UNIVERSITY OF LIVERPOOL

Doctorate in Clinical Psychology

Psychological Determinants of Addiction-Like Eating Behaviour: Exploring the Roles of Mental health, Personality Traits and Eating Motivations

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Table of Contents

List of Tables 3

Acknowledgements 4

Introductory Chapter 5

References 7

Chapter One: Systematic Review 9

Abstract 10

Introduction 12

Aim of the Systematic Review 20

Method 21

Study Identification 21

Screening and Selection 23

Data Extraction and Synthesis 23

Assessment of Study Quality 24

Results 25

Demographic Information 36

Publication Context and Study Characteristics 36

Measures of Food Addiction 37

Measures of Psychological Distress 37

Measures of Emotional Eating 38

Main Findings for Review Question One 39

Main Findings for Review Question Two 40

Quality Assessment 42

Discussion 43

Summary of Main Findings 43

Strength, Limitations and Future Research. 47

Quality Assessment 50

Strengths and Limitations of the Review Process 51

Clinical Implications 52

Conclusions 53

References 55

Chapter Two: Empirical Paper 73

Abstract 74

Introduction 76

Study Aims and Hypotheses 82

Method 83

Participants 83

Design ... 85
Materials ... 85
Procedure ... 88
Ethical Considerations ... 89
Statistical Analysis ... 89
Additional Mediation Analysis ... 90
Results ... 91
Descriptive Statistics ... 91
Structural Equation Modelling Analysis ... 93
Summary of Direct and Indirect Effects ... 96
Discussion ... 98
Clinical Implications ... 102
Strengths, Limitations and Future Research ... 105
Conclusions ... 108
References ... 109
Appendices ... 126
Appendix A ... 127
Scoring guide for the Quality Assessment Tool for Studies with Diverse Designs ... 127
Appendix B ... 128
Demographic information of participants excluded for analysis ... 128
Appendix C ... 130
Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) ... 130
Appendix D ... 131
Barratt Impulsiveness Scale (Patton, et al., 1995) ... 131
Appendix E ... 132
Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (Lynam, et al., 2006) ... 132
Appendix F ... 133
Palatable Eating Motives Scale: Coping subscale (Burgess et al., 2014) ... 133
Appendix G ... 134
Palatable Eating Motives Scale: Enhancement subscale (Burgess et al., 2014) ... 134
Appendix H ... 135
Addiction-like Eating Behaviour Scale (Ruddock, et al., 2017) ... 135
Appendix I ... 136
Demographic and Body Mass Index Information Collected ... 136
Appendix J ... 137
Ethical approval acceptance confirmation letter ... 137

Appendix K 138
Study Advert 138
Appendix L 139
Information leaflet 139
Appendix M 142
Consent Form 142
Appendix N 143
Debrief Letter 143
Appendix O 145
Comparisons of measures with normative/other non-clinical populations 145
Appendix P 147
Standardized Estimates 147
Appendix Q 148
SEM including gender as a covariate 148

List of Tables

Table 1: Terms Used to Search Within Electronic Databases 19
Table 2: Summary of the Design and Outcomes For 11 Studies Reviewed 274
Table 3: Quality Assessment Tool for Studies with Diverse Designs Criteria and Scoring 34
Table 4: Demographic Information 836
Table 5: Means, Medians, Standard Deviations, for Demographic Information 84
Table 6: Descriptive statistics for all Variables 914
Table 7: Correlations 925
Table 8: Unstandardised Direct Effects and Indirect Effects 958

List of Figures

Figure 1: PRISMA Flow Diagram of Selection Process 26
Figure 2: Diagrammatic Representation of Hypothesized Relationships Between the Variables 75
Figure 3: SEM Model Path Diagram 87

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Introductory Chapter

Obesity is on the rise (World Health Organisation, 2020) and the National Health Service (NHS) offers a wide range of weight loss and binge eating clinical services to support people with overweight[1], obesity and/or disordered eating patterns. Interventions range from guidance and advice in general practices (NHS, 2019), to specialist weight loss clinical services (for example, NHS, N.D.) and binge eating clinical services (NHS, 2020). A wide range of multidisciplinary teams offer a variety of clinical services, including guidance and advice, guided self-help, psychological therapy, and medication (for example, NHS, 2020). Psychological interventions focus on reducing the psychological barriers to health behaviour change and maintenance (Brennan et al., 2018). They are typically cognitive behavioural therapy based and thus adapted from approaches used to overcome mental health difficulties (Brennan et al., 2018). However, despite the range of services available, long term weight loss success is limited and relapse is frequent (De Lorenzo., 2020). Nondieting psychological interventions have been developed with the aim of increasing psychological wellness, without a focus on weight loss (Macdonald & Cassin, 2017). The nondieting model emerged because weight reducing interventions have limited long-term success (Macdonald & Cassin, 2017) and for people with overweight and obesity comorbid psychological distress is well documented (WHO, 2020), and focusing on weight loss can further contribute to psychological distress (Macdonald & Cassin, 2017). Nondieting psychological interventions and weight reduction interventions have equally poor long-term results in terms of weight reduction (Macdonald & Cassin, 2017), thus understanding the mechanisms that may contribute to obesity is necessary to inform on treatment and prevention strategies

[11] The expression ‘people with overweight/obesity/underweight/ healthy weight’ is used throughout the paper. Although it is grammatically incorrect, it is an accepted convention within the body of literature.

Chapter One is a systematic review which aimed to identify and synthesize all studies that examine the associations between food addiction, psychological distress (depression and/or anxiety), and emotional eating. It also aimed to explore whether there are any mediators or moderators to the primary associations. This area was chosen because literature indicates that food addiction, psychological distress and emotional eating are interrelated as well as being independent factors contributing to obesity (for example, Burrows et al., 2018; Pickett et al., 2020; Pursey et al., 2014). To date, no published systematic review has explored the interrelated nature of the primary associations or any mediators or moderators that may underpin them. Eleven papers were included for review.

Chapter Two is an empirical paper which aimed to explore the relationships between psychological distress, personality traits (impulsivity and sensation seeking) and addiction-like eating behaviour, and the extent to which these associations are mediated by eating motivations. Food addiction has been robustly associated with psychological distress and impulsivity; literature also indicates sensation seeking may contribute to food addiction (for example, Burrows et al., 2018; Maxwell et al., 2020). However, the psychological mechanisms underpinning these associations remain unclear. Specific motivations have been identified as individual differences that may drive consumption of palatable foods: ‘Coping motives’ referring to food consumption to alleviate negative affective states and ‘enhancement motives’ referring to the hedonic effects of food consumption (for pleasure and not for metabolic or physiological need) to promote positive experiences (Burgess et al., 2014). Therefore, the empirical paper aimed to investigate whether these motives mediate the associations between psychological distress, personality traits and food addiction. The empirical paper will be submitted to the journal Appetite for publication. Appetite specialises in cultural, social, psychological, sensory and physiological influences on the selection and

intake of foods and drinks, and thus this journal and its objectives were deemed a good fit for the empirical study.

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Chapter One: Systematic Review

Food Addiction and its Associations with Psychological Distress and Emotional Eating: A Systematic Review

Abstract

Background: Emerging research has indicated that food addiction, psychological distress and emotional eating are interrelated as well as being independent factors contributing to obesity. A recent systematic review found that food addiction and mental distress (depression and anxiety) are positively associated. However, the psychological mechanisms which underpin this association are unclear. For example, the potential role of emotional eating (i.e., eating to alleviate negative emotional states) in this relationship has not been systematically investigated.

Objectives: This review aimed to identify and synthesize all studies which have examined associations between food addiction, psychological distress (depression and/or anxiety), and emotional eating. It also explored whether there are any mediators or moderators of the primary associations.

Design: Systematic review

Method: Studies were identified by searching five databases: PsycINFO, PubMed, CINAHL, EMBASE and MEDLINE. The inclusion criteria were, 1) report the outcomes of food addiction, psychological distress (anxiety and/or depression) and emotional eating; 2) report the associations between all three target variables; 3) with human participants. The exclusion criteria were, 1) not published in English; 2) full text not available. Eleven studies met this criterion and were included for review. The 16-item Quality Assessment Tool for Studies with Diverse Designs was used to assess quality of the studies.

Results: Food addiction, psychological distress, and emotional eating were consistently positively associated across the eleven studies. Four of the eleven studies conducted mediation analyses which included additional variables. Preliminary evidence suggests that

emotional eating may mediate associations between psychological distress and eating behaviours.

Conclusion: Food addiction, psychological distress, and emotional eating are positively correlated; however, this review was unable to conclusively identify any psychological mechanisms that may underpin the target associations. There was some preliminary evidence that suggests emotional eating may mediate associations related to psychological distress and eating behaviours. This emphasizes the need to consider emotional experiences in the development of prevention and treatment strategies of maladaptive eating behaviours, including food addiction.

Keywords: Food addiction, addiction-like eating behaviour, eating behaviour, psychological distress, depression, anxiety, emotional eating, systematic review.

Introduction

Obesity has tripled worldwide since 1975 (World Health Organisation [WHO], 2020), if the current trend continues, obesity is estimated to increase to nearly half the global population by 2030 (Dobbs et al., 2014). Obesity is defined as a body mass index (BMI) of 30kg/m^2 or more and overweight is defined as a BMI of 25-29kg/m^2 (WHO, 2020). Recent statistics suggested that 50% of men and 55% of women were people with overweight or obesity globally (WHO, 2020) and percentages were higher in England with men at 68% and women at 58% (Public Health England, 2017). The annual spend on obesity-related ill-health was more than the combined total on the judicial system, fire service and police, at an estimated £6.1 billion (Public Health England, 2017) and the cost to the National Health Service is expected to reach £10 billion by 2050 (Government Office for Science and Department of Health and Social Care, 2007).

An energy imbalance between calories consumed and calories expended is the fundamental basis of people becoming overweight and developing obesity (WHO, 2020). However, the onset and development of obesity is complex and individualised, and may include psychological, sociological, biological, evolutionary, economic, and institutional factors (Dobbs and Manyika, 2015). Obesity is a preventable and treatable condition, with strategies frequently focusing on reducing sedentary lifestyles and improving dietary intake, however, long-term success is limited and relapse is frequent (De Lorenzo., 2020). Therefore, it is important to understand the psychological mechanisms that may contribute to the behavioural phenomenon of overconsumption, so it may inform clinical interventions and contribute to public health prevention strategies.

Comorbid physical-ill health and obesity has been long established in literature, and in recent decades, comorbid mental ill-health and obesity has emerged (Luppino et al., 2010; Rajan & Menon, 2017; WHO, 2020). Obesity and mental ill-health have both been linked to

increased mortality, morbidity, and disability, and a decreased quality of life; when they occur together, the adverse health outcomes can be amplified (Avila, et al., 2015). Furthermore, obesity and mental ill-health have been linked in a reciprocal longitudinal relationship, for example, with depression being predictive of developing later obesity, and obesity increasing the subsequent risk of depression (Luppino et al., 2010). However, the psychological mechanisms linking mental ill-health and obesity remain unclear (Aldossari et al., 2021; Avila, et al., 2015).

The concept of 'food addiction' has emerged as one factor contributing to the rise in obesity (de Sousa Fernandes et al., 2020; Schulte & Gearhardt, 2018). Food addiction is characterised by excessive overeating related to a loss of control over consumption and intense food cravings (Gearhardt et al., 2009). The Yale Food Addiction Scale (YFAS; Gearhardt et al. 2009; 2016) was the first tool designed to measure food addiction and it translates the Diagnostic and Statistical Manual (DSM) of Mental Disorders criteria for substance use disorders to eating behaviour (5th ed.; American Psychiatric Association, 2013). The YFAS measures symptoms associated with food addiction based on the seven-substance dependence criterion, including withdrawal, a persistent desire or repeated unsuccessful attempts to quit, and diminished control over consumption. It can provide a diagnosis of food addiction, and/or a continuous measure of symptomology. However, the concept of food addiction likened to a substance use disorder is highly contested because research supporting the idea that specific foods have addictive properties is weak (Hebebrand et al., 2014; Markus et al., 2017; Ruddock et al., 2017). Despite this, YFAS is the dominant tool used in the past decade to assess the prevalence of food addiction and psychosocial correlates (for example Burrows et al., 2018).

The Addiction-like Eating Behaviour Scale (AEBS) was developed as an alternative to a substance-based conceptualisation of food addiction. It aims to quantify core cognitive and

behavioural processes underpinning addictive patterns of over-consumption of food via two subscales (enhanced drive to obtain food and poor dietary control), and thus the AEBS measurement is more aligned to a behavioural addiction to eating (Ruddock et al., 2017). Despite their theoretical differences, the AEBS is positively correlated with the YFAS (Ruddock, et al., 2017). However, the ABES has received minimal attention in literature, when compared to the YFAS. For the remainder of the current paper, the term 'food addiction' will be used to describe food addiction as assessed by the YFAS, unless specifically stated otherwise.

Prevalence rates of food addiction have been evidenced in clinical and non-clinical settings as 16.2% and 19.9%, respectively (Burrows et al., 2018; Pursey et al., 2014). Amongst patients seeking bariatric surgery, one review found prevalence ranged from 14% to 57.8% (Ivezaj et al., 2017). In a child-and-adolescent focused review, prevalence was 15% for all samples, 12% for community samples, and 19% for people with overweight/obesity (Yekaninejad et al., 2021). Higher body mass index (BMI) has been associated with higher food addiction symptomology in clinical and nonclinical settings (Penzenstadler et al., 2019), however, the association between food addiction and obesity is not exclusive because food addiction has also been associated with healthy weight people in clinical and nonclinical settings (Pursey et al, 2014). A non-linear relationship has also been discovered between food addiction and BMI with prevalence rates being highest for people with obesity (17.2%) and people with underweight (15%; Hauck et al., 2017).

Psychological distress (anxiety and depression) has been robustly associated with food addiction (Burrows et al., 2018; Skinner et al., 2021). A recent meta-analysis found that a positive, moderate association exists between food addiction and mental health outcomes, including anxiety and depression (Burrows et al., 2018), however, a simple direct association between these two variables is unlikely.

Biological processes may explain the link between distress and problematic eating behaviours including food addiction. While a corticotropin-releasing-hormone suppresses appetite following a stressful event so resources can be prioritised accordingly, another hormone, glucocorticoid, stimulates hunger in the hours later to replenish energy (Sominsky & Spencer, 2014). Ongoing psychological stress can induce this biological process leading to chronically stimulated eating behaviours (Sominsky & Spencer, 2014) that may manifest into addictive-like eating patterns.

Less is known about psychological mechanisms. However, emerging studies have suggested that emotional eating mediates the association between psychological distress and higher BMI/obesity (Clum et al., 2014; Goldschmidt et al., 2014; Lazarevich et al., 2016; van Strien et al., 2016), namely, higher psychological distress is predictive of higher emotional eating, which in turn is predictive of higher BMI. Lazarevich et al. (2016) suggested that people with higher levels of depression often have dysfunctional coping strategies and consequently are more at risk of developing abnormal eating behaviours, including overeating, in attempts to reduce negative mood states, and thus are at greater risk of developing obesity (Lazarevich et al., 2016). Furthermore, multiple authors have found trait emotional eating, as measured by the Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al., 1986) moderates the relationship between distress and food intake (O'Connor et al., 2008; van Strien et al., 2012; 2013). The DEBQ emotional eating subscale measures the extent to which people habitually engage in emotional eating behaviours, for example, 'Do you get the desire to eat when you are anxious, worried or tense?'. Using the DEBQ, van Strien et al. (2012) found people with lower emotional eating consumed less food than people with higher emotional eating during a sad movie. Therefore, it is plausible that emotional eating may contribute to the association between psychological distress and food addiction, and some relevant theory will now be considered.

There is no standardised definition of emotional eating, but underpinning theories generally suggest that the presence of negative emotions increases the motivations to eat, and because of the rewarding properties of food, the negative emotional experience is reduced (Macht & Simons, 2011); thus, food intake could be considered a maladaptive coping strategy. Sixty percent of people with overweight or obesity engage in emotional eating, and energy dense foods are often consumed in response to emotional experiences and thus further contributing to obesity (Frayn and Knäuper, 2018).

Emotional eating and psychological distress have been well documented as associated within literature, and previous reviews have highlighted emotional eating to be precipitated by psychological distress, including depression and anxiety (Ganley, 1989; Pickett et al., 2020). The association between emotional eating and psychological distress has been linked with the consumption of more calorie-dense foods and thus increased obesity risk (Lazarevich et al., 2016). Depression has been linked most strongly with disordered eating patterns (Masheb & Grilo, 2006), whereas anxiety has been associated with increased preferences for hyperpalatable foods (Yannakoilia et al., 2008).

