

The bidirectional relationship between food addiction and emotional eating, in relation to mindfulness

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Abstract: The link between food consumption and psychological wellbeing seems more complex than the direct relationship of hunger and eating. Over the last four decades, this bidirectional relationship gains continuously research and debate importance. Thus, the purpose of the present study was to further enhance understanding, regarding the impact of mindfulness of general eating behaviour. In order to extend relevant knowledge various factors, such as mindful eating, food addiction, emotional eating, BMI, gender, and age, were integrated and explored through both correlation and regression analyses. Eighty-six participants ($M = 30.$) completed three self-reported questionnaires regarding their eating habits and patterns, as well as their ability to mindfully reflect on their eating practice. As hypothesized, a significant negative correlation between emotional and mindful eating was identified, while mindful eating was found to have a significant influence on BMI scores. Mindful eating did not, however, influence food addiction behavior; this was more likely to be influenced by emotional eating tendencies. Overall, findings provide evidence that mindful eating can impact on both clinical practice and research, in regards to understanding eating behaviour and food addiction.

Keywords: food addiction, emotional eating, mindful eating, appetite, eating disorders, psychology, clinical psychology.

1. INTRODUCTION

Both animals and humans are stimulated, cautious and even irritable when hungry; increasing their craving for food (Gibson, 2006a). After the completion of a satisfying meal, they usually become lethargic or revitalized; depending on both amount and constituents of the consumed meal (Macht, Haupt & Salewsky, 2004). In humans, the relation between food consumption and psychological euphoria appears more complicated than the direct link of hunger and eating (Rolls, 2007). External causes seem to affect both the quantity and the quality of their nourishment patterns. Therefore, various researches have presented evidence both on the psychoactive effect of food and the impact of emotional state on food preferences (Christensen, 2001; Gibson, 2006b; Lyman, 1989; Jacka, Pasco, Mykletun, Williams, Hodge, O'Reilly, Nicholson, Kotowicz & Berk, 2010; Mason, Epel, Aschbacher, Lustig, Acree, Kristeller, Cohn, Dallman, Moran, Bacchetti, Laraia, Hecht, Daubenmier, 2016; Sanchez-Villegas, Verberne, De Irala, Ruiz-Canela, Toledo, Serra-Majem & Martinez-Gonzalez, 2011; Wurtman, 1988).

That bidirectional relationship between food consumption and psychological wellbeing is based on two core components. On the one side, both addiction and nutrition researches have consistently identified that food's ingredients interrelate with biological and biochemical dependencies. While, on the other side, it has been identified a behavioural tendency; eating in response to negative experienced emotions (Adam & Epel, 2007; Blumenthal & Gold, 2010; Hebebrand, Albayrak, Adan, Antel, Dieguez, De Jong, Leng, Menzies, Mercer, Murphy, VanDer Plasse, & Dickson, 2014; Kontinen, Mannisto, Sarlio-Lahteenkorva, Silventoinen, & Haukkala, 2010; Volkow & Wise, 2005).

Little is known, however, of whether "mindful" interaction in eating process can affect both eating behavior and BMI (Olson & Emery, 2015; Van Dyke & Drinkwater, 2014; Pinto-Gouveia, Carvalho, Palmeira, Castilho, Duarte, Ferreira, Duarte, Cunha, Matos & Costa, 2017). As a result of the emergence of mindfulness on the psychological field, while

also of that complicated relationship between food and mood, the purpose of this study was to explore the way nutrition preferences and psychological state of being relate to mindful eating.

Can food addiction affect eating patterns?

There is a significant body of research on the fields of neuroscience, nutrition, biopsychology and addiction, which identify commonalities between food addiction and drug abuse (Gearhardt, Corbin & Brownell, 2009; Gibson & Green, 2002; Lieberman, 2003; Parylak, Koob & Zorrilla, 2011; Piccinni, Marazziti, Vanelli, Franceshini, Baroni, Costanzo, Mirko, Veltri & Dell'Osso 2015). That recent and disputable term is focused on identifying food's ingredients that lead to biological and biochemical dependencies, whilst there is evidence that food can affect both neural activity and mood. Specific neurotransmitters and endorphins, such as serotonin and dopamine, as well as hormones, such as melatonin and noradrenaline, apart from regulating the way individuals feel and behave under stress, they also control what, why, when and how much they eat (Bottaccioli, 2005; Gibson, 2006b; Lieberman, 2003).

