Study Design** | **Measures** | **Findings** |
| **[83]** | Obese (BMI > 30kg/m2), age = 44.88, 75.8% female, 45.3% white, BMI = 38.3 kg/m2 | 96 | Quasi-experimental. Compared those who met criteria for food addiction with those who did not using Chi-square analysis and ANOVAs. | Researchers assessed participants eating disorder psychopathology through interview. Depression, emotion dysregulation, eating pathology and the presence of food addiction (YFAS) were further assessed through self-report measures. | 41.5% of participants met criteria for food addiction. No difference in age, race, gender or psychiatric comorbidity between those who did and did not meet criteria for food addiction. Higher YFAS scores were associated with negative affect, emotional dysregulation, binge eating, body image concerns and lowered self-esteem. |
| **[84]** | Overweight and obese (BMI > 27kg/ m2), age = 47.4, 68.4% female, 84.2% white, BMI = 38.2 kg/m2 | 57 | Participants in the study were engaging in an 18-week weight loss intervention. Data used in the present study was taken at baseline (pre-intervention) and 7 weeks into the trial. ANOVAs and bivariate correlations were used to examine relations between scores on the YFAS and variables of interest. | Food addiction pathology, psychological distress (depression), maladaptive eating behaviours, eating self-efficacy, weight-stigma, internalised weight-bias, body image. | Higher food addiction symptomology was associated with greater depression, maladaptive eating behaviours (e.g. binge eating), higher internalised and externalised weight bias and body shame. There was no relationship between YFAS scores and body satisfaction. |
| **[81]** |  |  |  |  |  |
| Study 1 | 52% female, 63% white | 659 | Participants completed an online survey assessing attitudes towards a “food addicted” person compared to other highly stigmatised conditions including obesity, addiction and disability. | Researchers assessed: 1) willingness to interact; 2) emotional responses (e.g. disgust); and 3) beliefs about personal responsibility and blame for the target individual | The label “food addict” was more stigmatised than obesity and had an additive effect on weight stigma. |
| Study 2 | 54.7% male, 64.6% white | 570 | Participants completed an online survey assessing attitudes towards a “food addicted” person compared to more specific addictions (smokers and alcoholics). | As above | Food addiction was viewed more favourably than other addictions. |
| **[85]** | Adults recruited through an online survey platform 54.7% male, 64.6% white | 570 | Participants were randomly assigned to answer questions about food addiction, alcoholism or nicotine addiction. Participants read a vignette describing a person with one of these conditions and were asked about their attitudes towards the vignette [81] and their beliefs about the condition itself (presented here). | Researchers assessed attitudes and beliefs about addiction in general and more specifically about alcoholism, food addiction and smoking. | Alcoholism was viewed as more of a “disease” than food addiction which was perceived as more of a “disease” than smoking. Smoking and food addiction were rated more highly on the free will scale (more behavioural based) than alcoholism. People were most likely to attribute food addiction (as oppose to smoking or alcoholism) to general unhappiness with one’s life. |
| **[77]** | 71% white, age = 34.55, BMI = 25.4 kg/m2 | 625 | 2 (addiction vs non-addiction) x 2 (obese vs normal weight) Between-Subjects Experimental Design.  Participants read  information that explained obesity from a food-addiction or non-addiction perspective. They then read vignettes which described either an obese or normal weight person. | Assessed participant’s level of stigma and blame towards both the target vignettes and obese persons in general, as well as their own fear of becoming fat. | A food addiction explanation of obesity elicited less stigma, blame and lower perceived psychopathology towards the target vignette. A food addiction explanation elicited less blame towards obese people and reduced participant’s own fears about becoming fat. |
| **[86]** | 80% female, Aged 18-84, BMI = 27.4 kg/m2 | 479 (U.S. = 215, Australia = 264) | Quasi-experimental. Outcome measures were compared on pre-existing groups (Country, BMI). | Food addiction symptomology (YFAS), weight-stigma and body mass index (BMI). Also assessed attitudes about the causes of obesity and the impact of food addiction. | Low levels of stigma were reported overall. Obese individuals scored higher on some stigma measures. |
| **[87]** | University students, 76% female, age = 20.19 | 793 | Correlational. | Use of survey to assess relationships between body image, depression, food addiction, gender and BMI. | Body image scores were lower for females than males.  Negative relationship observed between depression and body image scores.  Positive relationship between food addiction stores and both depression, and BMI. |
| **[88]** | 74% female, age = 38, BMI = 33 kg/m2 | 23 | Qualitative. Semi-structured interview. | Interviews assessed participants views on the ways in which “food addiction” impacts stigma, treatment seeking, and support for obesity-reducing policies | Some thought that a “food addict” label would be accompanied by both increased experiences of stigma, and increased self-stigma, although did indicate it would likely promote psychological treatment seeking. |
| **[20]** |  |  |  |  |  |
| Study 1 | University Students, 90% female, 76% white, age = 18.7, BMI = 22.0 kg/m2 | 658 | Quasi-experimental design. The study administered preliminary tests to stratify three groups: self-perceived food addicts (SPFA), food addicted as per the YFAS, and non-food-addicted (NFA). | All participants completed measures of eating pathology, body dissatisfaction, and explicit and internalized weight stigma. | Significant differences were found between each of the three groups: eating pathology, body dissatisfaction and weight-stigma increased in severity from non-food addicted, to self-perceived food addicted, to those who met criteria for food addiction as per the YFAS. |
| Study 2 | 59.8% female, 58.6% white, age = 35.1, BMI = 27.9 kg/m2 | 614 | Same as above | Additional to measures used in study 1, measures of impulsivity, food cravings, binge eating, and depressive symptomatology were assessed. | Eating pathology distinguished SPFA from those food addicted as per the YFAS but not from NFA. |