Food addiction and emotional eating are both characterised by eating behaviours, such as a loss of control and overconsumption in the absence of physiological need, and there is evidence they are positively correlated (for example, Pursey et al., 2014). However, these constructs differ in the processes underpinning food intake. For example, emotional eating is characterised by food intake to alleviate distress (Macht & Simons, 2011). Whereas food addiction is characterised by addictive-like psychological and behavioural symptoms, for example, cravings and withdrawal-like symptoms and thus the processes underpinning food intake is to cease or reduce these addictive-like symptoms (Bonder et al., 2018; Lennerz, & Lennerz, 2018). To date, the author was unable to locate a systematic review that primarily focused on the association between food addiction and emotional eating; Burrows et al.

(2018) suggested the association between food addiction and emotional eating was less clear, than for example food addiction and depression, because few studies consistently reported these outcome measures and thus meta-analysis was not possible.

Theories of emotional eating differ in their focus and emphasis, however, can offer insight into the association between psychological distress and food addiction. Interoception-based theories (for example, developing from Bruch, 1955, as cited in Reichenberger et al., 2020) suggested that people with obesity lack interoceptive awareness (an internal sensation of hunger and fullness), which may result in overeating in response to negative emotions. Therefore, in the context of psychological distress, instead of responding with adaptive emotion regulation strategies, the physiological arousal could be perceived as hunger and thus increase eating behaviours (Reichenberger et al., 2020), which may manifest in addictive-like eating patterns.

Emotional eating can also be accounted for by learning theories (for example, Booth, 1994, cited in Macht & Simons, 2011); the negatively reinforcing properties of food intake, in the form of reducing the intensity of negative emotions, will increase the likelihood of such behaviours recurring in the future via operant conditioning. A classical conditioning effect can also be induced via the repeated pairing of negative emotions and eating, which can promote increased motivations/cravings to eat when experiencing negative emotions (Reichenberger et al. 2020), and thus the rewarding properties of food could lead to loss of control and manifest in addictive-like eating patterns.

Cognitive models can also offer insight into emotional eating. Herman and Mack (1975) suggested that the cognitive process of restraint (or trying not to eat) can lead to overconsumption. The development of rigid rules in the context of dieting, such as “I’ll never eat cake again” can be difficult to uphold, and even minor violations to the rules can lead to a ‘what the heck’ effect, that is cognitive abandonment of the rules and consequently

overeating (Reichenberger et al. 2020). In the presence of psychological distress, it may further interfere with the cognitive control needed to uphold such rigid rules and consequently increase eating behaviours that may manifest in addictive-like eating patterns (Reichenberger et al. 2020).

Predominantly the term emotional eating refers to eating in response to negative emotional experiences (for example, Pickett et al., 2020), but more recently several authors have evidenced increased eating behaviours in response to positive emotions (for example, Bongers et al., 2013a; 2013b; 2016). However, the mechanisms underpinning 'positive emotional eating' are less clear (Sultson, et al., 2017). It is possible that positive emotional eating and negative emotional eating are entirely different constructs (Sultson, et al., 2017), for example, it is widely accepted that higher negative emotional eating is associated with higher BMI, however, higher positive emotional eating has been associated with lower BMI (Bourdier et al., 2017). Thus, although eating behaviours may increase in response to positive emotional experiences, it may not mirror maladaptive eating patterns evidenced in negative emotional eating (Sultson, et al., 2017), and instead may relate to hedonic effects of food consumption to enhance positive experiences and/or emotions (for example, Burgess et al., 2014).

Binge eating is another eating behaviour characterised by a loss of control over consumption, with a pattern of recurrent episodes of unusually large intake of food over a short period (Giel et al., 2017). As with food addiction and emotional eating, binge eating has been implicated in the rise in obesity (Giel et al., 2017). Food addiction, emotional eating and binge eating are all characterised by a loss of control over consumption, however, they differ conceptually in terms of amount and/or pattern of food consumption, and the psychological function of consumption. Despite some of these conceptual differences these eating behaviours are associated in literature (for example, Barnhart et al., 2021; Gearhardt et al.,

2012). One possible explanation is that in the context of eating behaviour questionnaires, people do not differentiate well between the reasons associated with eating behaviours (Vainik et al., 2019). The umbrella term, 'uncontrolled eating' has been proposed for several correlated psychological constructs, including food addiction, emotional eating and binge eating that are characterised by loss of control over consumption of food, in the absence of hunger or metabolic need (Vainik et al., 2019). This approach would enable a wide scope of meta-analytic data to be combined to inform future research, however, it may lead to an over-generalisation for some populations. For example, in the context of binge eating and food addiction, binge eating is neither a necessary nor a sufficient component of food addiction (Davis, 2013), thus people who meet the criteria for food addiction, may not also meet the criteria for binge eating. Furthermore, some evidence suggests that food addiction may represent a distinct phenomenon from binge eating (Piccinni et al., 2021). For example, hormone patterns represent distinct differences, with ghrelin levels being associated with food addiction, whereas nesfatin-1 is associated with binge eating (Lopez-Aguilar et al., 2018). Therefore, applying evidence from binge eating literature to populations related to food addiction may not be appropriate; consequently, binge eating is not included in the current review.

In summary, psychological distress and food addiction have been robustly associated, but the psychological mechanisms underpinning this association remains unclear. Emotional eating has been associated with food addiction and psychological distress, but to the authors best knowledge, the interrelated nature of these three variables have not been systematically reviewed. Furthermore, recent evidence suggested emotional eating can mediate and moderate the association between psychological distress and obesity/food intake, and thus it is plausible that emotional eating may mediate the association between psychological distress and food addiction.

Aim of the Systematic Review

This review aimed to identify and synthesise all publications that have examined associations between food addiction, psychological distress (depression and/or anxiety), and emotional eating. Thus, the primary aim and systematic review question one is: Is food addiction associated with psychological distress (depression and/or anxiety) and emotional eating?

As a secondary aim, the review explored what psychological mechanisms have been identified as mediators or moderators to the primary associations. Therefore, systematic review question two is: What psychological mechanisms have been identified as mediators or moderators to the primary associations?

The process of mediation and moderation provide an understanding of how a third variable effects the relationship between a dependent and independent variable. Mediation explains the relationship between the dependent and independent variable through the mediator, whereas moderation explains whether the third variable modifies the relationship, such as the strength and direction, between the dependent and independent variable. Please see Hayes (2018) for a thorough explanation.

Method

The systematic review protocol was designed in accordance with the PRISMA statement and checklist (Moher, et al., 2009) and prospectively registered on PROSPERO (registration number: CRD42020214457). PROSPERO is an international database that records systematic review protocols to reduce unplanned duplication (Moher, et al., 2014).

Study Identification

Following initial scoping searches, a comprehensive literature search was undertaken in January 2021 of five electronic databases: PsycINFO (from 1887), PubMed (from 1950), CINAHL (from 1937), EMBASE (from 1947) and MEDLINE (from 1948). The search was updated in September 2021; 14 new studies were found, but following a title and abstract sift, no additional papers met the inclusion criteria and thus the review was not updated. Articles indexed in one of the five databases and published between 1989 and January 2021 were included.

The search terms were developed by reviewing the search strategy from a previous systematic review on food addiction (Burrows, et al., 2018), emerging research in the field of food addiction, psychological distress, and emotional eating (for example, Ruddock et al., 2017) and reviewing reference lists of associated literature (for example, Burrows, et al., 2018). The final search terms are provided in Table 1. Reference lists of key papers were also reviewed for additional papers to include (for example, Burrows et al., 2018) and an expert in the field was contacted to see if they were aware of any additional upcoming publications that could be included.

Table 1

Terms Used to Search Within Electronic Databases

Variable	Search terms used
Food addiction	"food* OR eat* OR feed* OR consum* OR behavio?r*" combined with "addict* OR behavio?r*" OR "overeat* OR substance related disorder* OR food OR eat*"
OR	
Emotional eating	"emotion* eat* OR maladapt* eat* OR food preference* OR eat* habit* OR food habit*"
AND	
Food Addiction Scale	"Yale food addiction scale OR YFAS OR Yale food addict* OR food addict* scale OR food addict* questionnaire OR Addiction-like Eating Behavio?r Scale OR AEBS"
AND	
Anxiety and/or depression	"psychological distress OR psychological well* OR emotional distress OR emotional well* OR anxi* OR depress*"

Note. Truncation * and the Boolean operator OR were used to broaden search. The Boolean operator AND was used to ensure the papers included all target variables to meet the eligibility criteria.

The search terms were combined with the Boolean operator 'AND' or 'OR' to ensure the search result included all three target variables. 'Food addiction' and 'emotional eating' have overlapping terminology within literature, for example 'eating behaviour' can be used to describe both variables, so to produce a more inclusive search result the Boolean operator 'OR' was used for these two variables so that the search result only needed to include search terms relating to either food addiction or emotional eating, in the hope of capturing all relevant studies in the search result. In accordance with the Burrows et al. (2018) review, 'food addiction scale' was added as a standalone search term, in addition to 'food addiction', because without this addition, the search result was not within the scope of the current review, for example, if the 'food addiction scale' search term was removed, the EMBASE database produced 178,628 search results alone (as of 1st September 2021). To date, few

measurement tools have been developed to measure food addiction/addictive-like eating and thus the known measures (for example, YFAS, AEBS) were included within the search terms to minimise the risk of any studies being missed from the search result. Cross checking other reviews on food addiction was another precautionary measure.

Eligibility Criteria

This review was open to all studies that met the eligibility criteria; the inclusion criteria were, 1) report the outcomes of all three of the target variables, as assessed by standardised tools: food addiction, psychological distress (anxiety and/or depression) and emotional eating; 2) report the associations between all three target variables; and 3) with human participants. The exclusion criteria were, 1) not published in English; 2) full text not available.

Screening and Selection

In the first screening stage, titles and abstracts were screened against inclusion and exclusion criteria. When eligibility was unclear, the study was reviewed more thoroughly at the second stage. In the second stage, the full text was reviewed against eligibility criteria, and studies were either selected for review or excluded. A second independent reviewer was used to screen a randomly selected 10% sample at each stage to assess for consistency. The same independent reviewer also screened all studies selected for review to confirm accurate selection. Disagreements about the selection of studies were resolved through discussions, and third independent reviewer was available to assist, if needed.

Data Extraction and Synthesis

The lead reviewer extracted the relevant data to address the review questions; Table 2 details the data extracted, including demographic information, methodological information, and target outcomes. For the primary question, a narrative synthesis was employed, specifically, describing the measurement tools used and the associations between the

variables of interest. For the secondary exploratory question, which considered whether any psychological mechanisms have been identified as mediators or moderators to the primary associations, a narrative synthesis was employed, specifically, describing any mediator or moderator examined and the outcomes of these analyses. Due to the heterogeneity of the sample and exploratory nature of the secondary question, a meta-analysis was not deemed appropriate.

Assessment of Study Quality

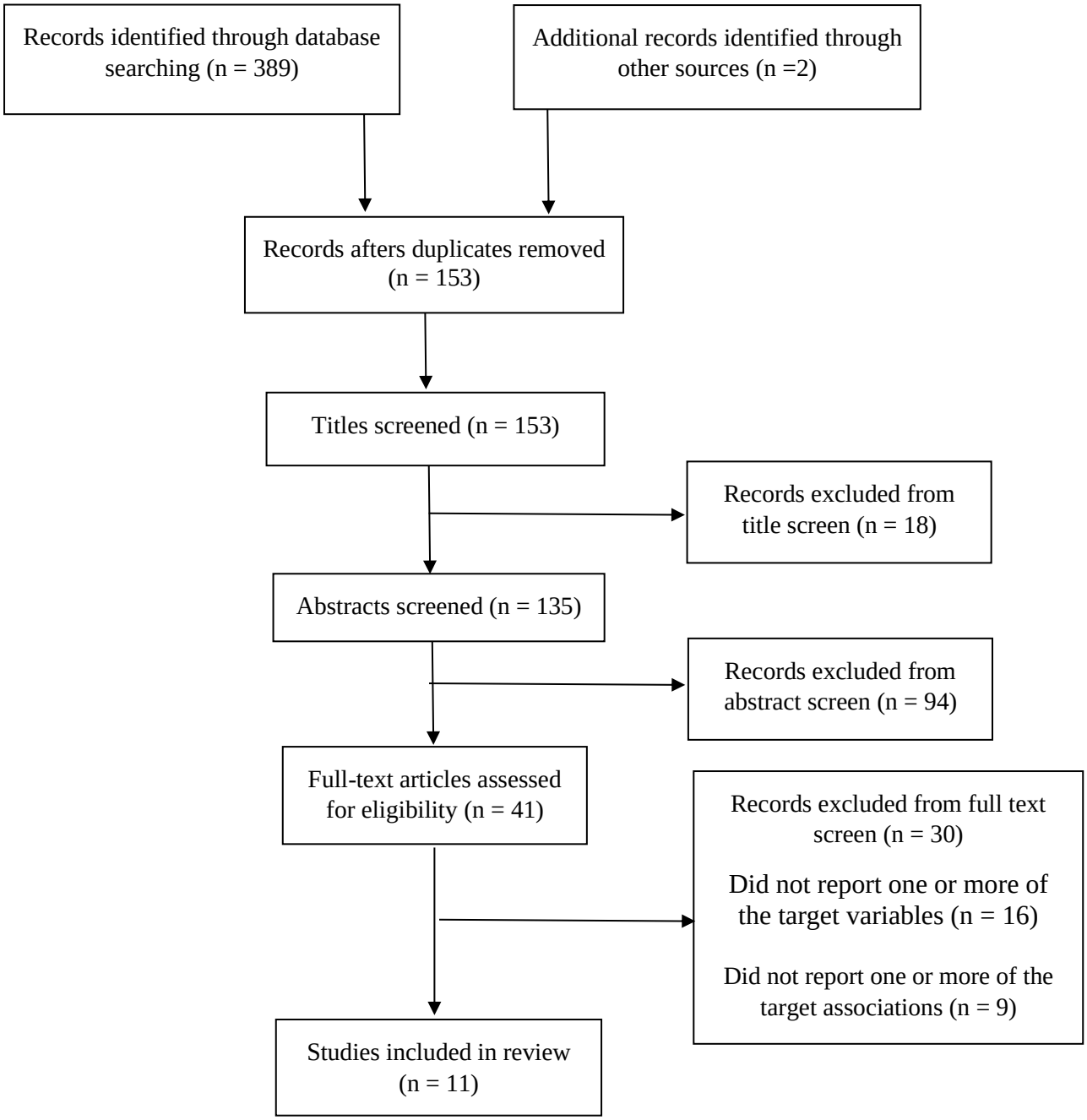
The lead author assessed the quality of each study using the 16 item Quality Assessment Tool for Studies with Diverse Designs (QATSDD; Sirriyeh et al., 2012). Table 3 outlines the quality assessment. The independent reviewer was used to quality assess a randomly selected 10% sample to assess consistency to the tool. Of the 16 items, two items relate to quantitative methodologies only and two items relate to qualitative methodologies only. The remaining 12 items relate to both methodologies. The QATSDD offers guidance on how to score each item on a scale of zero to three; higher scores suggest greater quality. A maximum score of 48 is possible for mixed methods papers and 42 for qualitative or quantitative papers. To compare quality between papers, the percentage of each paper is calculated from the score obtained with the possible maximum score; higher percentages suggest greater quality (see Appendix A the QATSDD scoring scale). The QATSDD has good reliability and validity across diverse studies and goes beyond dichotomous yes/no answers to give a range of quality for each item, however, it requires sufficient knowledge and expertise to assess quality fairly and consistently (Sirriyeh et al., 2012).

Results

The search of electronic databases in January 2021 produced 389 studies; two additional studies were found in the manual search of references. Once duplicates were deleted, the titles and abstracts of 153 papers were screened for the inclusion criteria and 41 papers were deemed eligible for a full text review. Eleven papers met the inclusion criteria and are outlined in Table 2 (Benzerouk et al., 2018; Bourdier, et al., 2020; Bourdier, et al., 2018; Burmeister, et al., 2013; Loxton & Tipman, 2017; Masheb, et al., 2018; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Mills, et al., 2019; Mills, et al., 2020; Nolan & Jenkins, 2019). Figure 1 outlines the PRISMA flow diagram selection process.

Figure 1

PRISMA Flow Diagram of Selection Process



Notes: Flow chart developed in accordance with Moher et al. (2009) PRISMA principles.