At the same time, the biochemical relationship between nutrition and addiction comes along with the fact that both share common routes through the brain. For instance, dopamine, GABA, adrenaline, noradrenaline, acetylcholine, 5-HT, glutamic acid, opioid, amino acids are all triggered by addictive processes of some particular foods and substances (Ioakimidis, Zandian, Ulbl, Bergh, Leon & Sodersten, 2011; Soh, Walter, Baur & Collins, 2009; Volkow, Wang, Fowler, Telang, 2008). In addition, stress-craving cycle between food consumption and mood is also affected by rewarding and pleasurable factors; the more rewarding a food or drug is considered, the greater the need for that particular food-stimulus (Berridge & Robinson, 1998; Gibson, 2006a; Volkow, Wang, Fowler, Logan, Jayne, Franceschi, Wong, Gatley, Gifford, Ding & Pappas, 2002; O'Malley, Krishnan-Sarin, Farren, Sinja & Kreek, 2002).

As mentioned above, apart from the biochemical processes involved into food addiction, there are also biological reasons which can explain that relation. Cortisol, glucose and insulin are considered important for balanced brain function. According to various studies, food consumption has a direct impact on both insulin and glucose levels which in turn influence both mood and cognition (Benton, 2002; Gibson, 2006b; Epel, Lapidus, McEwen & Brownell, 2001).

Particular foods therefore, are likely to increase food consumption since they activate biophysiological areas of the human body. For example, nutrition loaded with high-fat, high-sugar and low fiber carbohydrates, such as chips, pizzas, sweets and processed foods is constantly related to unhealthy eating behaviour and yet they serve to stimulate important bodily biochemical and biological activities as mentioned above (Carrera-Bastos, Fontes-Villalba, O' Keefe, Lindeberg, & Cordain, 2011; Henderson, Irving, Gregory, Bates, Prentice, Perks, Swan & Farron, 2003; Stice, Burger & Yokum, 2013). Moreover, palatable and processed foods raise the blood-sugar imbalances caused by stress hormones, thus affecting "mood highs and lows" (Ifland, Preuss, Marcus, Rourke, Taylor, Burau, Jacobs, Kadish & Manso, 2009). Ending, various studies have also mentioned that dietary patterns in high amounts of processed foods interrelates with higher risk of potential development of depressive symptoms (Akbarly, Brunner, Ferrie, Mamot, Kivimaki & Sigh-Manoux, 2009; Lieberman, 2003; Sanchez_Villegas et al., 2011; Simopoulos, 2001).

Which is the role of emotional eating on food consumption?

Continuous research provides evidence that physiological, psychological and sensory mechanisms affect food choices (Van Strien, Kontinen, Homberg, Engels, Winkens, 2016; Bongers & Jansen, 2017). More specific, human body involves two emotional and behavioural systems regarding self-regulation; impulsive and reflective. Impulsive system makes quick links between a choice and the subsequent sensation. It explores external environments for fast ways of pleasure and reward. On the other hand, reflective system is more focused on planning, reasoning and long-term goals. When an individual is under stress or mentally exhausted, such as in case of depression, reflective system is weakened. Though, impulsive system is more likely to take over, forcing people to think less about the long-term consequences and encouraging them to choose more palatable and unhealthy foods, as well as, postpone or even skip meals (Gesch, Hammond, Hampson, Eves, Crowder, 2002; Hofmann, Friese & Wiers, 2008; Strack & Deutsch, 2004). When someone feels anxious, for example, healthy eating habits are commonly the first that are sacrificed.

At the same time, behavioural tendency to eat in response to negative experienced emotional cues has been identified. Emotional cues, such as depression, boredom and nervousness can frequently lead to overeating (Meule & Vogeles, 2013; Arnou, Kenardy & Argas, 1995; Heatherton & Baumeister, 1991). People report consuming hyper-palatable foods not

only to gain energy, but also to experience rewarding sensations, to cope with stress and/or fatigue, to enhance cognition, and/or to ameliorate mood (Chao, Grilo, White & Sinha, 2015; Gibson, 2012; Weinstein, Shide & Rolls, 1997; Steptoe, Lipsey & Wardle, 1998). For example, Oliver and Wardle (1999) reported that sweets and chocolate were eaten more by all groups under stress, even by those who ate less overall; conversely, intakes of fruit, vegetables, meat and fish were less likely to be consumed or remained unchanged in the stress groups.