*Note.* Body Mass Index (BMI), Analysis of Variance (ANOVA), Yale Food Addiction Scale (YFAS), self-perceived food addicts (SPFA), non-food-addicted (NFA).

One study found that “obese” and “food addict” labels elicited similarly high levels of weight stigma, but that when combined elicited greater stigma than either label alone [81]. However, “food addicts” were less stigmatized than other addictions (e.g. drug addiction) and were viewed as more likeable and less responsible for their condition than targets described as having an alcohol or tobacco addiction [81]. These findings suggest that although “food addiction” may not cause the same level of stigma associated with a drug addiction, the term “food addict” may have an additive effect that increases the overall level of weight stigma aimed at this population, but less than that aimed at people with drug addictions.

Latner et al. [77] randomly assigned participants (n=625) to one of four experimental conditions in which they read about the causes of obesity that described either a food addiction explanation or a non-addiction explanation. They then read a vignette describing an obese or non-obese individual who was portrayed as being either addicted or not addicted to food. Findings showed that an addiction-based model of obesity reduced weight stigma and blame towards both the “food addicted” target and people who are obese in general. Exposure to food addiction messages were also associated with decreases in “fear of fat” (a reduced concern about gaining excess weight). These findings suggest that a FAM of obesity could potentially help reduce weight stigma and its adverse consequences related to emotional eating and/or psychological distress, though effect sizes were small.

In contrast to the above studies that examined links between food addiction messages and stigmatizing attitudes toward individuals with obesity, research assessing the effects of such messages on internalized stigma or self-perceptions is scarce. Cullen et al. [88] conducted a qualitative study of adults who are overweight or obese to examine their views about being labelled a “food addict” and how this affected their self-perceptions. Participants commonly reported that the addict label would “make [them] feel bad about [themselves]”. In contrast to attribution theory, participants’ self-stigma appeared to be associated with the view that they had little control over their weight.