Table 2

Summary of the Design and Outcomes For 11 Studies Reviewed

Abbreviations are defined in the footnote. *M* = Mean; *SD* = Standard Deviation; *SEM* = Standard Error of the Mean; B = unstandardized beta coefficients; β = standardized beta coefficients; *r* = correlation coefficients. Significant results *Italicised*. (-) = negative association; (+) = positive association; *CI* = Confidence Interval; * Significant < .05; ** Significant < .01; *** Significant < 0.001; **** Significant < 0.0001; non-significant > 0.05.

First author, country, publication year	Primary focus of article	Participant characteristics (*N*)	Design, data collection method and methodology	Measurement tools	Reported associations between variables	Reported mediators or moderators and outcomes	Quality (%)
Benzerouk, France, 2018	Prevalence of the food addiction phenotype and its association with psychiatric disorders in bariatric surgery candidates.	N = 128 adults referred for bariatric surgery M age 41.5 (SD = 11.3), Female = 71.1%, M BMI = 46.1 (SD = 6.6) College educated or higher = 62.5%	Cross-sectional, Self-report measures, Quantitative. Spearman's correlation analysis to explore associations	French version of YFAS-2, BDI-II, French version of DEBQ-emotional eating subscale.	*(+) Food addiction with depression (r = .54***) and emotional eating (r = .49**).* *(+) Emotional eating with depression (r = .37***)*	Not reported	86
Bourdier, France, 2020	Differences in emotionally driven and addictive-like eating behaviours between people with obesity, healthy-weight and overweight people.	N = 1142 university students data collected from a larger study *M* age 23.4 (*SD* = 7.5), Female = 85%, *M* BMI = 22.7 (SD = 3.8) with 82.1% healthy weight, College educated or higher = 97.6%	Cross-sectional, Self-report measures, Quantitative. Spearman's correlation analysis to explore associations in three groups based on BMI: Group with people with obesity (OB) n =	mYFAS, HADS, EMAQ-Negative subscale, EMAQ-Positive subscale. Additional tool in medication analysis: IES-2 RHSC subscale.	*(+) Food addiction with depression for OB (r = .51*), OW (r = .39*) and NW (r = .24*).* *(+) Food addiction with anxiety of OB (r = .56*), OW (r = .5*) and NW (r = .31*).* *(+) Food addiction with negative emotional eating for OB (r = .51*), OW (r = .35*) and NW (r = .3*).* *(-) Food addiction with positive emotional eating for OW (r = -.22*) and NW (-.21*);* OB not significant.	Group with obesity only Mediator: EMAQ-Negative subscale Predictor variable: HADS Outcome variable: IES-2 RHSC subscale *Model 1: Negative emotional eating as mediator between depression and the lack of reliance on internal cues to regulate food intake.* *The indirect effect was statistically significant (β = 0.043, p = 0.020).*	69

			57, overweight (OW) n =147 and healthy weight (NW) n = 938 Mediation analysis with a bootstrapping resampling technique (with a 1000 sample) to test mediators.		*(+) Negative emotional eating with depression for OB (r = .42*);* OW and NW not significant. *(+) Negative emotional eating with anxiety for OB (r = .49*);* OW and NW not significant. *(-) Positive emotional eating with depression for OW (r = -.17*), and NW (r = -.07*);* OB not significant. *(-) Positive emotional eating with anxiety for OW (r = -.25*) and NW (r = -.13*);* OB not significant.	*Model 2: Negative emotional eating as mediator between anxiety and the lack of reliance on internal cues to regulate food intake* *The indirect effect was statistically significant (β = 0.052, p = 0.004).*	
Bourdier, France, 2018	Associations between psychological distress, emotional eating, food addiction and BMI; and the potential mediation effect of eating behaviours. between psychological distress and BMI.	N = 1349 university students from a web-based survey *M* age 21.08 (SD = 2.77), Female = 76.3%, *M* BMI = 21.84 (SD = 3.56). Bachelor's degree educated or higher = 99.8%	Cross-sectional, Self-report measures, Quantitative. Spearman's rank correlation was used to explore associations. Multiple-group structural equation modelling, with sex as a grouping variable, was used to test mediators.	mYFAS, HADS, Reverse scoring of the IES-2 RHSC subscale for emotional eating.	*(+) Food addiction with depression (*r *= .26**), anxiety (*r *= .27**) and emotional eating (*r *= .49**).* *(+) Emotional eating with depression (*r *= .15*) and anxiety (*r *= .20**)*	*Model 1: Emotional eating as a mediator between psychological distress and BMI* *The indirect effect was statistically significant for both sexes (females: β = 0.07, p = 0.001; males: β = 0.13, p = 0.001).* *Model 2: Food addiction as a mediator between psychological distress and BMI* *The indirect effect was significant for both sexes (females: β = 0.07, p = 0.011; males: β = 0.12, p = 0.045).*	74

Burmeister, United States, 2013	Relationship between food addiction symptoms and short-term weight loss	N = 57 People who were overweight or obese and enrolled in a behavioural weight loss intervention. *M* age 47.4 (SD = 13.7) Female = 68.4%, Caucasian = 84.2%, College educated or higher = 91.2%, *M* BMI = 38.2 (SD = 8.1).	Cross-sectional, Self-report measures, Quantitative. One-tailed bivariate correlations were used to explore associations.	YFAS, CES-D, DEBQ-emotional eating subscale.	*(+) Food addiction with depression (r = .50**) and emotional eating (r = .58**).* *(+) Emotional eating with depression (r = .31**)*	Not included	79
Loxton, Australia, 2017	Associations between individual differences in reward sensitivity and food addiction, and to explore potential mediators (binge-eating, hedonic, emotional, and externally driven eating)	N = 374 undergraduate Psychology students completed online surveys via advertisements on social media. *M* age of 30.58 (SD = 12.70), Female = 100%, Caucasian = 95%, *M* BMI = 24 (SD = 5.95).	Cross-sectional, Self-report measures, Quantitative. Correlations were used to explore associations. Multiple mediation analysis with a bootstrapping resampling technique (with a 10,000 sample) was used to test mediators.	YFAS, DASS, DEBQ-emotional eating subscale. Additional tool in medication analysis: SRS, PFS, DEBQ-external eating subscale, BEQ.	*(+) Food addiction with depression (*r *= .34***), anxiety (*r *= .34***) and emotional eating (*r *= .49***).* *(+) Emotional eating with depression (*r *= .37***) and anxiety (*r *= .31****)	Model 1: *Binge-eating*, *emotional eating*, externally driven eating, and hedonic eating (*food availability*, food present and food taste subscales) as mediators between reward sensitivity and food addiction. *The indirect effect was statistically significant for binge-eating (B = 0.028; 95% CI: 0.015–0.044), emotional eating (B = 0.014; 95% CI: 0.005–0.027) and food availability (B = 0.032; 95% CI: 0.016–0.055).* Indirect effect was not statistically significant via external eating, food taste and food present.	76

Masheb, United States, 2018	Validity of a brief version of the YFAS in weight loss seeking patients, and to determine whether food addiction contributes to excess weight.	N = 126 Veterans with OW/O at a weight management intervention *M* age of 61.8 (SD = 8.6), Male = 89.7%, Caucasian = 76%, *M* BMI = 38 (SD = 7.42).	Cross-sectional, Self-report measures, Quantitative. Pearson's Product Moment Correlation analysis to assess associations between variables.	mYFAS. PHQ-2. YEOQ.	*(+) Food addiction with depression (r = .43***) and emotional eating (r = .63***).* *(+) Emotional eating with depression (r = .60***)*	Not reported	79
Miller-Matero, USA, 2014	Prevalence of problematic eating behaviours and their relationship with other eating behaviours, BMI, and psychiatric symptoms.	N = 142 adults' data from chart reviews prior to bariatric surgery. *M* age 46.26 (SD = 11.7) Female = 81%, Caucasian = 53.5%, African American = 39.4%, *M* BMI = 49.05 (SD = 9.56).	Cross-sectional, Self-report measures taken during semi-structured interview, Quantitative. Correlations were used to assess associations between variables.	YFAS, HADS, EES.	*(+) Food addiction with depression (r = .33**), anxiety (r = .26**), emotional eating total (r = .49**).* *(+) Emotional eating with depression (r = .17*) and anxiety (r = .30**).*	Not reported	76
Miller-Matero, USA, 2018	Whether preoperative problematic eating behaviours predict weight loss outcomes following bariatric surgery.	N = 146 adults' data from chart reviews prior to bariatric surgery. *M* age 46 (SD = 11.8), Female = 82.2%, White = 65.3% *M* BMI = 49.3 (SD = 8).	Cross-sectional, Self-report measures, Quantitative. Correlation analysis was used to assess associations between variables	YFAS, HADS, EES.	*(+) Food addiction with depression (r = .34**), anxiety (r = .25*), emotional eating (r = .57***)* *(+) Emotional eating with depression (r = .23*) and anxiety (r = .32**).*	Not reported	74

Mills, Australia, 2019	Compare eating behaviours in relation to neurobiological measures between people with Major depressive disorder and healthy controls.	N = 120 adults recruited by media and university advertisement. 60 people with MDD and 60 healthy controls. *M* age 25 (SD = 6.61), Female = 57%, *M* BMI of 25.80 (SD = 5.41) for people with MDD and 25.10 (SD = 5.35) for people in control group.	Cross-sectional, Self-report measures, Quantitative. Pearson's correlation coefficients and Spearman's rank correlations were used to determine relationships between the variables.	YFAS, BDI-II, DEBQ-emotional eating subscale.	*(+) Food addiction with depression (r = .50***) and emotional eating (r = .55***).* *(+) Emotional eating with depression (r = .46***)*	Not reported	69
Mills, Australia, 2020	Symptoms of overeating, food addiction and plasma dopamine levels in people with MDD, compared to controls by sex.	N = 140 recruited by media and university advertisement. 80 people with MDD and 60 healthy controls. *M* age 25 (SD = 7), Female = 57%, *M* BMI of 26.7 (SD = 5.9) for people with MMD group and 25.1 (SD = 5.4) for people in control group.	Cross-sectional, Self-report measures, Quantitative. Pearson's correlation coefficients and Spearman's rank correlations were used to determine relationships between the variables.	YFAS-2, BDI-II, DEBQ-emotional eating subscale.	*(+) Food addiction with depression (r = .51**) and emotional eating (r = .57**).* *(+) Emotional eating with depression (r = .49**)*	Not reported	76

Nolan, USA, 2019	Whether the presence of irrational beliefs predicts higher food addiction symptoms. If the relationship exists, to examine if it is mediated by depression, trait anxiety, and/or emotional eating, and whether it depends on BMI.	N = 239 university students. *M* age 20.72 (SEM = 0.42), European = 73.2%, Female = 73.6%, *M* BMI = 24.07 (SEM = 0.32), Majority undergraduate students.	Cross-sectional, Self-report measures, Quantitative. Pearson's correlation coefficients were performed to determine relationships between the variables. Mediation multiple regression analysis was conducted using PROCESS (with 5000 bootstrapping samples) to examine mediators and moderators. Exploratory analyses: Serial mediation.	mYFAS2, STAI, SDS, DEBQ-emotional eating subscale. Additional tool in medication analysis: SGABS.	*(+) Food addiction with depression (r = .34****), anxiety (r = .36****) and emotional eating (r = .49****).* *(+) Emotional eating with depression (r = .34****) and anxiety (r = .42****).*	Model 1: *Emotional eating as a mediator between irrational beliefs and food addiction.* *Indirect effect was significant for emotional eating (B = 0.02; 95% CI: 0.010–0.034).* Indirect effect was not significant through trait anxiety or depression. No significant interactions were found with BMI as a moderator. Model 2: *Trait anxiety as a mediator between irrational beliefs and emotional eating* *Indirect effect was significant for trait anxiety (B = 0.02; 95% CI: 0.006–0.027).* Indirect effect was not significant through depression. Model 3: *Serial mediator between irrational beliefs, trait anxiety, emotional eating, and food addiction, in that order.* *Indirect effect between irrational beliefs on food addiction was significant through trait anxiety and emotional eating (B = 0.02; 95% CI: 0.007–0.028).* The serial indirect path including depression was not significant.	74

Note. Yale Food Addiction Scale version 2 (**YFAS-2**; Gearhardt, et al., 2016); French version of **YFAS-2** (Brunault, et al., 2017); Beck Depression Inventory (**BDI-II**; Beck et al., 1996); French version of **BDI-II** (Collet & Cottraux, 1986); Dutch Eating Behavior Questionnaire (**DEBQ**; van Strien, et al., 1986); French version of **DEBQ** (Lluch, et al., 1996); Body mass index (**BMI**); Modified Yale Food Addiction Scale (**mYFAS**; Flint, et al., 2014); Hospital Anxiety and Depression Scale (**HADS**; Zigmond & Snaith, 1983); Emotional Appetite Questionnaire (**EMAQ**; Nolan, et al., 2009); Intuitive Eating Scale-2 Reliance on Hunger and Satiety Cues subscale (**IES-2 RHSC**; Camilleri, et al., 2015); Structural Equation Modelling (**SEM**); Yale Food Addiction Scale (**YFAS**; Gearhardt et al., 2009); Center for Epidemiological Studies Depression Scale (**CES-D**; Radloff, 1977); Depression, Anxiety and Stress Scale (**DASS**; Lovibond & Lovibond, 1995); Sensitivity to Reward Scale (**SRS**; Torrubia, et al., 2001); Power of Food Scale (**PFS**; Lowe et al., 2009); Binge Eating Questionnaire (**BEQ**; Halmi, et al., 1981); Patient Health Questionnaire (**PHQ-2**; Kroenke, et al., 2003); Yale Emotional Overeating Questionnaire (**YEOQ**; Masheb & Grilo, 2006); Emotional Eating Scale (**EES**; Arnow, et al., 1995); Major Depressive Disorder (**MDD**); Modified Yale Food Addiction Scale 2.0 (**mYFAS2**; Schulte & Gearhardt, 2017); State-Trait Anxiety Inventory for Adults (**STAI**; 1983); Self-report Depression Scale (**SDS**; Zung, 1965); Shortened General Attitude and Belief Scale (**SGABS**).

Table 3

Quality Assessment Tool for Studies with Diverse Designs (QATSDD) Criteria and Scoring

Quality criteria	Benzerouk et al., 2018	Bourdier et al., 2020	Bourdier et al., 2018	Burmeister et al., 2013	Loxton et al., 2017	Masheb et al., 2018	Miller-Matero et al., 2014	Miller-Matero et al., 2018	Mills et al., 2019	Mills et al., 2020	Nolan et al., 2019
Explicit theoretical framework	3	3	3	3	3	3	3	3	3	3	3
Statement of aims/objectives in main report.	3	3	3	3	3	3	3	3	3	3	3
Clear description of research setting	3	3	3	3	3	3	3	3	3	3	3
Evidence of sample size considered in terms of analysis.	3	0	1	1	0	0	0	0	0	3	0
Representative sample of target group of a reasonable size	2	1	2	1	2	2	2	2	2	2	2
Description of procedure for data collection	3	3	3	3	3	3	3	3	3	3	3
Rationale for choice of data collection tool(s)	3	1	1	3	2	3	3	3	1	1	2
Detailed recruitment data	3	3	2	3	3	3	3	3	3	3	3
Statistical assessment of reliability and validity of measurement tool(s)	2	1	1	1	1	2	1	2	0	0	1
Fit between research question and method of data collection	3	3	3	3	3	3	3	3	3	3	3

Fit between research question and format and content of data collection tool e.g., interview schedule (Qualitative studies only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fit between research question and method of analysis.	3	3	3	3	3	3	3	2	3	3	3
Good justification for analytic method selected.	3	3	3	3	3	3	3	2	3	3	3
Assessment of reliability of analytic process (Qualitative studies only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evidence of user involvement in design	0	0	0	0	0	0	0	0	0	0	0
Strengths and limitations critically discussed.	2	2	3	3	3	2	2	2	2	2	2
Total quality rating (max 42)	36	29	31	33	32	33	32	31	29	32	31
Percentage (%)	86	69	74	79	76	79	76	74	69	76	74

Note. 0 = not at all, 1 = Very slightly, 2 = Moderately, 3 = Completely: Sirriyeh et al., (2011).

Demographic Information

The 11 studies included in Table 2 had a combined total of N = 3963 participants, with sample sizes ranging from N = 57 to N = 1349. Eight studies ranged from N = 120 to N = 374 participants, with just two studies being larger at N = 1142 to N = 1349 participants (Bourdier, et al., 2020; Bourdier, et al., 2018) and one study being smaller at N = 57 participants (Burmeister, et al., 2013). Most participants were Caucasian and female, with a mean age range of 20.72 - 61.8 years. The average BMI ranged from 21.84 – 49.3 kg/m^2; in four studies the average BMI was in the healthy weight range (Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Nolan & Jenkins, 2019), in two studies the average BMI was in the overweight range (Mills, et al., 2019; Mills, et al., 2020) and in five studies the average BMI was in the obesity range (Benzerouk et al., 2018; Burmeister, et al., 2013; Masheb, et al., 2018; Miller-Matero et al., 2014; Miller-Matero et al., 2018).