How does mindful eating affect that relationship?

“Mindful eating” refers to a non-judgmental awareness of physical and emotional perceptions associated with eating in a food-related environment. It has been indicated as an accurate tool to explore the way people identify dietary patterns. For instance, mindful construct help individuals to distinguish and respond to satiety; i.e. knowing when they are satisfied or full, or identifying but not responding to cues for eating, such as advertising, boredom or anxiety (Framson, Kristal, Schenk, Littman, Zeliadt & Benitez, 2009). More specifically, various researchers have hypothesized that mindless eating explains the inability to sustain healthier dietary achievements following most weight loss interventions (Kindwell, Hasford & Hardesty, 2015; Kristeller, Wolever & Sheets, 2014; Levoy, Lazaridou, Brewer, Fulwiler, 2017; Wansink, Painter & North, 2005). Furthermore, mindfulness during meal consumption seems to enhance digestion and reduce stress-related symptoms such as bloating (Kabat-Zinn, 2003; Leary & Tate, 2007; Weinstein, Brown & Ryan, 2009). Though, little is known of whether reflective and “mindful” interaction in eating procedure can impact on food choices and eating behavior (Framson, Kristal, Schenk & Littman, 2009; Moor, Scott & McIntosh 2013).

The current study attempted to enhance knowledge of the role mindfulness plays in general eating behaviour. In order to explore the association between mindful eating and Body Mass Index (BMI), various factors were entered in a regression analysis. A web-based questionnaire study was administered via two websites. The questionnaire incorporated several demographic questions and dependent measures that related to unhealthy nutriment choices. These specifically included: 1) emotional eating patterns; as measured by the Emotional Eating Scale (EES, Arnow, Kenardy & Argas, 1995), 2) mindful eating; as measured by the Mindful Eating Questionnaire (MEQ, Framson, et al, 2009) and 3) food addiction; as measured by Yale Food Addiction Scale (YFAS, Gearhardt, Corbin & Brownwell, 2009). Demographic questions were related to age, gender, height and weight, so that body mass index (BMI) could be determined.

It was hypothesized that (1) there would be a significant negative correlation between emotional eating and mindful eating activity; 2) more mindful eating would predict healthier BMI scores; and 3) more mindful eating would be a significant predictor of mindful eating patterns, in terms of less food addiction.

2. METHOD

Participants

Eighty-six non-clinical individuals voluntarily participated in response to the announcement on two diverse blogs; “Treat Yourself” related to psychology and “Recipiada” related to cooking. The sample consisted of forty-two females (48.8%) and thirty-three males (38.4%); while nineteen (12.8%) of them did not provide information related to sex. Participants’ mean age was ($M = 30.6$, $SD = 10.44$), while its range varied from 19 to 58 years. Broken down by gender, the mean age for female participants was ($M = 31.23$, $SD = 10.72$), while for the males was ($M = 31.27$, $SD = 8.26$). Furthermore, the mean BMI score was ($M = 22.80$, $SD = 3.07$), for females ($M = 20.94$, $SD = 3.15$) and for males ($M = 24.18$, $SD = 4.98$).

Design and Measures

Multiple regression design, through SPSS statistics, was used to explore the association of this cross-sectional study’s variables. Criterion variable (Dependent Variable) for the second hypothesis was BMI and for the third Food Addiction. Predictors (Independent Variables) regarding the second hypothesis were Emotional Eating, Mindful Eating, Age, Gender and Food Addiction; while for the third hypothesis BMI, Emotional Eating, Mindful Eating, Age and Gender.

Yale Food Addiction Scale

YFAS is a 25-item measurement which explores the relationship between the addictive effect of food and consumption. It operationalises both food preference and addiction by evaluating evidences of substance-dependence symptoms, such as tolerance, withdrawal and loss of control in eating behaviour.