More research examining the self-stigmatising effects of food addiction messages is needed, including research to assess the impact of these messages on clinical and health outcomes, such as self-efficacy, eating and weight, and treatment seeking. Existing literature on the effects of a FAM on eating behaviours and attitudes has returned mixed results [89, 21, 90]. One study found that participants had increased dietary concern and ate fewer calories in a subsequent bogus taste test when given a food addiction diagnosis [90]. Whilst another study found that giving participants a news article supporting the concept of food addiction appeared to have a bi-directional effect on eating behaviour. The variability in intake of indulgent food was much greater in this group than it was for participants who read an article that dismissed the concept of food addiction [21]. These findings suggest that for some people the FAM may promote stringent eating behaviour, dietary concern and treatment-seeking, whilst others may view food addiction as grounded in their neurobiology, thus undermining self-efficacy and weight-loss intentions. Given these uncertainties, it is critical that the impact of food addiction explanations of obesity on self-efficacy for eating and weight-loss receive further attention.

**Potential Insights from Biological Models of Obesity and Stigma**

Although there is a paucity of research on the direct impact of a FAM on weight stigma, previous studies assessing the impact of biological attributions of obesity offer some insight into how information about food addiction may be interpreted by the public. This is because biological attributions for body weight, like a FAM, reduce the perceived influence of factors under personal control (i.e. poor diet and lack of exercise) and emphasises the role of factors outside of personal control (e.g. neurobiology and genetics). Evidence has shown that biological causal attributions for obesity can have positive impacts on weight stigma, such as decreased weight bias internalisation [91] and increased body satisfaction [92]. Describing obesity as resulting from non-controllable factors (e.g. genetics) rather than controllable factors (e.g. poor diet and lack of exercise) also reduced external blame and weight-based discrimination [76, 75]. Thus, it is plausible that a FAM for obesity could reduce weight stigma through a similar attribution process. However, biological attributions could have negative and as yet unknown impacts on people’s eating and clinical behaviour. For example, Hoyt and colleagues [92] found that while messages that “obesity is a disease” did increase body satisfaction, it was also associated with increased unhealthy food choices. This could reflect either lowered perceived behavioural control or less motivation to make healthier choice associated with increased body satisfaction. A comprehensive analysis of the impact of food addiction messages needs to also consider the potential clinical impact on a person’s eating and weight behaviours and their self-efficacy. For example, a recent study showed that people who believe their weight is due to biological causes, such as genetics, are more likely to perceive their weight as unchangeable [93]. This may partially explain why providing overweight individuals with biological explanations of obesity increases unhealthy food choices [92] and contributes to difficulty achieving weight loss [94].

**Conclusions and Future Implications for Research and Policy**

Despite considerable media attention to the concept of food addiction, public support of food addiction as a contributing cause of obesity [28], and the growing use of food addiction approaches in the clinical treatment of obesity [95], there is little empirical research examining the impact of food addiction messages on public and personal weight stigma. The limited evidence available leaves many unanswered questions. It is unclear what impact food addiction explanations of obesity may have for the health and wellbeing of individuals with obesity or for broader societal attitudes, especially when these messages are communicated widely via public health campaigns or during clinical consultations in treatment settings. Large surveys of public and patient attitudes are needed to clarify the ways in which a FAM is interpreted and in turn affects attitudes and behaviours. Ideally, there is a need for studies employing experimental manipulations (e.g. a food addiction diagnosis) to identify the effects of a FAM on behaviour (e.g. eating and food choice, behaviour towards overweight individuals) [90]. By elucidating how food addiction messages affect members of society, it may be possible to devise public health promotion and clinical messages that reduce stigma and discrimination towards overweight individuals while eliminating negative impacts on self-image, self-efficacy, eating and weight.

**References**

1. Abarca-Gómez L, Abdeen ZA, Hamid ZA, Abu-Rmeileh NM, Acosta-Cazares B, Acuin C et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. The Lancet. 2017;390(10113):2627-42.

2. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet. 2014;384(9945):766-81.

3. Statistics ABo. Overweight and Obesity National Health Survey: First Results, 2014-2015. 2015. http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/4364.0.55.001~2014-15~Main Features~Overweight and obesity~22

4. Ogden CL, Carroll MD, Fryar CD, Flegal KM. Prevalence of obesity among adults and youth: United States, 2011-2014. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2015.