Publication Context and Study Characteristics

The 11 studies took place between 2013 and 2020, with only two studies being earlier than 2017 (Burmeister, et al., 2013; Miller-Matero et al., 2014). Six studies recruited participants from a university setting (Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Mills, et al., 2019; Mills, et al., 2020; Nolan & Jenkins, 2019) and five studies recruited participants from a health setting (Benzerouk et al., 2018; Burmeister, et al., 2013; Masheb, et al., 2018; Miller-Matero et al., 2014; Miller-Matero et al., 2018).

The 11 studies took place across three counties; five were conducted in the United States of America (Burmeister, et al., 2013; Masheb, et al., 2018; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Nolan & Jenkins, 2019), three in France (Benzerouk et al., 2018; Bourdier, et al., 2020; Bourdier, et al., 2018) and three in Australia (Loxton & Tipman, 2017; Mills, et al., 2019; Mills, et al., 2020).

The 11 studies used quantitative methodologies with a cross-sectional design and utilised self-report questionnaires to gather data. All 11 studies used correlation analysis to investigate the associations between food addiction, emotional eating, and psychological distress. In addition, four studies also employed mediation analysis (Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Nolan & Jenkins, 2019), which included the target variables within the current review (for example, anxiety, depression, emotional eating and food addiction was explored by Nolan and Jenkins, 2019), as well as highlighting other relevant variables (for example, reward sensitivity was explored by Loxton and Tipman, 2017).

Measures of Food Addiction

All 11 studies measured food addiction using a version of the self-report Yale Food Addiction Scale (YFAS). Five studies used the standard 25-item version of the YFAS, which was based on the seven-substance dependence criterion of the DSM–IV-TR (Burmeister, et al., 2013; Loxton & Tipman, 2017; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Mills, et al., 2019). Three studies used the nine-item modified YFAS (mYFAS), which is an abbreviated version of the YFAS (Bourdier, et al., 2020; Bourdier, et al., 2018; Masheb, et al., 2018). Two studies used the 35-item YFAS-2 (Benzerouk, et al., 2018; Mills, et al., 2020), which is a DSM-5 revised version of the YFAS; Benzerouk, et al., (2018) used a French validated version. One study used the 13-item mYFAS2, which is an abbreviated version of the YFAS-2 (Nolan & Jenkins, 2019).

Measures of Psychological Distress

All 11 studies used self-report measures to assess anxiety and depression. Six studies measured anxiety and depression (Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Miller- Matero et al., 2014; Miller-Matero et al., 2018; Nolan & Jenkins, 2019) and five studies measured depression only (Benzerouk et al., 2018; Burmeister, et al., 2013; Masheb, et al., 2018; Mills, et al., 2019; Mills, et al., 2020). The 14-item Hospital Anxiety and

Depression Scale (HADS) was used in four studies to measure anxiety and depression and the 21-item Beck Depression Inventory (BDI-II) was used in three studies to measure depression; the remaining five measures were used in one study each (Center for Epidemiological Studies Depression Scale [CES-D]; Depression, Anxiety and Stress Scale [DASS]; Patient Health Questionnaire [PHQ-2]; State-Trait Anxiety Inventory for Adults [STAI]; Self-report Depression Scale [SDS]).

Measures of Emotional Eating

All 11 studies used self-report measures to assess emotional eating. Six studies used the emotional eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ; (Benzerouk et al., 2018; Burmeister, et al., 2013; Loxton & Tipman, 2017; Mills, et al., 2019; Mills, et al., 2020; Nolan & Jenkins, 2019), which measures emotional eating behaviours in adults. Benzerouk et al., (2018) used a French validated version. Two studies used the Emotional Eating Scale (EES; Miller-Matero et al., 2014; 2018), which measures three types of emotional eating (anger/frustration, anxiety, and depression) and the remaining three measures were only used in one study (Emotional Appetite Questionnaire [EMAQ], which measures the tendency to eat in response to both positive and negative emotions and situations; Yale Emotional Overeating Questionnaire [YEQQ], which measures the frequency of overeating in response to a range of emotion; reverse scored Intuitive Eating Scale-2 Reliance on Hunger and Satiety Cues subscale [IES-2 RHSC], which measures individuals' tendency to follow their physical hunger and satiety cues when determining when, what, and how much to eat.

Main Findings for Review Question One

Association Between Food Addiction and Psychological Distress

All studies reported a positive association between food addiction and psychological distress, indicating that higher food addiction is associated with higher psychological distress. Specifically, all 11 studies looked at the association between food addiction and depression, with the correlation coefficients ranging from weak to moderate (r = .24 - .54), however, only two studies reported a weak correlation coefficient (Bourdier, et al., 2018; Bourdier, et al., 2020), the remainder were moderate. Six of those studies also looked at the association between food addiction and anxiety, with the correlation coefficients ranging from weak to moderate (r = .25 - .56; Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Nolan & Jenkins, 2019). One study analysed the association between food addiction and psychological distress (depression and anxiety) in three different BMI groups (people with healthy weight, overweight and obesity) and found significant associations in all three groups (Bourdier et al., 2020).

Association Between Food Addiction and Emotional Eating

All studies reported a positive moderate association between food addiction and emotional eating; correlation coefficients ranged from r = .3 to .63, indicating that higher food addiction is associated with higher emotional eating. One study analysed the association between food addiction and negative emotional eating in three different BMI groups (people healthy weight, overweight and obesity) and found significant positive associations in all groups (Bourdier et al., 2020). The same study also considered the association between food addiction and positive emotional eating (i.e., increased eating behaviours in response to positive emotions; Bourdier et al., 2020); here, negative associations were found but only in groups of participants with overweight and healthy weights, not in groups of participants with obesity.

Association Between Psychological Distress and Emotional Eating

All studies reported a positive association between psychological distress and emotional eating; correlation coefficients ranged from weak to moderate for depression (r = .15 - .60) in all studies and anxiety (r = .20 - .49) in six studies (Bourdier, et al., 2020; Bourdier, et al., 2018; Loxton & Tipman, 2017; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Nolan & Jenkins, 2019). One study analysed the association in three different BMI groups and found results varied; only the group with people with obesity showed a significant positive association between psychological distress (anxiety and depression) and emotional eating (Bourdier et al., 2020). The same study also considered the association between psychological distress and positive emotional eating and again found that results varied depending on BMI group; only the groups with people with overweight and healthy weight showed a significant negative association, with correlation coefficients ranging from r = -.25 to -.07 (Bourdier et al., 2020). This indicates some preliminary evidence that higher psychological distress is associated with lower positive emotional eating for people with overweight and healthy weight, but not for people with obesity.

Main Findings for Review Question Two

What Psychological Mechanisms Have Been Identified as Mediators or Moderators to the Primary Associations?

Of the 11 studies included for review, four studies employed mediation analysis (Bourdier et al., 2020; Bourdier et al., 2018; Loxton & Tipman, 2017; Nolan & Jenkins, 2019). No studies specifically investigated whether emotional eating mediated the association between psychological distress and food addiction, however they did produce some relevant findings. Given the exploratory nature of question two, a summary of the most relevant and significant mediation analyses will be reported; please see Table 2 for full details.

Mediation Analysis: Emotional Eating as a Mediator

Four studies found a significant indirect effect of the mediator emotional eating on four different predictor-outcome pairings (Bourdier et al., 2020; Bourdier et al., 2018; Loxton & Tipman, 2017; Nolan & Jenkins, 2019). Bourdier et al. (2018) found emotional eating mediated the association between psychological distress and BMI, that is, higher psychological distress is predictive of higher emotional eating, which is in turn predictive of increased weight status. In a later study, Bourdier et al. (2020) found emotional eating also mediated the association between psychological distress and the lack of reliance on internal cues to regulate food intake. Namely, higher psychological distress is predictive of higher emotional eating, which in turn is predictive of difficulties perceiving internal signals, such as hunger and satiety; this may promote increased food intake in the absence of physiological need. Loxton and Tipman (2017) found emotional eating mediated the association between reward sensitivity (trait tendency of people to notice and seek out rewards in their environment) and food addiction; that is higher reward sensitivity is predictive of higher emotional eating, which in turn is predictive of food addiction. Finally, Nolan and Jenkins (2019) found emotional eating mediated the association between irrational beliefs and food addiction. That is, increased irrational beliefs (habitual affect-eliciting thought patterns that can result in dysfunctional emotional and/or behavioural responses, [Beck, 1976]), are predictive of higher emotional eating, which is in turn predictive of higher food addiction. Nolan and Jenkins (2019) also found a serial significant indirect effect, whereby trait anxiety and emotional eating, in that order, mediated the association between irrational beliefs and food addiction. Namely, irrational belief thinking style was associated with increased anxiety, which in turn was associated with increased emotional eating, which was associated with food addiction.

Quality Assessment

The results of the quality assessment using the QATSDD (Sirriyeh, et al., 2012) are presented in Table 3. The quality percentages ranged from 69-86%, with eight of the 11 studies ranging within the 70s. Within a relatively short period, three individual authors were the first author on two studies each (Bourdier, et al., 2020; Bourdier, et al., 2018; Miller-Matero et al., 2014; Miller-Matero et al., 2018; Mills, et al., 2019; Mills, et al., 2020), along with most the research being published recently, and this may have contributed to the similar quality ratings. The QATSDD does not specify what percentages equates to good/poor quality and thus interpretations of results are subjective.

The most varied category was 'evidence of sample size considered in terms of analysis', with scores ranging from 0 – 3; most studies did not report power calculations or effect size, and this made the 'representative sample of target group of a reasonable size' difficult to determine. The lowest rated category was 'evidence of user involvement in design', with all studies receiving score of 0. Multiple categories received full marks across all studies (please see Table 3).

Benzerouk et al. (2018) scored the highest quality rating (86%), predominantly due to the level of descriptive detail provided and structure of the paper. Limitations included a lack of service user involvement and a brief section on strengths and limitations. Bourdier et al., (2020) and Mills et al., (2019) scored the lowest quality rating (69%), predominantly due to the lack of descriptive detail provided and with some key information not being reported, such as a 'statistical assessment of reliability and validity of measurement tool(s)'.

Discussion

Summary of Main Findings

The aim of the current review was to systematically identify, synthesise and appraise all studies that reported the associations between food addiction, psychological distress, and emotional eating (question one). As an exploratory aim, this review also considered whether any psychological mechanisms have been explored as mediators or moderators relevant to primary associations (question two). Five databases were searched using systematic review methodology and 11 studies met the inclusion and exclusion criteria. This review added to the Burrows et al. (2018) review related to food addiction and mental health outcomes, by offering eight additional studies exploring the association between psychological distress and food addiction, and systematically reviewing the association between food addiction and emotional eating, which was deemed not possible by Burrows et al. (2018) meta-analytic review because too few studies consistently reported these outcome measures. However, only three studies were included in both reviews because many of the studies included in the current review were published after Burrows et al. (2018), and many of the studies in Burrows et al. (2018) did not meet the criteria for the current review because they did not measure emotional eating.

All studies in the current review reported a significant positive association between food addiction and psychological distress; these findings support previous research that found increased food addiction is associated with increased psychological distress (Burrows et al., 2018; Skinner et al., 2021). This could highlight some overlapping features of the two constructs that may contribute to the positive association, particularly because in other forms of addiction, psychological distress is a well-established antecedent (for example, Hunt et al., 2020).

All studies in the current review also reported a significant positive association between emotional eating and food addiction; this supports previous evidence that found increased food

addiction was associated with increased emotional eating (Pursey et al., 2014). It is plausible that the rewarding properties of food consumption, characterised as emotional eating (for example, Bennett et al., 2013; Frayn & Knauper, 2018) may contribute to a loss of control over consumption that may mirror food addiction, and thus the features of these two constructs may also overlap, but this warrants further exploration.

All studies in the current review reported a significant positive association between psychological distress and emotional eating; these findings support previous research that found that increased psychological distress is associated with increased emotional eating (Pickett et al., 2020). Furthermore, this association supports the idea that food can be consumed in response to negative emotions to alleviate negative affective states (for example, Bennett et al., 2013; Frayn and Knauper, 2018). Eating in response to psychological distress may be in part explained by lack of awareness and difficulties distinguishing between psychological distress and hunger (Pinaquy et al., 2003), and thus, emotional eating may represent a tendency to eat mindlessly without awareness of the reasons for eating (Pidgeon et al., 2013).

One study considered the target associations in three different BMI groups and produced some findings of note (Bourdier et al., 2020). Interestingly, when groups differed, people with overweight and healthy weight produced the same findings and in contrast to people with obesity. For example, for people with obesity, higher negative emotional eating was associated with higher psychological distress (anxiety and depression), however, no significant association was found for people with overweight and healthy weight. This may be because people with higher psychological distress often have dysfunctional coping strategies and consequently are more at risk of developing abnormal eating behaviours, such as emotional eating, in attempts to reduce negative mood states, and thus are at greater risk of developing obesity (Lazarevich et al., 2016).

All the studies in the current review considered emotional eating in the context of negative emotions, however, one study also explored positive emotional eating (Bourdier et al., 2020). Higher positive emotional eating was associated with lower food addiction and lower psychological distress, but only for people with overweight and healthy weight (Bourdier et al., 2020). This supports the idea that if eating behaviours increase in response to positive emotional experiences, they may not mirror maladaptive eating patterns evidenced in for example, negative emotional eating and food addiction (Sultson, et al., 2017), that increase the risk of obesity, and instead may relate to hedonic effects of food consumption to enhance positive experiences and/or emotions (for example, Burgess et al., 2014).

In contrast to people with overweight and healthy weight, Bourdier et al. (2020) found for people with obesity, all associations involving positive emotional eating were not significant; this supports existing evidence that found higher positive emotional eating was associated with lower weight status (Bourdier et al., 2017). This may be because negative emotional eaters are different to positive emotional eaters (Bongers et al., 2013a; 2013b) and further adds to the theory that the two forms of emotional eating represent different constructs (Sultson, et al., 2017). These findings highlight the need for research to explore positive emotional eating further.

All four studies that conducted mediation analysis found emotional eating acted as a mediator across four different predictor and outcome variable pairings and one exploratory serial mediation pathway (Bourdier et al., 2020; Bourdier et al., 2018; Loxton & Tipman, 2017; Nolan & Jenkins, 2019). Each pairing included two target variables of the current review; two studies included psychological distress as a predictor variable (Bourdier et al., 2020; Bourdier et al., 2018) and two included food addiction as the outcome variable (Loxton & Tipman, 2017; Nolan & Jenkins, 2019). These preliminary findings offer some evidence that emotional eating may mediate associations between psychological distress and eating behaviours.

Review question two also highlighted other variables that may contribute to food addiction. For example, Nolan and Jenkins (2019) found irrational beliefs to be associated with food addiction, but only in the context of the mediation effect of emotional eating in one pathway, and anxiety and emotional eating in the serial pathway. Irrational beliefs were not directly associated with food addiction. Namely, irrational beliefs were proposed as precipitating the psychological distress and consequently emotional eating, which resulted in food addiction (Nolan & Jenkins, 2019). Another study highlighted the role of the personality trait, reward sensitivity as a vulnerability to food addiction (Loxton & Tipman, 2017). It was proposed that people with higher reward sensitivity are more attuned to the reinforcing properties of substances, including hyperpalatable food, due to a genetic profile linked to reward responsiveness (Davis et al., 2013). This is consistent with emerging literature in the field of food addiction that has implicated other personality traits, such as impulsivity, with increased food addiction (Maxwell et al., 2020). Few studies have explored mediators for the association between reward sensitivity and food addiction, or other personality traits, and thus Loxton and Tipman, (2017) have contributed to the field highlighting that emotional eating, plus other mediators (see table two) may act as potential underlying psychological mechanisms. This calls for future research to see if this mediation effect is also evidenced in other personality traits and food addiction.

The review question also highlighted other variables that psychological distress may be predictive of, which may offer insight into addictive-like eating patterns; higher psychological distress was predictive of higher emotional eating, which is in turn predictive of increased weight status (Bourdier et al., 2018). Drawing on Bourdier et al.'s (2020) 'interoceptive blindness' theory, it is plausible that the interplay between psychological distress and emotional eating impacts on the ability to perceive internal signals about hunger and fullness

and thus promotes over-consumption, which could mirror addictive-like eating patterns. However, future research would need to explore this.