Mindful Eating Questionnaire

Each of the Mindful Eating Questionnaire (MEQ)'s 28 items included a four-point rating scale. All items were categorised under disinhibition (the inability to stop eating even when full); awareness (noticing, or attending to sensations, perceptions, thoughts and feelings regarding eating behaviour); external cues (eating in response to environmental effects); and emotional response (eating in response to negative emotional state).

Emotional Eating Scale

Emotional Eating Scale (EES) was designed to facilitate investigation into the relationships between specific negative emotional states and overeating separated in three subscales (Anger/Frustration, Anxiety, and Depression).

Body Mass Index component incorporates the algorithm of weight in kilograms (measured to the nearest 100 grams) divided by height in meters squared (measured to the nearest 0.5 centimetres).

3. RESULTS

Out of eighty-six participants replied on the survey, five were excluded from the analysis due to drop out. All missing data were replaced with their series means. During the initial analysis, descriptive statistics of the sample indicated the mean scores and the standard deviations of the variables (Appendix, Table I). Regarding the eighty-two valid answers of the self-reported body mass index (BMI), 7.3% were underweight ($BMI < 18.5 \text{ kg/m}^2$), 63.4% were of normal ($BMI = 18.5 - 24.9 \text{ kg/m}^2$), 28.1% were overweight ($BMI = 25.0 - 29.9 \text{ kg/m}^2$), and 1.2% were obese ($BMI > 30.0 \text{ kg/m}^2$).

Hypothesis 1: Mindful Eating will negatively correlate with emotional eating. Pearson's r correlation was utilized for the first hypothesis. The exploration of emotional and mindful eating presented statistically significant negative moderate correlations ($r(86) = -0.323, p < 0.001$).

Hypothesis 2: More mindful eating will be a significant predictor of a healthier BMI scores. A stepwise multiple regression analysis was conducted to identify the best predictors of BMI out of mindful eating, food addiction, emotional eating, age, and gender (Appendix, Table II). The final model was significant ($F(3, 77) = 6.05, p < 0.001$; adjusted $R^2 = 0.19$). Explanatory variables, therefore, accounted for almost 20% of the variance of the criterion variable; BMI would be characterized moderate effect ($R = 0.44$). Food addiction and emotional eating were not included in the list of the predictors in the question. Table II summarizes information regarding the predictor variables that are included in the model. In the final regression model mindful eating was negatively and significantly correlated with the criterion variable, BMI ($t(77) = 2.27, p < 0.05$). For every standard deviation increase in mindful eating behavior, BMI would be reduced by 0.239 (Table II). Moreover, age was a positive and significant predictor of the criterion variable ($t(77) = 2.132, p < 0.05$). Participants tended to have higher BMI as they become older; for every standard deviation increase in age BMI would increase by 0.225. Finally, BMI of male participants was tended to rise by 0.211 ($t(77) = 2.02, p < 0.05$).

Hypothesis 3: More mindful eating will be a significant predictor of less food addiction. Regarding the third hypothesis, a stepwise multiple regression analysis was conducted to examine the predictors of food addiction out of mindful eating, age, gender, and emotional eating (Appendix, Table III). The final model was significant ($F(1, 79) = 36.51, p < 0.001$; adjusted $R^2 = 0.307$). The explanatory variable, thus, explained 31% of the variance for the criterion variable, food addiction, which would be characterized moderate effect (Multiple $R = 0.56$). Mindful eating, age, BMI, and gender were excluded from the model. Table III summarizes the coefficient of the predictor variable, which is included in the model. In the final regression model emotional eating positively and significantly correlated with the criterion variable, food addiction ($t(79) = 7.851, p < 0.001$). For every standard deviation increase in mindful eating behaviour, food addiction would be increased by 0.562 (Table, III).

4. DISCUSSION

As mentioned above, the purpose of this study was to develop understanding of the bidirectional relationship between food consumption and psychological wellbeing, by further investigating the impact of mindfulness in BMI and eating behaviour. Variables of BMI, food addiction, emotional eating, and mindful eating were integrated and explored through correlation and regression analyses, alongside with age and gender. It was hypothesised that mindful eating would negatively correlate with emotional eating and would be a significant predictor of higher BMI and lower food addiction.