5. Rosenheck R. Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. Obesity Reviews. 2008;9(6):535-47.

6. Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: implications for weight management. The American Journal of Clinical Nutrition. 2005;82(1):236S-41S.

7. Gearhardt AN, Davis C, Kuschner R, Brownell KD. The Addiction Potential of Hyperpalatable Foods. Current Drug Abuse Reviews. 2011;4(3):140-5.

8. Puhl RM, Andreyeva T, Brownell KD. Perceptions of weight discrimination: prevalence and comparison to race and gender discrimination in America. International Journal of Obesity (2005). 2008;32(6):992-1000.

\*\*9. Puhl R, Latner J, O'brien K, Luedicke J, Daníelsdóttir S, Forhan M. A multinational examination of weight bias: predictors of anti-fat attitudes across four countries. International Journal of Obesity. 2015;39(7):1166-73.

This paper assessed levels of, and predictors for, anti-fat attitudes across Canada, the U.S., Iceland and Australia.

10. Pischon T., Nimptsch K. (2016) Obesity and Risk of Cancer: An Introductory Overview. In: Pischon T., Nimptsch K. (eds) Obesity and Cancer. Recent Results in Cancer Research, vol 208. Springer, Cham.

11. Collaborators TGO. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. New England Journal of Medicine. 2017;377(1):13-27. doi:10.1056/NEJMoa1614362.

12. Puhl R, Suh Y. Health consequences of weight stigma: implications for obesity prevention and treatment. Current Obesity Reports. 2015;4(2):182-90.

13. Vartanian LR, Porter AM. Weight stigma and eating behavior: a review of the literature. Appetite. 2016;102:3-14.

14. Sutin AR, Terracciano A. Perceived weight discrimination and obesity. PloS one. 2013;8(7):e70048.

15. Phelan SM, Burgess DJ, Yeazel MW, Hellerstedt WL, Griffin JM, Ryn M. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. Obesity Reviews. 2015;16(4):319-26.

16. Hatzenbuehler ML, Keyes KM, Hasin DS. Associations between perceived weight discrimination and the prevalence of psychiatric disorders in the general population. Obesity. 2009;17(11):2033-9.

17. Puhl RM, Heuer CA. The stigma of obesity: a review and update. Obesity (Silver Spring, Md). 2009;17(5):941-64.

18. Tompson T, Benz J, Agiesta J, Brewer K, Bye L, Reimer R et al. Obesity in the United States: public perceptions. The Food Industry. 2012;53(26):21.

19. Gearhardt AN, Corbin WR, Brownell KD. Food Addiction An Examination of the Diagnostic Criteria for Dependence. Journal of Addiction Medicine. 2009;3(1):1-7.

\*\*20. Meadows A, Nolan LJ, Higgs S. Self-perceived food addiction: Prevalence, predictors, and prognosis. Appetite. 2017;114:282-98.

This study assessed the prevalence of self-perceived food addiction and it’s relationship with validated measures of food addiction symptomology, weight stigma, body image and eating behaviours.

\*\*21. Hardman, Rogers PJ, Dallas R, Scott J, Ruddock HK, Robinson E. “Food addiction is real”. The effects of exposure to this message on self-diagnosed food addiction and eating behaviour. Appetite. 2015;91:179-84.

Authors address concerns that exposure to food addiction messages may increase self-diagnosis of food addiction thereby promoting the intake of unhealthy foods. Those exposed to food addiction messages showed increased self-diagnosis and more variability in food intake than controls.

22. Ruddock HK, Dickson JM, Field M, Hardman CA. Eating to live or living to eat? Exploring the causal attributions of self-perceived food addiction. Appetite. 2015;95:262-8.

23. 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):711-7.

24. Gearhardt AN, Bragg MA, Pearl RL, Schvey NA, Roberto CA, Brownell KD. Obesity and Public Policy. Annual Review of Clinical Psychology. 2012;8(1):405-30.

25. Smith DG, Robbins TW. The Neurobiological Underpinnings of Obesity and Binge Eating: A Rationale for Adopting the Food Addiction Model. Biological Psychiatry. 2013;73(9):804-10.