It remains unclear if emotional eating mediates the association between psychological distress and food addiction, however, the findings of the current review have offered complimentary support to this idea; firstly, the interrelated nature of the three target constructs, and secondly, emotional eating emerging as mediating associations related to psychological distress and food addiction. However, one study offered strong supporting evidence; Nolan and Jenkins (2019) found a significant indirect effect within a serial mediation analysis that included irrational beliefs, anxiety, emotional eating, and food addiction, in that order. Based on these combined findings, it is plausible that emotional eating may mediate the association between psychological distress and food addiction, with psychological distress being predictive of emotional eating, due to the negatively reinforcing properties of food intake to alleviate negative affective states (Reichenberger et al., 2020), and the rewarding properties of food could contribute to loss of control over intake and manifest in addictive-like eating patterns. It is also plausible that the interplay between psychological distress and eating patterns may affect the ability to perceive internal signals, such as hunger and satiety (Bourdier et al., 2020), which may result in increased food intake that mirrors food addiction. However, future research would need to explore this idea.

Strength, Limitations and Future Research.

The 11 studies included in this review reported consistent results for question one, however, there are some important strengths and limitations that should be considered when interpreting the findings. All 11 studies were quantitative, cross-sectional in design and used correlation analysis to explore the strength and direction of associations between the variables. Four studies also used mediation analysis to explore the underlying mechanism by which one variable influences another variable through a mediator variable. However, both correlation

and mediation analysis remain a linear statistical model, and thus causality cannot be inferred (for example, Suhr, 2006). Future research would benefit from using diverse methodologies, particularly longitudinal designs, and randomised controlled trials to increase the robustness of the findings.

All 11 studies used self-report questionnaires which rely on the subjective recall of behaviours, cognitions, and emotions; this could be considered a limitation because assessor-administered measures produce more reliable and valid findings, particularly for eating behaviours (Everett, et al., 2021) and social desirability bias with eating behaviours may also exist (Bourdier et al., 2020).

All studies included in the current review used a version of the YFAS (for example Gearhardt et al., 2009). This provides strengths in the consistency of the construct across studies, but limitations with no opportunity to compare findings using different tools, such as the AEBS (Ruddock et al., 2017). Given the contested nature of food addiction (Hebebrand et al., 2014; Ruddock et al., 2017), future research would benefit from exploring the established associations between food addiction, psychological distress, and emotional eating with a measure of addiction-like eating behaviours, such as the AEBS. If similar associations are discovered, research would also benefit from exploring the psychological mechanisms that may underpin these associations.

There is no standardised definition of emotional eating and thus it is possible the different measures of emotional eating used across the studies are measuring different constructs. Future research would benefit from proposing a standardised definition of emotional eating, so that measures can be assessed for validity to the standardised construct, and exploring the different types of emotional eating, such as positive emotional eating. However, more recently, the validity of emotional eating measures has been contested; studies have failed to find increased food consumption in response to negative affect, in self-

determined emotional eaters across lab and in naturalistic settings (Bongers & Jansen, 2016). This suggests that emotional eating may not just be about food intake in the context of affect, and instead may include a variety of eating behaviours, and thus the multifaceted nature of emotional eating requires refinement (Bongers & Jansen, 2016).

Only two studies included in the current review were published before 2017. This highlights a surge in the field and suggests the current review is well placed in time for guiding future research. However, given the speed of research emerging, the current systematic review will need to be updated soon with the potential addition of a meta-analysis to further add to the findings.

All 11 studies included in the current review used adult participants. There is a growing number of studies exploring food addiction and psychological distress with adolescents (Skinner et al., 2021), however, the author was unable to find any studies that also included a measure of emotional eating. The period of adolescence has been characterised by the onset of psychological distress (Natsuaki et al., 2009), disordered eating patterns (Favaro et al., 2019; Neumark-Sztainer et al., 2011; Slane et al., 2014), substance use (Kingston & Raghavan, 2009), and independence seeking behaviours including food choices that may include an increase of hyperpalatable foods (French et al., 2001) and irregular eating and snacking away from home (Savige et al., 2007). Therefore, this group is at a high risk for food addiction (Skinner et al., 2021). In accordance with adult studies (see Burrows et al., 2018), a recent review found food addiction and psychological distress to be associated amongst adolescents, with higher levels found in females and higher weight status (Skinner et al., 2021). However, in adult populations, the severity of food addiction is most often classified as severe, whereas Skinner et al. (2021) found food addiction severity was most often classified as mild or moderate. The severity of food addiction is evidenced to progress over time (Skinner et al., 2021); thus, future research should explore whether early indicators of food addictions are

predictive of more severe food addiction and comorbid psychological distress in adulthood, and whether emotional eating is associated with food addiction and psychological distress in this population. Skinner et al. (2021) suggested this could provide the opportunity for the development of transdiagnostic prevention and management intervention strategies.

The sample included for review lacked diversity; most studies included educated women who were Caucasian and in Western countries; this will limit how generalisable the review findings are beyond these populations. Future research would benefit from seeking diverse populations, in particular groups that are underrepresented in this current review. For example, people with underweight, because food addiction has been evidenced in this population and people with a diagnosis of anorexia nervosa (Hauck et al., 2017), yet the psychological mechanisms underpinning these associations remain unclear. Future research would also benefit from seeking male participants, as they were underrepresented in the current review, and exploring gender differences in the primary associations because psychological distress, food addiction, eating behaviours and stress-related eating all have gender differences evidenced (for example, Carr, et al., 2020; Laitinen et al., 2002; Riecher-Rössler, 2017; Schmidt, 2012). Finally, future research would benefit from seeking participants in non-Western settings because disordered eating behaviours are on the rise in non-western countries (Makino et al., 2004; Pike & Dunne, 2015), yet literature remains sparse in the context of food addiction.

Quality Assessment

The QATSDD was used to assess the quality of each study included in for review. The QATSDD does not specify a quality cut-off and thus interpretations can be subjective. Despite this, the QATSDD has good reliability and validity, but it requires sufficient knowledge and expertise to assess quality fairly and consistently and to promote consistency, the QATSDD offers a scoring guide (see appendix A). The QATSDD equally distributes scores across survey

items, thus it is possible for a study to receive a high percentage but score low on items required for a robust methodology, such as a small sample size that is not adequately powered.

The QATSDD highlighted multiple strengths of the studies in the current review, with multiple QATSDD items obtaining the maximum points across all studies, particularly surrounding the theoretical framework, statement aims and objectives, description of the research setting and data collection and fit between research question and method of data collection, which are all essential for providing a clear, thorough, reproducible, and transparent piece of research. The QATSDD also highlighted multiple limitations across the studies in the current review, for example, none of the studies evidenced user involvement in design. User involvements add a unique set of perspectives and lived experiences that can contribute meaningfully to the process (Morse, et al., 2021) and thus is important for increasing reliability and validity of research, offering an expert by experience perspective, and improving the research experience for participants, and thus should be considered in all research.

Strengths and Limitations of the Review Process

The current review specified that papers must report the outcomes of all three of the target variables, food addiction, emotional eating, and psychological distress. Other eating behaviours, such as binge eating, which is correlated with food addiction and emotional eating (for example, Barnhart et al., 2021; Gearhardt et al., 2012) were not included for review. Several studies have indicated a high prevalence of food addiction in those who meet the criteria for binge eating (Piccinni et al., 2021), thus excluding binge eating as a standalone variable from the current review may have excluded influential literature. Furthermore, irrespective of the amount or pattern of food consumption, which are some of the distinctive features of eating behaviours, it is the loss of control over consumption, the shared feature, that predicts greater levels of emotional distress, comorbid psychopathology and psychosocial impairment (Davis, 2013); therefore, combining such uncontrolled eating behaviours may

produce new insight. Future research may benefit from exploring the relationship between food addiction and binge eating and to consider binge eating in the context of the current review.

The lead author performed data extraction and quality assessment, which may result in selection bias. A second independent reviewer screened a randomly selected 10% to increase robustness and no discrepancies were documented; this indicated consistency to the selection criteria and quality assessment tool, but subjectivity and error was still possible. The review was completed in accordance with the PRISMA statement and checklist and registered on PROSPERO prospectively, so a reproducible and transparent systematic review process was available. An inclusive and comprehensive search strategy was utilised with strict adherence to the inclusion and exclusion criteria. Databases were selected to include those in Burrows et al. (2018) review and additional databases in hope to capture all relevant studies. Where associations were not published, but were referenced within the studies, lead authors were contacted to request the additional data. Despite efforts to be inclusive, it is possible that relevant studies were not identified, however, the search strategy was thorough enough that a representative sample should be captured.

Clinical Implications

Given the rise in obesity and the comorbid physical ill-health and mental ill-health, this review aimed to explore the psychological mechanisms that may contribute to the behavioural phenomenon of overconsumption, and consequently obesity, so it may inform clinical interventions and contribute to public health prevention strategies. Several clinical implications have been highlighted from the findings.

Psychological distress, emotional eating and food addiction have all been evidenced as interrelated and previous literature suggested they all contribute to the risk of obesity. Current weight management strategies typically focus on reducing dietary intake and increasing exercise (NHS, 2019), without consideration of emotion experiences and management.

Furthermore, such strategies could even contribute to obesity by inducing weight-related stigma (for example, self-blame and shame about not conforming with social norms; Pickett et al., 2020), which could result in psychological distress and increased emotional eating, which may mirror addictive-like eating patterns and consequently result in overeating and increase risk of obesity.

Treatment interventions for food addiction have been considered in a recent review (Leary et al., 2021); lifestyle modification, bariatric surgery, and medication use were evidenced as the most effective in five of nine studies (Leary et al., 2021). However, correlates of food addiction and potential precipitating factors, including psychological distress and emotional eating highlighted in the current review appeared not to be considered in interventions for food addiction. Interventions for weight loss have targeted emotional eating and have shown potential that may transfer to food addiction. Lattimore (2020) proposed an emotional eating-specific mindfulness intervention, whereby prior to attempting weight loss, the focus is to use mindfulness to address psychological factors (emotional eating) that may underpin overeating and undermine weight-loss efforts. The use of mindfulness techniques to reduce emotional eating compliments previous findings of the current review (Bourdier et al., 2020; Pidgeon et al., 2013) and could reduce the concept of 'interoceptive blindness' and consequently bring awareness to food consumption and reduce addictive-like eating patterns, however, future research would need to address this.

Conclusions

The current review aimed to systematically review the associations between food addiction, psychological distress, and emotional eating, and secondly, explore any psychological mechanisms that may underpin these associations. It confirmed previous findings and evidenced psychological distress, food addiction, and emotional eating as positively correlated and interrelated. Despite the interrelated nature of these variables,

treatment interventions developed to reduce food addiction do not target psychological distress and emotional eating. Similarly, despite food addiction, psychological distress, and emotional eating being implicated in obesity risk, NHS recommended weight loss strategies do not target these factors, and this could in part explain why long-term weight loss success is limited. Preliminary evidence suggests emotional eating may play a key role by mediating associations related to psychological distress and eating behaviours. Recent developments in weight loss interventions have focused on using mindfulness to reduce emotional eating prior to weight loss attempt and found promising findings that may contribute to the field of addictive-like eating patterns. However, future research would need to explore this. The current review highlighted limitations within the evidence base and provided directions for how to advance the field in the future.

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Chapter Two: Empirical Paper

Psychological Distress, Impulsivity, Sensation Seeking and Addiction-Like Eating Behaviours: The Mediating Role of Eating Motivations

The empirical paper will be submitted to Appetite for consideration for publication.

Abstract

Background: 'Food addiction' has been robustly associated with psychological distress (depression and anxiety) and impulsivity. Literature also indicates sensation seeking may contribute to food addiction. However, the psychological mechanisms underpinning these associations are unexplored. Specific eating motivations have been identified as individual differences that may drive consumption of palatable foods, coping and enhancement motives. It is plausible these motives may mediate the associations between psychological distress, personality traits and food addiction.

Objectives: The current study explored the relationships between psychological distress (depression and anxiety), personality traits (impulsivity and sensation seeking) and addiction-like eating behaviour, and the extent to which these associations were mediated by eating motivations (eating to cope or eating to enhance).

Design: Cross-sectional design was used. Quantitative methodology was employed to investigate the study hypotheses via web-based self-report questionnaires.

Method: A total of 436 people from the general population aged 18 years and above, and fluent in English language were recruited to a web-based survey. The following measures were used: Hospital Anxiety and Depression Scale, Barratt Impulsiveness Scale, sensation seeking subscale of the UPPS-P (Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale), Addiction-like Eating Behaviour Scale, and coping and enhancement subscales of the Palatable Eating Motives Scale. Demographic information and self-reported height and weight were also obtained to calculate body mass index. Structural equation modelling was used to test the hypotheses.

Results: A significant indirect effect of coping motives on psychological distress and addictive-like eating was found. However, no significant indirect effects were found for coping

or enhancement motives between personality traits (impulsivity or sensation seeking) and addictive-like eating.

Conclusion: The findings indicate greater levels of psychological distress are predictive of higher levels of eating to cope, which are predictive of higher levels of addictive-like eating behaviour. This emphasizes the need to consider emotion experiences and management in the development of maladaptive eating behaviours, which may also inform prevention and treatment strategies related to obesity,

Keywords: Food addiction, addiction-like eating, psychological distress, depression, anxiety, coping motives, enhancement motives, emotional eating, impulsivity, sensation seeking.

Introduction

Obesity is on the rise, and it is predicted to rise to nearly half the global population by 2030 (Dobbs et al., 2014). This is problematic given the well documented adverse health and social factors associated with obesity, such as increased mortality and morbidity (Avila, et al., 2015; Luppino et al., 2010; Public Health England, 2017; Rajan & Menon, 2017; World Health Organisation [WHO], 2020). The fundamental cause of obesity is an energy imbalance of calories consumed and expended (WHO, 2020), however, the onset and development of obesity is complex and individualised, and comprises diverse factors, including psychological, sociological, economical, and even biological (Dobbs and Manyika, 2015).

A biological basis has been proposed as contributing to the risk of obesity, in the context of distress and eating behaviours (Sominsky & Spencer, 2014). Appetite is suppressed by a corticotropin-releasing-hormone immediately after a stressful event, so that resources may be prioritised (Sominsky & Spencer, 2014). In the hours later, glucocorticoid is released to stimulate hunger and eating behaviour to replenish energy (Sominsky & Spencer, 2014). In the context of ongoing psychological distress, this adaptive process can become maladaptive, with eating behaviours being chronically stimulated, often for hyperpalatable foods, such as foods high in fat, salt and/or sugar, and thus increases obesity risk (Sominsky & Spencer, 2014).

'Food addiction', defined as excessive overeating of high-calorie food accompanied by loss of control and intense food cravings (Gearhardt et al., 2009), has emerged as contributing to overeating and obesity (Schulte & Gearhardt, 2018; de Sousa Fernandes et al., 2020). The Yale Food Addiction Scale (YFAS; Gearhardt et al. 2009; 2016) measures specific criteria related to food addiction, such as withdrawal, a persistent desire or repeated unsuccessful attempts to quit, and diminished control over consumption; it offers a continuous measure of symptomology, and a diagnosis of food addiction. The YFAS translates the Diagnostic and Statistical Manual (DSM) of Mental Disorders criteria for substance use disorders to eating

behaviour (5th ed.; American Psychiatric Association, 2013). However, evidence to support the idea that certain foods contain specific addictive substances is contested (Hebebrand et al., 2014; Ruddock et al., 2017). Thus, the transference of the DSM criteria to define food addiction is possibly too simplistic and risks dismissing environmental influences (Hebebrand & Gearhardt, 2021).

The Addiction-like Eating Behaviour Scale (AEBS) was developed as an alternative tool to quantify addictive-like patterns of eating (Ruddock et al., 2017). The measurement provided by the AEBS is more aligned to a behavioural addiction to eating, like a gambling disorder whereby similar brain reward pathways are activated, but without an addictive substance involved (Kalon et al., 2016). The AEBS provides a continuous measure of addictive-like eating that assesses core cognitive and behavioural processes underpinning addictive patterns of over-consumption. The two subscales in the AEBS, namely, enhanced drive to obtain food and poor dietary control, reflect the dual-process models of addictive disorders and overeating, that is, increased reward responsivity and diminished inhibitory control (Ruddock et al., 2018). The AEBS is positively correlated with other measures of maladaptive eating, including the YFAS (Gearhardt et al., 2009), however, it has received minimal attention in literature in comparison to the YFAS.