As hypothesised there was a negative relationship between emotional and mindful eating activity. Evidence suggest that when individuals have emotional influences, such as aggression, anxiety and depression, they tend to be less mindful during eating. Therefore, when they feel emotionally and mentally drained are usually less predisposed by a reflective mode of being, while also less likely to care about longitudinal consequences; even when it comes to food. Consequently, individuals may be unable to stop eating even when full, read sensations, perceptions, feelings, and thoughts cues before or during a meal. When a meal is consumed under emotional cues and without awareness, is also probably failed to be reported on memory system, leading thus into higher amounts of food. Additionally, emotional eating may drive them to eat in response to environmental stimuli and negative emotional state, while also consume hyper-palatable foods. Besides, emotional cues quite often force people to use food as a coping method to deal with stress, anger, self-control and sadness (Arnou, Kenardy & Argas, 1995; Framson, et al., 2009; Mason, Epel, Aschbacher, Lustig, Acree, Kristeller, Cohn, Dallman, Moran, Bacchetti, Laraia, Hecht & Daubenmier, 2016; Ross, 2007; Hofmann, Friese & Wiers, 2008). All the above mention the presence of emotional eating and the need for therapeutic tools, based on mindful eating such as “Emotional Ability” (Kidwell, Hasford & Hardesty, 2015) and “Mindfulness-Based Eating Awareness Training” (Kristeller, Wolever & Sheets, 2014), that could be applied in both everyday life and clinical practise.

Since mindful thinking increases disidentification and decreases emotional response to possibly threatening stimuli (Arch & Crascke, 2006; Pinto-Gouveia, Carvalho, Palmeira, Castilho, Duarte, Ferreira, Duarte, Cunha, Matos & Costa, 2017), people are, therefore, more likely to cope in adaptive ways, rather in ways that perpetuate stress and ill-being (Brown & Ryan, 2003; Levoy, Lazaridou, Brewer & Fulwiler, 2017). They could, thus, instead of using emotional eating as an avoidant and coping strategy, learning to be more mindful regarding eating process, by increasing their control of relevant habitual and automatic behavioural responses. Consequently, mindful reflection could improve both eating behaviour and emotionally charged contexts, while mindful eating could help them to objectively observe inner procedures, thoughts, and feelings as they occur, instead of engaging in past and future negative focused or distorted eating patterns.

Moreover, as it was hypothesised, more mindful eating proved to be a significant predictor of healthier eating behaviours, in terms of healthier BMI. When an individual is aware of external stimuli and emotional cues, such as distraction and disinhibition regarding food consumption, their weight tended to be within healthier limits of the BMI ratio. If, as Framson et al. (2009) suggested, mindful eating is a skill that can be learned, similar to mindfulness, it could be considered as a beneficial and supplementary tool in clinical practice, in regards to eating disorders; without though underestimating both biological and temperament predispositions. Binge eating, for instance, could be partially eliminated when individuals report meal process, eat less rapidly and recognise other cues, rather than hunger, which drive them to eat. Furthermore, increased awareness on foods’ sensation and taste could possibly distract them from their internal, emotional cues and perceptions. In addition, since mindfulness increase immune function, there is a possible better function of the metabolic system, and hence lower BMI, in non-clinical people.

Mindful eating was not, however, a significant predictor of food addictive behaviour; though emotional eating was confirmed. Current results, thus, suggest that while mindfulness can influence both eating patterns and BMI, it has a limited effect on addictive eating choices. Food addiction may be more biologically predetermined by human bodies, and thus craving different foods at particular times. Therefore, particular nutrition patterns are gradually reinforced and established. In other words, individuals may be aware of their unhealthy eating choices, but continue eating for emotional, reward and sensory satisfaction.

As previously mentioned, when individuals feel emotionally and mentally challenged, for instance due to stress, anger, and/or depression, they tend to care less about long-term results, sacrificing healthy eating patterns for quick, palatable, energy-boost food choices. However, food choices due to emotional disturbance do not indicate causality. More specific, addictive food ingredients can also affect both the neural and hormonal system changing eating behaviour. As various research has indicated, there are common biochemical and biological pathways between addictive food ingredients and psychoactive substances (Hendy, 2012; Hofmann, Friese & Wiers, 2011; Ioakimidis et. al, 2011, Soh et al., 2009q Strack & Deutsch, 2004). Therefore, the more someone follows these specific addictive eating habits the more he or she wants to repeat them; especially when these habits are “highly rewarding”, such as hyper-palatable choices (Gibson, 2012; Volkow & Wang, 2002).