26. Ifland J, Preuss H, Marcus M, Rourke K, Taylor W, Burau K et al. Refined food addiction: a classic substance use disorder. Medical Hypotheses. 2009;72(5):518-26.

27. Ruddock HK, Hardman CA. Food Addiction Beliefs Amongst the Lay Public: What Are the Consequences for Eating Behaviour? Current Addiction Reports. 2017;4(2):110-5.

\*\*28. Lee NM, Lucke J, Hall WD, Meurk C, Boyle FM, Carter A. Public Views on Food Addiction and Obesity: Implications for Policy and Treatment. PLoS ONE. 2013;8(9):e74836. doi:10.1371/journal.pone.0074836.

Provided the first large survey of demonstrating significant public support for food addiction explanations of obesity and its likely impact on public policy and clinical treatment.

29. Volkow ND, O'Brien CP. Issues for DSM-V: should obesity be included as a brain disorder? American Journal of Psychiatry. 2007;164(5):708-10.

30. Volkow ND, Wang G-J, Tomasi D, Baler RD. The Addictive Dimensionality of Obesity. Biological Psychiatry. 2013;73(9):811-8.

31. Avena NM, Rada P, Hoebel BG. Evidence for sugar addiction: behavioral and neurochemical effects of intermittent, excessive sugar intake. Neuroscience & Biobehavioural Reviews. 2008;32(1):20-39.

32. Avena NM, Bocarsly ME, Hoebel BG, Gold MS. Overlaps in the Nosology of Substance Abuse and Overeating: The Translational Implications of "Food Addiction". Current Drug Abuse Reviews. 2011;4(3):133-9.

33. Volkow N, Wang GJ, Fowler JS, Tomasi D, Baler R. Neuroimgaing of addiction. In: Seeman P, Madras BK, editors. Imaging of the Human Brain in Health and Disease. San Diego: Elseveir; 2014. p. 1-26.

34. Stice E, Figlewicz DP, Gosnell BA, Levine AS, Pratt WE. The contribution of brain reward circuits to the obesity epidemic. Neuroscience & Biobehavioral Reviews. 2013;37(9, Part A):2047-58.

35. Stice E, Yokum S. Neural vulnerability factors that increase risk for future weight gain. Psychological Bulletin. 2016;142(5):447.

36. Smith DG, Jones PS, Williams GB, Bullmore ET, Robbins TW, Ersche KD. Overlapping decline in orbitofrontal gray matter volume related to cocaine use and body mass index. Addiction Biology. 2015;20(1):194-6. doi:10.1111/adb.12081.

37. Johnson PM, Kenny PJ. Dopamine D2 receptors in addiction-like reward dysfunction and compulsive eating in obese rats. Nature Neuroscience. 2010;13(5):635-41.

38. Koob GF, Le Moal M. Neurobiology of Addiction. New York: Academic Press; 2006.

39. Geiger B, Haburcak M, Avena N, Moyer M, Hoebel B, Pothos E. Deficits of mesolimbic dopamine neurotransmission in rat dietary obesity. Neuroscience. 2009;159(4):1193-9.

40. Gearhardt, Corbin WR, Brownell KD. Preliminary validation of the Yale Food Addiction Scale. Appetite. 2009;52(2):430-6.

41. Long CG, Blundell JE, Finlayson G. A systematic review of the application and correlates of YFAS-diagnosed ‘food addiction'in humans: are eating-related ‘addictions'a cause for concern or empty concepts? Obesity Facts. 2015;8(6):386-401.

\*\*42. Carter A, Hendrikse J, Lee N, Yucel M, Verdejo-Garcia A, Andrews Z et al. The Neurobiology of ‘food addiction’ and its Implications for Obesity Treatment and Policy. Annual Reviews of Nutrition. 2016;36:105-28.

This paper critically analyses the neuroscientific evidence for food addiction, and its clinical, social and policy implications.

43. Ziauddeen H, Farooqi IS, Fletcher PC. Obesity and the brain: how convincing is the addiction model? Nature Reviews Neuroscience. 2012;13(4):279-86.