A reciprocal longitudinal relationship between obesity and mental ill-health is well documented (for example, Luppino et al., 2010). More recently, mental health outcomes have emerged as robust correlates of food addiction, as assessed by the YFAS (Burrows et al., 2018; Skinner et al., 2021) and emerging research has associated depression and addictive-like eating as assessed by the AEBS (Cardoso et al., 2020). Meta-analytic evidence highlighted a positive, moderate association exists between food addiction and mental health conditions, including anxiety and depression (Burrows et al., 2018). However, it is unlikely that a simple direct

association exists, and thus further exploration is warranted to explore the underpinning psychological mechanisms.

Substance-use disorders and food addiction/problematic overeating have shared behavioural features and neural underpinnings (Gearhardt et al., 2011; Pivarunas, & Conner, 2015; Schulte & Gearhardt, 2020; Tang et al., 2021). Thus, substance use literature may provide insight into patterns of problematic eating behaviours (Joyner et al., 2015). Specific motivations have been evidenced as individual differences driving the consumption of palatable foods and alcohol; coping and enhancement motives (Burgess et al., 2014; Cooper, 1994). 'Coping motives' refers to consuming food/alcohol to alleviate negative affective states and 'enhancement motives' refers to the hedonic effects of food/alcohol consumption (for pleasure and not for metabolic or physiological need) to promote positive experiences. These motives are consistent with the two major sources of reinforcement evidenced in substance use (Koob, 2004); negative reinforcement and positive reinforcement.

Coping motives positively correlate with food addiction and when compared to other motives, coping motives have the strongest association with the behavioural indicators of food addiction (Burgess et al., 2014; Joyner et al., 2015). Consistent with this, coping motives have been evidenced as the greatest risk for increased consumption, dependence and problems related to alcohol (for example, Cooper et al., 1995; Kassel et al., 2000; Merrill & Read, 2010). Thus, it is plausible that eating behaviours driven by coping motives may increase the risk of manifesting into addictive-like eating patterns.

Joyner et al. (2015) considered the association between coping motives and BMI and found food addiction to be a mediator. This suggests coping motives may increase food intake via the presence of food addiction symptoms and this may account for higher BMI (Joyner et al., 2015). However, Joyner et al. (2015) did not consider what factors led to the employment of coping motives and thus this remains unclear.

Like coping motives, emotional eating generally refers to eating in response to negative emotions to alleviate distress (Frayn & Knauper, 2018), thus emotional eating literature may inform on coping motives. Emotional eating has been evidenced as a mediator in associations related to psychological distress, uncontrolled eating behaviours, and obesity (for example, Bourdier et al., 2018; 2020; Loxton & Tipman, 2017; Nolan & Jenkins, 2019). For example, Nolan and Jenkins (2019) found a serial mediation effect of trait anxiety and emotional eating (in that order) on irrational beliefs and food addiction; irrational beliefs referring to thought patterns that increase the risk of distress (Beck, 1976). Thus, it is plausible that the association between psychological distress and food addiction, as evidenced in Burrows et al. (2018) may be mediated by coping motives. That is, when people experience psychological distress, they consume food in attempt to cope, which in turn results in lack of control and manifests as addiction-like eating. Consistent with this idea, Reaves et al. (2019) found that coping motives mediated the relationship between mental health (anxiety sensitivity and hopelessness) and unhealthy snacking.

In addition to psychological distress, personality traits have also been implicated in eating behaviours; sensation seeking, described as the desire for intense and novel experience, has been associated with the overconsumption of food, disinhibited eating behaviours, such as binge-eating, and consequently obesity (for example Fischer et al., 2008; Kelly et al., 2015). However, sensation seeking has received less attention in the context of food addiction. A recent review of five studies evidenced no association, (Maxwell et al., 2020), with just one study evidencing a negative association (VanderBroek-Stice et al., 2017). However, sensation seeking has been widely implicated in other forms of addictive behaviour, (for example, Woicik et al., 2009) and interventions that have focused on sensation seeking have reduced addictive substance use (Edalati & Conrod, 2018). These mixed findings emphasise the need to

explore further this association, and to consider underlying psychological processes that may inform on these mixed findings.

Food is increasingly being consumed for pleasure, rather than physiological need, and contributing to a rise in obesity (Lowe & Butryn, 2007). Enhancement motives, as previously described, refers to the hedonic effects of food intake (Burgess et al., 2014). Enhancement motives positively correlate with food addiction (Burgess et al., 2014); consistent with this, enhancement motives have been evidenced as increasing the risk of consumption and problems related to alcohol (for example, Cooper et al., 1995). Thus, it is plausible that eating behaviours driven by enhancement motives may increase the risk of manifesting into addictive-like eating patterns.

Joyner et al. (2015) considered the association between enhancement motives and BMI and found food addiction to be a mediator. This suggests enhancement motives may increase food intake via the presence of food addiction symptoms because of the hedonic effects of food, and this may account for higher BMI (Joyner et al., 2015). However, Joyner et al. (2015) did not consider what factors led to the employment of enhancement motives and thus it remains unclear. However, in the context of alcohol use, specific reinforcement pathways have been evidenced for specific personality traits, with sensation seeking being associated with higher alcohol consumption via enhancement motives (Woicik, et al., 2009). Thus, it is plausible that people who have greater sensation seeking may be more likely to eat to gain the hedonic effects of food consumption, which in turn results in lack of control and manifests as addiction-like eating.

The personality trait impulsivity, described as the inability to control behaviour in the face of cues for reward and/or punishment, has also been associated with the overconsumption of food, disinhibited eating behaviours, and consequently obesity (Gerlach et al., 2015; Pivarunas, & Conner, 2015). A recent review suggested impulsivity is robustly correlated with

food addiction (Maxwell et al., 2020). This may be because people with higher impulsivity have reduced inhibitory control and are less able to resist hyperpalatable foods due to an increased sensitivity to its rewarding properties (Jasinska et al., 2012; Moeller et al., 2001). However, it is unlikely a simple direct association exists, and thus further exploration is warranted to explore the underpinning psychological mechanisms. Particularly as interventions that focused on impulsivity have reduced addictive substance use (Edalati & Conrod, 2018) and disinhibited eating behaviours, such as binge-eating (Ince et al., 2021).

In the context of impulsivity and food addiction, potential mediators remain unclear, but drawing on alcohol use literature, impulsivity has been associated with consumption via both reinforcement pathways, coping and enhancement motives, as previously described (Woicik, et al., 2009). In compliment to these findings, Loxton and Tipman (2017) found emotional eating and hedonic eating mediated the association between reward sensitivity and food addiction. Reward sensitivity has been described as the tendency of people to notice and seek out rewards in their environment (Loxton & Tipman, 2017). Reward sensitivity and impulsivity share common neural pathways that contribute to the development and maintenance of addictive behaviours, including food addiction (Volkow et al., 2002; 2008, cited in Maxwell et al., 2020) Therefore, these findings may inform on the association between impulsivity and addictive-like eating (Maxwell et al., 2020). Thus, it is plausible that people who have greater impulsivity may eat to gain the hedonic effects of food consumption, and/or to reduce negative affective states, which in turn results in lack of control and manifests as addictive-like eating.

Study Aims and Hypotheses

This study aims to explore the relationship between psychological distress (depression and anxiety), personality traits (impulsivity and sensation seeking) and addiction-like eating behaviour, and the extent to which these associations are mediated by eating motivations (eating to cope or eating to enhance). With regards to the literature discussed, the following hypotheses are proposed (see Figure 2 for visual representation):

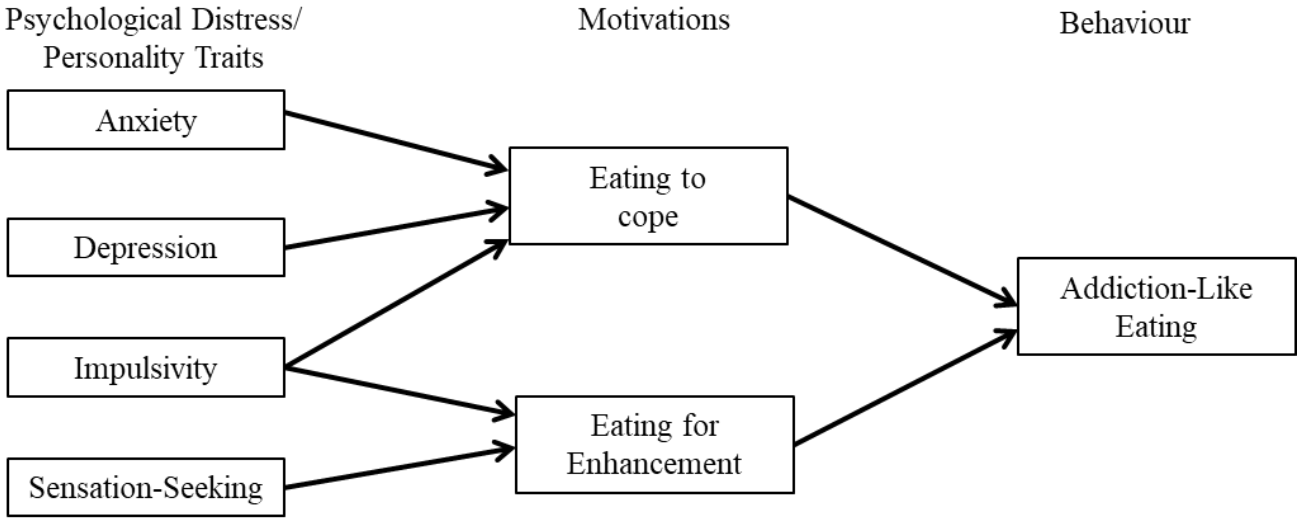
Hypothesis 1: The relationship between both depression and anxiety, and addiction-like eating behaviour will be mediated by eating motivations of coping.

Hypothesis 2: The relationship between sensation seeking and addiction-like eating behaviour will be mediated by eating motivations of enhancement.

Hypothesis 3: The relationship between impulsivity and addiction-like eating behaviour will be mediated by both coping and enhancement eating motivations.

Figure 2

Diagrammatic Representation of Hypothesized Relationships Between the Variables



Method

Participants

Recruitment took place in May 2019. Participants were recruited through online advertising via social media and by email and leaflet distribution. Participants were invited to follow a link displayed via social media, email or leaflet (Appendix K) to an information page (Appendix L) outlining the study and linking to the questionnaires. Eligibility for the study included males and females aged 18 years and above who were fluent in English. The total number of participants that began the study was 564, however, 128 participants were not included for analysis because they did not consent to participate and exited the study (N = 38), provided some demographic information but exited before beginning the questionnaires (N = 31) or had incomplete datasets (N= 59). The final sample size included for analysis was 436. See Table 4 and 5 for full descriptive statistics (N = 436).

Table 4

Demographic Information

Item	Category	Frequency (N = 436)	Percentage
Gender	Male	68	15.6
	Female	368	84.4
Age (y)	18 – 29	141	32.3
	30 – 39	168	38.5
	40 – 49	65	14.9
	50 – 59	40	9.2
	60+	22	5.1
Education	None	3	0.7
	GCSE grade D or below or equivalent	7	1.6
	GCSE grade C or above or equivalent	47	10.8
	A-level or equivalent	72	16.5
	University degree or equivalent	163	37.4
	Postgraduate qualification or equivalent	46	10.6
	Masters or equivalent	66	15.1
	PHD or equivalent	32	7.3
Income	£5,200 or less	5	1.1
	£5,200 - £10,399	7	1.6

	£10,400 - £15,599	21	4.8
	£15,600 - £20,799	17	3.9
	£20,800 - £25,999	40	9.2
	£26,000 - £36,399	74	17
	£36,400 - £51,999	110	25.2
	£52,000 - £77,999	105	24.1
	£78,000 or more	57	13.1
Employment status	Voluntary employment	3	0.7
	Employed full-time	318	72.9
	Employed part-time	70	16.1
	Unemployed and looking for work	2	0.5
	Unemployed and not looking for work	1	0.2
	Retired	9	2.1
	Student	19	4.4
	Unable to work due to health or disability	7	1.6
	Housewife/husband	7	1.6
BMI (kg/m2)	Underweight (<18.5)	11	2.5
	Healthy weight (18.5 – 24.9)	172	39.5
	Overweight (25.0 – 29.9)	115	26.4
	Obesity (30.0 – >40.0)	131	30
	Not reported/unclear	7	1.6

Note. BMI = Body Mass Index.

No notable discrepancies were observed between the 436 participants included for analysis and the 128 participants excluded for analysis; please see Appendix B for the demographic information of participants who were not included for analysis.

Table 5

Means, Medians, Standard Deviations, for Demographic Information

N = 436	**Mean**	**Median**	**SD**	**Range**
Age (y)	36.15	33	10.915	18 – 71
BMI (kg/m2) *	27.9	25.97	7.3125	16.4 – 61.8

Note. *****BMI N = 429.

Of the 436 participants, 368 (84.4%) were female and 68 (15.6%) were male. Age ranged from 18 – 71 years, with a mean age of 36.15 years (SD ± 10.915). Of the 436 participants, 172 (39.5%) were a healthy weight, 115 (26.4%) were overweight and 131 (30%) had obesity, based on the NHS (2019) BMI classifications. Of the 436 participants, 318 (72.9%) were employed full-time, 307 (70.4%) had a university degree or higher and 215 (49.3%) had an income between £36,400 - £77,999.

Design

A cross-sectional design was used. Quantitative methodology was employed to investigate the study hypotheses via web-based self-report questionnaires.

Materials

Psychological Distress: Depression and Anxiety

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a 14-item self-report questionnaire that provides a measure of anxiety and depression over the last week. Seven of the items relate to anxiety, for example, '*I feel tense or 'wound up'* and seven items relate to depression, for example, *'I feel as if I am slowed down'*. Items are scored on a 4-point scale ranging from 0 – 3; the total score for anxiety and depression is calculated independently. The HADS has been widely used in research and its psychometric properties such as sensitivity, specificity, and reliability have been found to be consistently satisfactory (for example, Bjelland, et al., 2002; Brennan, et al., 2010). The reliability for the HADS in the current study was Cronbach's alpha (a) = .762 for depression and a = .846 for anxiety.

Due to the sensitive nature of psychological distress, particular consideration was given to the measure used to minimise potential distress. The HADS is recommended by the Department of Psychology, University of Liverpool for use in research due to its lay language and low risk wording, for example, it asks about symptoms associated with anxiety and

depression over the last week, but it does not ask high risk questions and it does not use the words depression or anxiety throughout.

Personality Traits: Impulsivity and Sensation Seeking

The Barratt Impulsiveness Scale (BIS-11; Patton, et al., 1995) is a 30-item self-report questionnaire designed to assess the personality/behavioural construct of impulsiveness. For example, *'I do things without thinking'.* Items are scored on a 4-point scale ranging from 1 (rarely/never) to 4 (almost always/always). The BIS-11 has six first-order subscales (attention, motor, self-control, cognitive complexity, perseverance, cognitive instability) and three second-order subscales (attentional impulsiveness, motor impulsiveness, nonplanning impulsiveness). Scores from each subscale or a total score for impulsivity can be used. The total score was used in this study; the total score has been shown to be an internally consistent measure of impulsiveness among multiple populations (Patton, et al., 1995). The BIS-11 has been shown to have reliability and criterion-related validity across samples (Vasconcelos et al., 2012). For the current study α = .817. See Appendix D.

The sensation seeking subscale of the Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (UPPS-P; Lynam, et al., 2006) is a 12-item self-report questionnaire used to assess sensation seeking (a tendency to seek out novel and thrilling experiences). For example, '*I generally seek new and exciting experiences'.* Items are scored on a 4-point scale ranging from 1 (strongly agree) to 4 (strongly disagree); the mean score was used in this study. For the current study α = .897. See Appendix E.

Eating Motives: Coping and Enhancement

The Palatable Eating Motives Scale (PEMS; Burgess et al., 2014) assesses motivations for consuming 'tasty foods' (such as highly processed foods, such as fast foods, fried foods, sweets, and salty snacks). The 5-item coping motives subscale assesses motivations to consume food to deal with negative emotions, for example, *'I consume these foods/drinks to forget my*

worries'. Items are scored on a Likert scale ranging from 1 (Never/Almost never) – 5 (Almost always/Always) and then the mean score is calculated. For the current study α =.916. See Appendix F.

The 5-item enhancement motives subscale assesses motivations to consume tasty food to enhance positive experiences/emotions or for their inherently rewarding aspects unrelated to social situations, for example, '*I consume these foods/drinks because it's fun'.* Items are scored on a Likert scale ranging from 1 (Never/Almost never) – 5 (Almost always/Always) and then the mean score is calculated. For the current study α = .817. See Appendix G.