Implications, future directions and limitations.

There are various reasons that macronutrient-poor, high-fat, high-sugar, high-salt foods are highly consumed, even though they significantly affect people's health and wellbeing. For instance, they tend to cost less than healthy choices. Moreover, even though individuals seem to be well-informed and aware of the effect of the constant advertising and ubiquitous nature of unhealthy foods, they still behave without control over it. This behaviour may be taking advantage of cue-triggered relapse to disrupt public health interventions designs to decrease malnutrition. Therefore, more careful inclusion of such food choices at schools and the market may provide more beneficial and long-term results regarding dietary behaviour. Moreover, integration of mindfulness training, in addition with psychotherapy, into dietary intervention programmes, for acute as well as generic eating behaviours, is also suggested by current findings.

As mentioned above, addictive substances seem to be more powerful than human control. People seem to eat towards emotional response, such as anger, anxiety and depression, prefer unhealthy food choices, without being aware of the process, stimuli, and emotional cues. Therefore, current findings could provide supplementary information regarding empirically supported treatments for at least some people with pathological eating issues, such as binge eating. A more in-depth exploration of the emotional cues may shed more light, since it will provide more detailed understanding of the emotional responses that urge an individual to eat; whether it is anger, depression or anxiety. For instance, is it more common to overeat in response to depression and anger, than anxiety as Arnow, Kenardy and 1994 suggest?

Moreover, in order to explain the construct of mindful eating, it would be useful to qualitatively examine, in future research, the ways in which people use mindful reflection to improve human eating behaviour. As it was mentioned above, mindful eating is the integration of awareness, disinhibition, emotional cues, external stimuli, and distraction regarding eating process or food-related environments. Therefore, it is unlikely that in-depth details of this complex relationship will be captured merely through quantitative research.

In addition, may be gained further enhance of understanding to be explored in more detail psychological, social, genetic and biological influences, which are usually involved into both occurrence and maintenance of maladaptive eating behaviour. For instance, common psychological effects related to eating disorders are usually impulsivity, emotional instability, perfectionism, low self-esteem, trauma and alexithymia. Final, a basic methodological weakness of this study is that BMI was self-reported by the participants, increasing the possibility that body weight was underreported and height has over-reported.

5. CONCLUSION

Throughout this paper, the participation of 86 adults provided more in-depth understanding of the relationship between food consumption and psychological wellbeing. Though the integration of mindful eating, emotional eating, BMI, and addictive food choices variables, the current study explored the role of mindfulness had on healthy eating behaviour. Results indicated that when individuals are aware of their eating behaviour, they tend to respond less to emotional cues and are more mindful regarding food consumption and the maintenance of a healthier BMI. However, there was a reported limited effect on addictive eating behaviour regarding mindful eating. This was probably due to biological predisposed influences of our bodies. Overall, the current findings offers evidence that mindful eating can positively impact both on clinical practice and research in regards to understanding and supporting healthful dietary behaviour.

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APPENDIX-A

List of Table:

Table I: Descriptives for BMI, mindful eating, emotional eating, food addiction, and age.

	N	M	SD
BMI	86	22.40	4.13
Mindful Eating	81	2.78	0.45
Emotional Eating	86	35.64	9.51
Food Addiction	86	13.12	2.67
Age	85	30.65	10.44

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Table II: Unstandardized and standardized regression coefficients for the variables included in the model with BMI as constant variable, and mindful eating, age, and gender as predictors (N = 81; $p < 0.001$; $R^2 = 0.19$).

Variables	B	SE B	β
BMI	23.916	3.47	
Age	0.095	0.045	0.225*
Mindful Eating	-2.225	0.981	-0.239*
Gender	1.381	0.676	0.211*

** $p < 0.005$

Table III: Unstandardized and standardized regression coefficients for the variables included in the model with food addiction as constant variable and emotional as predictor (N = 81; $R^2 = 0.31$).

Variable	B	SE B	β
Food Addiction	7.551	0.962	-
Emotional Eating	0.157	0.026	0.562**

** $p < 0.001$