44. Friedman R. What Cookies and Meth Have in Common. The New York Times [Internet]. 2017 [cited 13 January 2018];:SR1. Available from: https://www.nytimes.com/2017/06/30/opinion/sunday/what-cookies-and-meth-have-in-common.html

45. Tait M. A food addiction has defined my entire life. And it is slowly killing me. The Guardian [Internet]. 2017 [cited 13 January 2018];. Available from: https://www.theguardian.com/commentisfree/2017/jun/01/a-food-addiction-has-defined-my-entire-life-and-it-is-slowly-killing-me

46. Puhl RM, Andreyeva T, Brownell KD. Perceptions of weight discrimination: prevalence and comparison to race and gender discrimination in America. International Journal of Obesity. 2008;32(6):992-1000.

47. O'Brien KS, Latner JD, Ebneter D, Hunter JA. Obesity discrimination: the role of physical appearance, personal ideology, and anti-fat prejudice. International Journal of Obesity. 2013;37(3):455-60.

48. Roehling MV, Roehling PV, Pichler S. The relationship between body weight and perceived weight-related employment discrimination: The role of sex and race. Journal of Vocational Behavior. 2007;71(2):300-18.

49. O'brien KS, Latner JD, Halberstadt J, Hunter JA, Anderson J, Caputi P. Do antifat attitudes predict antifat behaviors? Obesity. 2008;16(S2):S87-S92.

50. Sabin JA, Marini M, Nosek BA. Implicit and explicit anti-fat bias among a large sample of medical doctors by BMI, race/ethnicity and gender. PloS One. 2012;7(11):e48448.

51. O'Brien KS, Hunter JA, Banks M. Implicit anti-fat bias in physical educators: physical attributes, ideology and socialization. International Journal of Obesity. 2007;31(2):308-14.

52. Greenleaf C, Petrie TA, Martin SB. Relationship of weight‐based teasing and adolescents' psychological well‐being and physical health. Journal of School Health. 2014;84(1):49-55.

53. Bucchianeri MM, Eisenberg ME, Wall MM, Piran N, Neumark-Sztainer D. Multiple types of harassment: Associations with emotional well-being and unhealthy behaviors in adolescents. Journal of Adolescent Health. 2014;54(6):724-9.

54. Madowitz J, Knatz S, Maginot T, Crow S, Boutelle K. Teasing, depression and unhealthy weight control behaviour in obese children. Pediatric Obesity. 2012;7(6):446-52.

55. Major B, Eliezer D, Rieck H. The psychological weight of weight stigma. Social Psychological and Personality Science. 2012;3(6):651-8.

56. Hunger JM, Major B. Weight stigma mediates the association between BMI and self-reported health. Health Psychology. 2015;34(2):172-5.

57. Jackson SE, Beeken RJ, Wardle J. Obesity, perceived weight discrimination, and psychological well‐being in older adults in England. Obesity. 2015;23(5):1105-11.

58. Himmelstein MS, Incollingo Belsky AC, Tomiyama AJ. The weight of stigma: cortisol reactivity to manipulated weight stigma. Obesity. 2015;23(2):368-74.

59. Tomiyama AJ, Epel ES, McClatchey TM, Poelke G, Kemeny ME, McCoy SK et al. Associations of weight stigma with cortisol and oxidative stress independent of adiposity. Health Psychology. 2014;33(8):862-7.

60. Schvey NA, Puhl RM, Brownell KD. The stress of stigma: exploring the effect of weight stigma on cortisol reactivity. Psychosomatic Medicine. 2014;76(2):156-62.

61. Adam TC, Epel ES. Stress, eating and the reward system. Physiology & Behavior. 2007;91(4):449-58.

62. Major B, Hunger JM, Bunyan DP, Miller CT. The ironic effects of weight stigma. Journal of Experimental Social Psychology. 2014;51:74-80.

\*\*63. Puhl RM, Quinn DM, Weisz BM, Suh YJ. The role of stigma in weight loss maintenance among US adults. Annals of Behavioral Medicine. 2017;51:754.