Addiction-Like Eating Behaviour

The Addiction-like Eating Behaviour Scale (AEBS; Ruddock, et al., 2017) is a 15-item self-report questionnaire focusing on appetitive drive and low dietary control. For example, '*I eat until I feel sick'*. Items are scored on a Likert scale ranging from 1 (Never/Strongly disagree) – 5 (Always/Strongly agree) and then the total score is calculated. The AEBS is a valid and reliable tool for quantifying the behavioural features of an 'eating addiction' and it is correlated positively with other measures of maladaptive eating, such as the YFAS and BMI (Ruddock, et al., 2017). For the current study α =.911. See Appendix H.

Demographic Information

Participants were also asked to provide demographic information, including age, gender and socio-economic status using a combination of current income on a 9-point scale (1 = < £5,200, 2 = £5,200 - £10,399, 3 = 10,400 - £15,599, 4 = £15,600 - £20,799, 5 = £20,800 - £25,999, 6 = £26,000 - £36,399, 7 = £36,400 - £51,999, 8 = £52,000 - £77,999, 9 = >£78,000), level of educational attainment on an 8-point scale (1 none, 2 GCSE grade D or below, 3 GCSE grade C or above, 4 A-level or equivalent, 5 university degree or equivalent, 6 postgraduate qualification or equivalent, 7 Masters or equivalent, 8 PHD or equivalent) and employment status on a 9-point scale (1 employed full-time, 2 employed part-time, 3

unemployed looking for work, 4 unemployed not looking for work, 5 retired, 6 student, 7 unable to work due to health or disability, 8 housewife/husband, 9 voluntary employment); these three factors can be an indication of socio-economic status (Cederberg et al., 2009). Weight (st/kg) and height (ft/cm) information was also collected so body mass index (BMI) could be calculated; self-reported height and weight can be a valid method of collecting BMI data (Pursey et al., 2014; Ng et al., 2011). See Appendix I.

Procedure

Prior to obtaining ethical approval, multiple opportunities were made available by the University of Liverpool to consult with members of an expert by experience group (people with lived experience of clinical psychology services). The expert by experience group was consulted regarding the study design and focus, and to explore potential ethical concerns and promote a better participant experience. In addition, prior to recruitment, a member of a private weight management group was consulted for feedback on completing the study online and on the overall participant experience.

Ethical approval was granted from the University of Liverpool on 21/02/2019 (ref: 3928; please see Appendix J for ethical approval acceptance confirmation letter). Data were collected using web-based questionnaires via Qualtrics (www.qualtrics.com). Potential participants were provided with an information sheet online that outlined that participation is voluntary, the nature of the study and what would be required of them. Participants were provided with the contact details for the researcher and supervisor, should any questions arise about potential participation. Potential participants were informed that their responses would confidential and anonymous and that they have the right to stop completing the questionnaires at any point. Potential participants were informed that once they submit their data, it would not be possible to withdraw it from the study because it would be stored anonymously. Participants

were asked to tick a box to give consent to participate and to acknowledge that participation is voluntary.

Participants were asked to provide demographic information, followed by the five study questionnaires, which were presented in a randomised order to reduce bias. Participants were also given the option to provide their email address to be entered into a prize draw for the chance of winning one of three £80 in Amazon vouchers, as reimbursement for taking part in the study. A separate survey was set up on Qualtrics to capture email addresses to maintain anonymity. Participants were informed that this information would be collected for the sole purpose of selecting winners for the prize draw, would be kept separate from their questionnaire responses and that their email address would be deleted once the winners were selected.

Ethical Considerations

Participants who responded to the study advert (see Appendix K) were provided with an information sheet (see Appendix L) and had to provide informed consent prior to starting questionnaires (please see Appendix M). Participants were informed that their anonymity and confidentiality would be upheld and were advised of their rights to withdraw. A full debrief letter was provided to every participant that started the study, which included the contact details for the researchers and information on how to access support from local NHS and community providers (please see Appendix N).

Statistical Analysis

Descriptive and inferential statistics were utilised for data analysis. Pearson's correlation coefficients between the main variables of interest were computed. Structural equation modelling (SEM) was used to explore the study hypotheses using analysis of moment structures (AMOS) version 27 (Arbuckle, 1989; 2011) The Maximum Likelihood method was used to estimate the parameters of the hypothesised model (Hu & Bentler, 1998;1999). To

describe the statistical significance of the specific relationships within the SEM, standardised direct effects are reported (see Table 8). Bias corrected bootstrapping was used to explore the statistical significance of the hypothesized indirect associations between the predictor variables (anxiety, depression, impulsivity, and sensation seeking) and the outcome variable (addiction-like eating behaviours), when mediated by eating motives (eating to cope and/or enhance); unstandardised indirect effects are reported (Table 8).

Based on a conservative anticipated effect size for the structural model of .2 and 90% power with alpha =.025, the proposed model of seven observed variables required 400 participant to ascertain model structure. This estimate was produced using the calculations described by Cohen (1988) and Westland (2010). The sample size included this study was N=436 indicating that the SEM analysis was adequately powered.

Additional Mediation Analysis

Due to the limited information regarding indirect effects produced using SEM for model pathways with multiple mediators (hypothesis 3), PROCESS (Preacher and Hayes, 2004) was available to follow up if a significant indirect effect was found. Hypothesis 1 and 2 only passed through one mediator in the structural model and thus the direct and indirect effects were available using SEM.

Results

Descriptive Statistics

Mean descriptive statistics for all variables are presented in Table 6.

Table 6

Descriptive statistics for all variables.

N = 439	Mean	Median	SD	Range	Min to Max survey range
Anxiety	8.83	8	4.21	0 - 20	0 - 21
Depression	4.69	4	3.28	0 - 16	0 - 21
Sensation seeking	2.58	2.58	.69	1 - 4	1 - 4
Impulsivity	62.47	61	10.18	35 - 99	30 - 120
Addictive-like Eating	44.32	44	10.24	17 - 71	15 – 75
Coping	2.18	2	1.02	1 - 5	1 - 5
Enhancement	2.33	2.2	.91	1 - 5	1 - 5

Note. SD = standard deviation; Min = minimum; Max = maximum.

When compared to normative or recent non-clinical samples, participants in this study scored similar ranges across all measures, except for the HADS Anxiety scale, whereby participants in the current study scored higher (mean 8.83, SD = 4.21, borderline abnormal range), indicating higher levels of anxiety than a normative population (mean 6.14, SD = 3.76, normal range; Crawford et al., 2001). See Appendix O for comparisons with normative/other non-clinical populations.

Correlation Analysis for All Variables

Pearson's correlation coefficients were calculated for all study variables, in addition to BMI and are presented in Table 7

Table 7

Correlations

	1	2	3	4	5	6	7	8
1 Anxiety								
2 Depression	.551**							
3 Sensation seeking	-.087	-.164**						
4 Impulsivity	.241**	.266**	.172**					
5 Addictive-like Eating	.277**	.413**	-.093	.209**				
6 Coping Motives	.315**	.318**	-.091	.089	.514**			
7 Enhancement Motives	.056	.011	.019	-.007	.376**	.465**		
8 Body Mass Index	.059	.274**	-.096	.034	.442**	.325**	.111	

Note. ** p<0.001; Only values p<.002 were considered statistically significant.

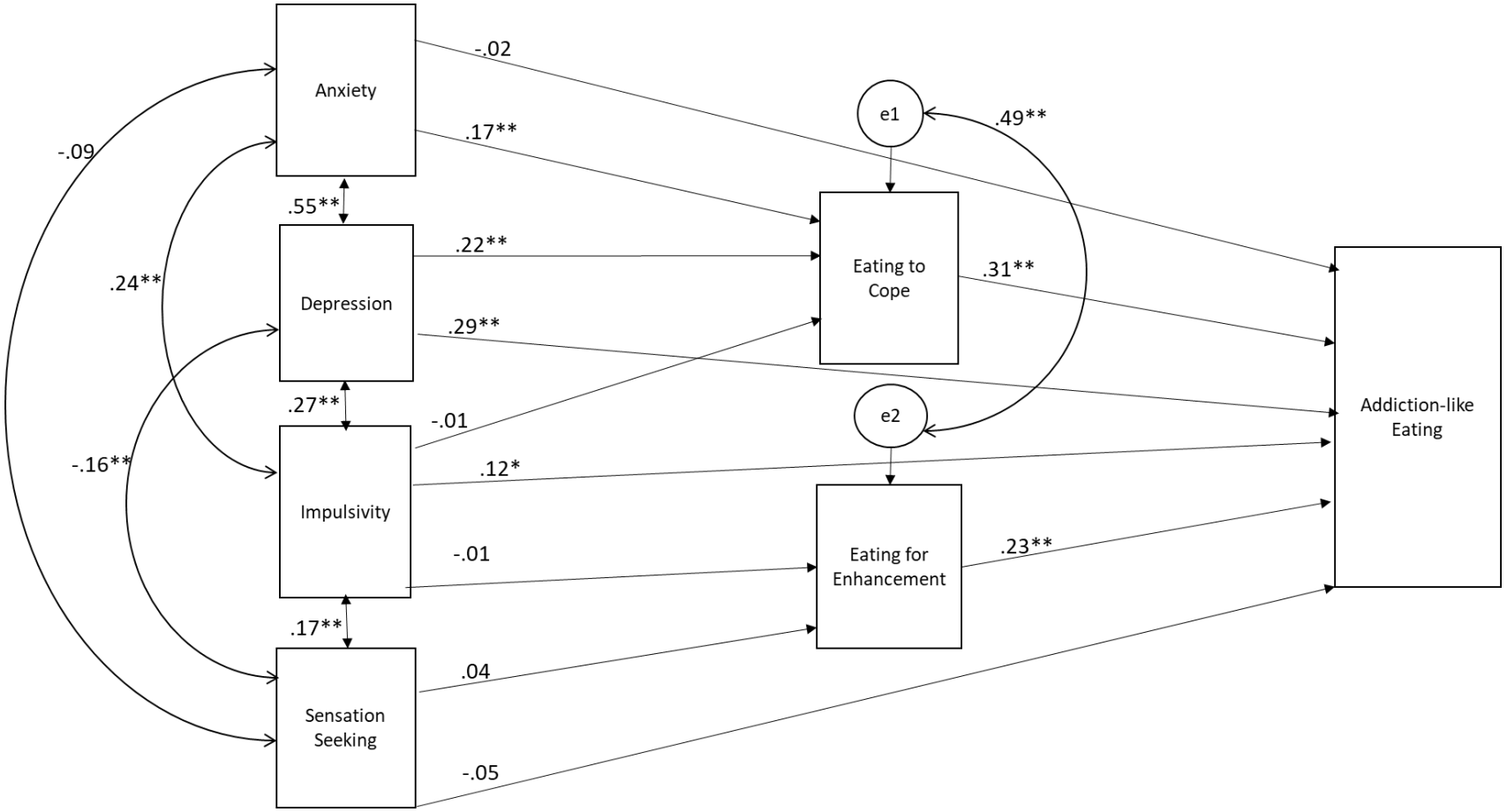
Structural Equation Modelling Analysis

SEM was used to test the proposed theoretical model whereby coping and/or enhancement motivations mediate the relationships between the predictor variables: anxiety, depression, sensation seeking and impulsivity, and the outcome variable: addiction-like eating behaviour. The Maximum Likelihood method was used to estimate the parameters of the hypothesised model. The first model fit was not acceptable, as shown by the following criteria: root mean square error of approximation (RMSEA) = .258 (must be less than .06 for good fit; Hu & Bentler, 1999), Standardized Root Mean Square Residual (SRMSR) = .0949 (must be less than .08 for good fit; Akinyode, 2016); comparative fit index (CFI) = .808 (must be greater than .95 for very good fit; Hu & Bentler, 1998;1999) and Bollen-Stine bootstrap p = .001 (must be non-significant; Hu & Bentler, 1998;1999). Only one correlation between residuals was required (as suggested by the modification indices) to improve the model fit; this was between the two subscales of the PEMS; coping and enhancement. Following this amendment, the model fit indices were good as demonstrated by the following criteria: RMSEA = .000; SRMSR = .0171; CFI = 1.000; NFI = .996 and Bollen-Stine bootstrap p = .467.

Figure 3 presents the SEM Path Diagram, which includes standardised regression slopes for direct effects and indirect effects. Full details of the unstandardised direct effects and indirect effects are presented in Table 8. For full details of the standardized estimates, please see Appendix P.

Figure 3

SEM Model Path Diagram



Note: Standardised estimates are provided. Standardised regression slopes for direct effects are represented by single-headed arrows. Correlations between variables and residuals (e1 and e2) are illustrated by curved double-headed arrows**.**

Table 8

Unstandardised Direct Effects and Indirect Effects

Significant results *Italicised;* *** p<0.001; ** p<0.01; * p<0.05

H	Effect type	Model Pathways Tested	B (S.E.)	p	CI (90%)
H1a	Direct	*Anxiety → Coping*	*.041** (.011)*	*.003*	*.019 - .064*
		Coping → AEB	*3.081** (.463)*	*.002*	*2.201 - 4.055*
		Anxiety → AEB	-.058 (.112)	.654	-.263 - .195
	Indirect	*Anxiety → Coping → AEB*	*.126** (.041)*	*.002*	*.056 - .220*
H1b	Direct	*Depression → Coping*	*.067** (.015)*	*.002*	*.034 - .097*
		Coping → AEB	*3.081** (.463)*	*.002*	*2.201 - 4.055*
		Depression → AEB	*.894** (.148)*	*.002*	*.581 - 1.209*
	Indirect	*Depression → Coping → AEB*	*.207*** (.059)*	*.001*	*.107 - .337*
H2	Direct	Sensation seeking → Enhancement	.056 (.057)	.385	-.058 - .173
		Enhancement → AEB	*2.622** (.483)*	*.002*	*1.566 - 3.681*
		Sensation seeking → AEB	-.676 (.584)	.286	-1.950 - .547
	Indirect	Sensation seeking → Enhancement → AEB	.148 (.164)	.358	-.139 - .483
H3	Direct	Impulsivity → Coping	-.001 (.005)	.778	-.010 - .007
		Impulsivity → Enhancement	-.001 (.004)	.759	-.011 - .008
		Coping → AEB	*3.081** (.463)*	*.002*	*2.201 - 4.055*
		Enhancement → AEB	*2.622** (.483)*	*.002*	*1.566 - 3.681*
		Impulsivity → AEB	*.121** (.040)*	*.008*	*.033 - .205*
	Indirect	Impulsivity → Coping and Enhancement → AEB	-.006 (.022)	.802	-.050 - .039

Notes: H = Hypothesis; CI = Confidence Intervals; AEB = Addiction-like eating behaviour.

Covariates – Gender Differences

Gender was added to the structural model as a covariate because gender differences have been evidenced in food addiction, emotional eating, and psychological distress (for example Boudier et al., 2018), however, it did not impact on the significance levels of the results and the hypothesised model (AIC= 52.639, BIC=154.580) was superior to the model which controlled for gender (AIC= 68.366, BIC=202.928). Please see Appendix Q for the model including gender as a covariate.

Summary of Direct and Indirect Effects

Hypothesis 1: The Relationship Between Both Depression and Anxiety, and Addiction-like Eating Behaviour Will Be Mediated by Eating Motivations of Coping

Hypothesis 1 included two separate pathways in the structural model; these will be summarised individually.

Pathway with Anxiety as the Predictor Variable

Direct Effects. The direct effect of anxiety on addictive-like eating was not significant, however, a significant direct effect was found for the following; anxiety on eating to cope, and eating to cope on addictive-like eating.

Indirect Effects. A significant indirect effect of eating to cope on anxiety and addictive-like eating was found. Thus, as predicted in hypothesis 1, eating to cope appears to mediate the relationship between anxiety and addictive-like eating. Given that the direct effect of anxiety on addictive-like eating was not significant, this indicates that the mediator was at least in part responsible for the significant indirect effect.

Pathway with Depression as the Predictor Variable

Direct Effects. A significant direct effect of depression on addictive-like eating, and depression on eating to cope was found. A significant direct effect of eating to cope on addictive-like eating was also found.

Indirect Effects. A significant indirect effect of eating to cope on depression and addictive-like eating was found. Thus, as predicted in hypothesis 1, eating to cope appears to mediate the relationships between depression and addictive-like eating.

Hypothesis 2: The Relationship Between Sensation Seeking and Addiction-like Eating Behaviour Will Be Mediated by Eating Motivations of Enhancement

Direct Effects. The direct effect of sensation seeking on eating for enhancement, and sensation seeking on addictive-like eating was not significant. However, a significant direct effect of eating for enhancement on addictive-like eating was found.

Indirect Effects. The indirect effect of eating for enhancement on sensation seeking and addictive-like eating was not significant. Thus, in contrast to hypothesis 2, the mediation effect of eating for enhancement on sensation seeking and addictive-like eating was not found.