This study assessed the potential role of internalised weight bias as a barrier to weight loss maintenace.

64. Pearl RL, White MA, Grilo CM. Weight bias internalization, depression, and self‐reported health among overweight binge eating disorder patients. Obesity. 2014;22(5):E142-E8.

65. Hilbert A, Braehler E, Haeuser W, Zenger M. Weight bias internalization, core self‐evaluation, and health in overweight and obese persons. Obesity. 2014;22(1):79-85.

66. Pearl RL, Puhl RM. The distinct effects of internalizing weight bias: An experimental study. Body Image. 2016;17(Supplement C):38-42.

67. Pearl RL, Wadden TA, Hopkins CM, Shaw JA, Hayes MR, Bakizada ZM et al. Association between weight bias internalization and metabolic syndrome among treatment‐seeking individuals with obesity. Obesity. 2017;25(2):317-22.

68. Latner JD, Barile JP, Durso LE, O'Brien KS. Weight and health-related quality of life: The moderating role of weight discrimination and internalized weight bias. Eating Behaviors. 2014;15(4):586-90.

69. O'Brien KS, Latner JD, Puhl RM, Vartanian LR, Giles C, Griva K et al. The relationship between weight stigma and eating behavior is explained by weight bias internalization and psychological distress. Appetite. 2016;102:70-6.

70. Puhl RM, Moss-Racusin CA, Schwartz MB. Internalization of Weight Bias: Implications for Binge Eating and Emotional Well-being. Obesity. 2007;15(1):19-23.

71. Tomiyama AJ. Weight stigma is stressful. A review of evidence for the Cyclic Obesity/Weight-Based Stigma model. Appetite. 2014;82:8-15.

72. Daníelsdóttir S, O'brien KS, Ciao A. Anti-fat prejudice reduction: a review of published studies. Obesity Facts. 2010;3(1):47-58.

73. Alberga A, Pickering B, Alix Hayden K, Ball G, Edwards A, Jelinski S et al. Weight bias reduction in health professionals: a systematic review. Clinical Obesity. 2016;6(3):175-88.

74. Persky S, Eccleston CP. Impact of genetic causal information on medical students’ clinical encounters with an obese virtual patient: health promotion and social stigma. Annals of Behavioral Medicine. 2010;41(3):363-72.

75. O'Brien KS, Puhl RM, Latner JD, Mir AS, Hunter JA. Reducing Anti‐Fat Prejudice in Preservice Health Students: A Randomized Trial. Obesity. 2010;18(11):2138-44.

76. Hilbert A, Rief W, Braehler E. Stigmatizing Attitudes Toward Obesity in a Representative Population‐based Sample. Obesity. 2008;16(7):1529-34.

\*\*77. Latner JD, Puhl RM, Murakami JM, O'Brien KS. Food addiction as a causal model of obesity. Effects on stigma, blame, and perceived psychopathology. Appetite. 2014;77:79-84.

Authors demonstrate that exposure to food addiction messages may reduce weight-stigma and blame towards overweight individuals.

78. Weiner B. An attributional theory of achievement motivation and emotion. Psychological review. 1985;92(4):548-573.

79. Crandall CS, D’Anello S, Sakalli N, Lazarus E, Nejtardt GW, Feather N. An attribution-value model of prejudice: Anti-fat attitudes in six nations. Personality and Social Psychology Bulletin. 2001;27(1):30-7.

80. Barry CL, McGinty EE, Pescosolido BA, Goldman HH. Stigma, discrimination, treatment effectiveness, and policy: public views about drug addiction and mental illness. Psychiatric Services (Washington, DC). 2014;65(10):1269-72.

\*81. DePierre JA, Puhl RM, Luedicke J. A new stigmatized identity? Comparisons of a “food addict” label with other stigmatized health conditions. Basic and Applied Social Psychology. 2013;35(1):10-21.

This paper assesses public attitudes towards “food addiction” in comparison with obesity and other addictions. Food addiction was viewed more favourably than alcohol and tobacco addictions but had an additive effect on weight stigma when combined with obesity.

82. Pescosolido BA, Martin JK, Long JS, Medina TR, Phelan J, Link B. "A disease like any other?": a decade of change in public reactions to schizophrenia, depression, and alcohol dependence. American Journal of Psychiatry. 2010;167(11):1321-30.

83. Gearhardt AN, White MA, Masheb RM, Morgan PT, Crosby RD, Grilo CM. An examination of the food addiction construct in obese patients with binge eating disorder. International Journal of Eating Disorders. 2012;45(5):657-63.

84. Burmeister JM, Hinman N, Koball A, Hoffmann DA, Carels RA. Food addiction in adults seeking weight loss treatment. Implications for psychosocial health and weight loss. Appetite. 2013;60:103-10.

\*85. DePierre JA, Puhl RM, Luedicke J. Public perceptions of food addiction: a comparison with alcohol and tobacco. Journal of Substance Use. 2014;19(1-2):1-6.

This paper compared beliefs about the etiology and maintenance of food, alcohol and tobacco addictions. Food and smoking addictions were viewed as more behaviour-based (and less disease-based), than alcohol addiction.

86. Lee NM, Hall WD, Lucke J, Forlini C, Carter A. Food Addiction and Its Impact on Weight-Based Stigma and the Treatment of Obese Individuals in the US and Australia. Nutrients. 2014;6(11):5312-26.

\*87. Şanlier N, Türközü D, Toka O. Body Image, Food Addiction, Depression, and Body Mass Index in University Students. Ecology of Food and Nutrition. 2016;55(6):491-507..

This study assessed the relationships between food addiction symptomology, body image, depression and body mass index (BMI).

88. Cullen AJ, Barnett A, Komesaroff P, Brown W, O'Brien KS, Hall W et al. A Qualitative Study of Overweight and Obese Australians’ views of Food Addiction. Appetite. 2017;115:62-70.

\*89. Ruddock HK, Field M, Hardman CA. Exploring food reward and calorie intake in self-perceived food addicts. Appetite. 2017;115:36-44.

The authors compared the eating behaviours and associated traits (dietary disinhibition, desire-to-eat, liking of foods etc.) of self-perceived food-addicts with self-perceived non-food-addicts.

\*\*90. Ruddock HK, Christiansen P, Jones A, Robinson E, Field M, Hardman CA. Believing in food addiction: Helpful or counterproductive for eating behavior? Obesity. 2016;24(6):1238-43.

This study explores how believing oneself to be a “food addict” impacts upon eating behaviours, finding that receiving a food addiction diagnosis may promote short term diet restriction.

91. Rief W, Conradt M, Dierk J-M, Rauh E, Schlumberger P, Hinney A et al. Is information on genetic determinants of obesity helpful or harmful for obese people?—A randomized clinical trial. Journal of General Internal Medicine. 2007;22(11):1553-9.

\*\*92. Hoyt CL, Burnette JL, Auster-Gussman L. “Obesity Is a Disease”: Examining the Self-Regulatory Impact of This Public-Health Message. Psychological Science. 2014;25(4):997-1002. doi:10.1177/0956797613516981.

This paper assessed the impact of describing obesity as a “disease”. Whilst such messages decreased body disatisfaction, they also appeared to undermine health-focused weight loss strategies (e.g. diet and exercise).

\*\*93. Pearl R, Lebowitz M. Beyond personal responsibility: Effects of causal attributions for overweight and obesity on weight-related beliefs, stigma, and policy support. Psychology & Health. 2014;29(10):1176-91.

This study examined the impact of causal attributions for obesity (biology, food environment, and personal responsibility) on weight stigma, support for obesity reducing policies and beliefs aout weight loss.

94. Burnette JL. Implicit theories of body weight: Entity beliefs can weigh you down. Personality and Social Psychology Bulletin. 2010;36(3):410-22.

95. Schulte EM, Joyner MA, Schiestl ET, Gearhardt AN. Future Directions in “Food Addiction”: Next Steps and Treatment Implications. Current Addiction Reports. 2017;4(2):165-71.