Hypothesis 3: The Relationship Between Impulsivity and Addiction-Like Eating Behaviour Will Be Mediated by Both Coping and Enhancement Eating Motivations.

Direct Effects. The direct effect of impulsivity on both coping motives (eating to cope and eating for enhancement) was not significant. However, a significant direct effect of impulsivity on addictive-like eating was found. Finally, a significant direct effect of both coping motives (eating to cope and eating for enhancement) on addictive-like eating was found.

Indirect Effects. The indirect effect of eating to cope and eating for enhancement on impulsivity and addictive-like eating was not significant. Thus, in contrast to hypothesis 2, eating to cope and eating for enhancement did not mediate the relationship between impulsivity and addictive-like eating. Due to the insignificant overall indirect effect, there was no need to further decompose this using the statistical package PROCESS, as originally intended.

Discussion

Summary of Main Findings

The present study explored the relationship between psychological distress (depression and anxiety), personality traits (impulsivity and sensation seeking), and addiction-like eating behaviour, and the extent to which these associations are mediated by eating motivations (eating to cope with negative emotions or eating to enhance positive emotions).

Summary of Findings Related to Hypothesis 1

As predicted in hypothesis 1, a mediation effect of coping motives on the associations between psychological distress and addictive-like eating was found. This suggests greater levels of psychological distress are predictive of higher levels of eating to cope, which are predictive of higher levels of addictive-like eating behaviour. This is consistent with previous findings on psychological distress, uncontrolled eating behaviours, and obesity (Bourdier et al., 2018; 2020; Nolan & Jenkins, 2019). Specifically, these findings extend Joyner et al.'s (2015) study, with psychological distress being implicated as the mechanism driving coping motives. However, this would need to be explored in a serial mediation; specifically assessing the mediation effect of coping and food addiction (in that order) on psychological distress and BMI.

Previous research can be drawn on to offer insight into hypothesis 1. Bourdier et al. (2020) described an 'interoceptive blindness', that is, the interplay between negative affect and eating patterns that is theorised to impact on the ability to perceive internal signals, such as hunger and satiety. Bourdier et al. (2020) suggested this can lead to non-nutritional eating and thus increases risk of obesity. In the context of hypothesis 1, it is plausible that a vicious circle is at play, whereby the interplay between psychological distress and eating to cope affects the perception of internal signals of satiety. This may lead to increased intake of

food/loss of control that manifests as addictive-like eating behaviours. However, future research would need to explore this.

Learning theories (for example, Booth, 1994, cited in Macht & Simons, 2011) may further offer insight into hypothesis 1 and why the transition from occasional overconsumption to addictive-like eating may occur (Kalon et al., 2016). Operant conditioning may occur when food is consumed to cope with psychological distress, and it is the negatively reinforcing properties of food that will increase the likelihood of the behaviours recurring. Thus, it is plausible that eating in response to coping motives mirrors addictive-like eating patterns. However, it is also possible that the repeated pairing of eating in the context of psychological distress results in a classical conditioning effect, whereby psychological distress triggers eating behaviours, such as cravings to eat (Reichenberger et al., 2020), which could contribute to addictive-like eating patterns.

Depression and anxiety were directly associated with coping motives; supporting the idea that food is consumed in response to psychological distress to alleviate the distress (for example, Bennett et al., 2013; Frayn and Knauper, 2018; Limbers & Summers, 2021). Coping motives were directly associated with addictive-like eating; this supports the idea that eating in the context of coping motives may increase the risk of cognitive and behavioural processes associated with addictive-like eating (Burgess et al., 2014; Joyner et al., 2015 Reaves et al., 2019).

The direct effect of psychological distress on addictive-like eating were mixed; depression was directly associated with addictive-like eating, however, anxiety was not; these findings compliment and contrast with previous literature. Depression and anxiety have been robustly correlated with food addiction in two recent systematic reviews (Burrow et al., 2018; Skinner et al., 2021), however, the range of severity of depression and anxiety was not reported within these reviews. A recent study with 69.2% of participants meeting the criteria

for depression found depression to be correlated with addictive-like eating (Cardoso et al., 2020). However, in the context of mediation analysis, a recent study found depression and trait anxiety were not directly associated with food addiction (Nolan and Jenkins, 2019); the severity of anxiety and depression was not specified, but based on normative samples (Addolorato et al., 1999; Knight et al., 1983), anxiety scores reflected clinically significant symptoms, and depression scores were in the normal range (Zung, 1965). The mixed findings could, to some extent, be explained by the severity of distress. For some people, severe anxiety and depression reduces eating behaviours, such as appetite (Polivy & Herman, 2005). In the current study, depression scores were comparable to a normative sample and in the normal range (Crawford et al., 2001). However, anxiety scores in the current study were higher than a normative sample and in the borderline abnormal range (Crawford et al., 2001; see appendix O). Thus, it is plausible that in the current study, increased anxiety may have to some extent, reduced eating behaviors, with the association between anxiety and addictive-like eating only becoming significant via the mediator, eating to cope. Another factor that may have contributed is that depression is most strongly associated with disordered eating patterns (Masheb & Grilo, 2006), whereas anxiety is more strongly associated with increased preferences for hyperpalatable foods (Yannakoilia et al., 2008), and thus increased preferences for hyperpalatable foods may not have been captured as well by the AEBS.

Summary of Findings Related to Hypothesis 2

In contrary to the predictions in hypothesis 2, eating for enhancement did not mediate the association between sensation seeking and addictive-like eating.

In compliment to previous findings (Maxwell et al., 2020), sensation seeking was not directly associated with addictive-like eating. In contrast to previous findings on motivation models for substance use and personality traits (Woicik et al., 2009), sensation seeking was not directly associated with eating for enhancement. This may represent a difference in

considering sensation seeking in the context of addictive-like eating and substance use, however, further research would need to explore this.

As described, sensation seeking was not directly associated to any of the eating behaviour variables in the model path; this may reflect the measurement tool used (Pivarunas, and Conner, 2015). All the studies in Maxwell, et al. (2020), and the current study used the sensation seeking subscale of the UPPS-P (Lynam, et al., 2006). This subscale focuses on specific risky/thrill seeking activities, such as, fast driving and parachute jumping, with little attention on general interest in novelty and risk-taking; thus, scores may reflect these specific interests and not adequately capture sensation seeking (Pivarunas, & Conner, 2015). However, through the UPPS-P, one previous study did find a negative association between sensation seeking and food addiction (VanderBroek-Stice et al., 2017), and sensation seeking has been associated with other disinhibited eating behaviours, such as binge eating (for example, Kelly et al., 2015). These conflicting findings warrant further exploration; it may be useful to examine the specific role of sensation seeking in food addiction/addictive-like eating through the development of a more construct-relevant measure (Pivarunas, & Conner, 2015).

Enhancement motives were directly associated with addictive-like eating. This supports the idea that eating in the context of enhancement motives to obtain the hedonic effects of food consumption (Lowe & Butryn, 2007), may increase the risk of cognitive and behavioural processes associated with addictive-like eating (Burgess et al., 2014; Joyner et al., 2015; Reaves et al., 2019). However, enhancement motives may not be as predictive of obesity risk as coping motives because overeating is not always associated with increased positive emotions/experiences (Mela, 2006). Instead, consumption may increase psychological distress and result in increased guilt and shame (Craven, & Fekete, 2019).

Summary of Findings Related to Hypothesis 3

In contrary to the predictions in hypothesis 3, eating motives (coping and enhancement) did not mediate associations between impulsivity and addictive-like eating.

In compliment to previous findings (Maxwell et al., 2020), impulsivity was directly associated with addictive-like eating, indicating that impulsivity does contribute to addictive-like eating. This may be due to reduced inhibitory control and increased reward responsiveness evidenced in impulsivity (Jasinska et al., 2012; Moeller et al., 2001), which could result in increased eating behaviours, mirroring addictive-like eating. However, the psychological mechanisms underpinning and motivating this relationship remains unclear.

In contrast to previous findings (Woicik et al., 2009), impulsivity was not directly associated with eating to cope or eating for enhancement. This may represent a difference in considering impulsivity in the context of addictive-like eating and substance use, however, further research would need to explore this. The direct associations of eating to cope and eating for enhancement on addiction-like eating was as previously described in hypothesis 1 and 2.

Clinical Implications

A recent systematic review considered current interventions for reducing food addiction symptoms (Leary et al., 2021); interventions spanned bariatric surgery, medication use, lifestyle modification and behavioural (food-specific inhibition training). Five of nine studies evidenced some potential for reducing food addiction symptoms, with lifestyle modification, medication use, and bariatric surgery evidenced as the most effective; however, the long-term effectiveness remains unclear (Leary et al., 2021). In the context of the current study, intervention success rates may improve if they also considered psychological predictors of food addiction, including psychological distress, motivations driving food consumption, and impulsivity.

In the context of psychological distress, interventions may benefit from targeting the development of helpful coping strategies, such as, distress tolerance skills (Swales et al., 2020), alongside nutritional education throughout the education system (Lazarevich et al., 2016). This may increase resilience and in the context of distress, adaptive coping strategies may be employed (Lazarevich et al., 2016), which may reduce maladaptive eating patterns and as a result, reduce risk of obesity. This is particularly important because people with higher depression often have dysfunctional coping strategies, such as abnormal eating behaviours, and are consequently at greater risk of developing obesity (Lazarevich et al., 2016).

In the context of maladaptive eating behaviours, such as eating to cope and addictive-like eating patterns, specific interventions such as emotional eating-specific mindfulness intervention (Lattimore, 2020) may be an effective approach. This approach aims to address psychological factors (such as mindless eating to reduce affective states) that may underpin overeating (Lattimore, 2020). This intervention could be particularly useful for reducing 'interoceptive blindness' (Bourdier et al., 2020) that may contribute to the findings for hypothesis 1, by bringing conscious awareness into eating behaviour; however, future research would need to consider this.

In the context of impulsivity, interventions that target subconscious processes that may contribute to 'mindless eating' and a lack of control may benefit from being considered in the context of addictive-like eating, for example (Cooper et al., 2010). Specifically, interventions that aim to decrease neural pathways of reward responsiveness and promote cognitive and behavioural control by bringing awareness to eating behaviours (Dickenson et al. 2013, Oğuz et al. 2016; Wansink & Chandon 2014) may contribute to reducing the risk of addictive-like eating pattern, however, future research would need to consider this.

The current study emphasizes that emotional experiences are implicated in maladaptive eating behaviours, which increase obesity risk. Thus, it is plausible that current obesity treatment strategies that focus on diet and exercise only (NHS, 2019) without consideration for emotional experiences, could contribute to the limited success of long-term weight loss (De Lorenzo., 2020). Furthermore, current obesity treatment strategies may even contribute to the rise in obesity, for example, by inducing weight-related stigma in the context of not conforming to social norms and associated shame and self-blame, and thus increasing eating behaviour as a form of coping (Pickett et al., 2020).

Given the overlap in food addiction and other forms of addictive behaviour, applying therapeutic interventions from other areas of addiction, such as cognitive behavioural therapy (CBT) to the concept of food addiction, may be an appropriate treatment strategy (Dimitrijević et al., 2015). Despite this idea, little is known about a CBT model of food addiction/addictive-like eating/uncontrolled eating/loss of control of eating, as separate from eating disorders; this is likely because CBT models are generally diagnostic based. Similarly, CBT is suggested as an appropriate intervention for binge eating, yet little is known about a cognitive model for binge eating (Young and Cooper, 2013). From a clinical perspective, CBT assumes that through the presence of negative automatic thoughts (NATs), maladaptive maintenance cycles persist, driven by the interplay of maladaptive cognitions, affect and subsequent behaviours (Beck, 2011; Kennerley, et al., 2016). Regarding hypothesis 1, it is possible these associations could be considered in terms of a ‘vicious cycle’ in CBT, for example, a NAT/triggering event may occur that results in low mood/depression. In attempt to cope, eating behaviour occurs (maladaptive coping strategy), and this could result in loss of control that mirrors addictive-like eating. The negative reinforcing effect may initially improve mood, but later, it may produce feelings of shame and guilt associated with

overconsumption, which may lead to a further increase of for example, depression, and later, additional eating attempts to reduce distress (Craven & Fekete, 2019), and the cycle persists.

Strengths, Limitations and Future Research

The large sample size with a BMI range that is representative of the ratio of people with overweight and obesity in England (68% of men and 58% women, Public Health England, 2017) and globally (50% of men and 55% of women, WHO, 2020) at 56.4% in the current study adds to the generalisability of the study. However, the sample did lack diversity (predominantly women, who had completed higher education and in full time employment); this will limit how generalisable the review findings are beyond these populations. Future research would benefit from seeking diverse populations, in particular groups that are underrepresented in this field. For example, seeking a predominantly male sample because previous research has suggested gender difference exist for addictive-like eating**,** unhealthy eating behaviours and stress-related eating (Carr, et al., 2020; Laitinen et al., 2002; Schmidt, 2012). When the current study controlled for gender within the structural model, it did not impact on the significance of the results, however, only 15.6% of participants were male and thus any gender differences may have been too small to detect in the structural model. Future research would also benefit from seeking people who are underweight because addictive-like eating has been evidenced in people with underweight and those who meet the criteria for anorexia nervosa (Hauck et al., 2017), however the psychological mechanisms underpinning these associations remain relatively unexplored. Disordered eating behaviours were historically considered a western issue; however, evidence suggests they have risen in non-western countries (Makino et al., 2004; Pike & Dunne, 2015). Despite this, research exploring food addiction and psychosocial correlates in non-western countries remains sparse. For example, in the Burrows et al. (2018) review, only two of 51 studies were in non-western settings (Ahmed et al., 2016; Tang & Koh, 2017). The current study was online and

thus geographically open, but the study was advertised online in western settings, therefore, future research would benefit from exploring the associations in the current study in non-western countries. However, cultural background is not geographically situated, and thus just considering western and non-western similarities/differences risks dismissing how certain food traditions and eating behaviours can be intergenerationally preserved across migration (Calandre, & Ribert, 2019). The current study did not capture ethnicity, and this limits how generalisable the findings are in the context of cultural diversity. Future research would benefit from capturing ethnicity, so that the associations found in the current paper could be considered in the context of cultural background.

The SEM model was adequately powered (for example, Cohen, 1988; Westland, 2010) and produced some significant findings that could have meaningful clinical implications. However, the current study remains a linear statistical model, and thus due to the cross-sectional nature, causality cannot be inferred (Suhr, 2006) and the findings should be interpreted in this context. However, SEM differs from, for example, correlation analysis and offers additional strengths, for example, the SEM model was rooted in theory to support hypotheses, as the model required relations between variables to be specified prior, including latent variable, so that the formal specification of the model could be estimated and tested (Suhr, 2006). However, future research would benefit from using diverse methodologies, including longitudinal designs to increase the robustness of the findings.

The current study was able to access a large sample size in a relatively short time and a potentially wide geographical range, however, online methods have received mixed findings regarding validity and reliability when compared to face-to-face recruitment (Hewson & Charlton, 2005; Szolnoki & Hoffmann, 2013; Szolnoki, et al., 2019). Online methods may also represent a bias regarding the type of participants who access studies, such as excluding those who do not access the internet. Studies involving eating behaviours have highlighted

assessor-administered measures produce more reliable and valid findings over self-report measures (Everett, et al., 2021). Thus, the use of self-report questionnaires could be considered a limitation, particularly because they involve subjective recall of behaviours, cognitions, and emotions, and/or a potential social desirability bias that can occur with eating behaviours (Bourdier et al., 2020).

Self-report measures of impulsivity have been criticised for having limited face validity, due to the insight required for subjective recall of thoughts, feelings and behaviours (for example, Haeffel & Howard, 2010). Furthermore, due to the combined assessment of impulsive behaviours overtime, self-report measures have limited ability to predict state occurrences of impulsive action (Cyders & Coskunpinar, 2011). However, self-report measures of impulsivity remain the most used method to assess impulsivity in research (Emery & Levine, 2017). Future research may benefit from using behaviour task measures to assess impulsivity, which may overcome some of the psychometric challenges in self-report measures (Emery & Levine, 2017). Behaviour task measures provide a measurement of state variability in impulsive action that is considered to capture trait characteristics of impulsivity (Emery & Levine, 2017). However, behaviour task measures occur in controlled laboratory settings and thus their generalizability to naturalistic settings is unclear (Emery & Levine, 2017). Behaviour task measures may also lack specificity and measure multiple concurrent processes, such as impulsivity, attention, and memory, and be unable to determine what factors influenced the findings (Dougherty et al., 2002). Furthermore, there is limited convergence between the two methods of measuring impulsivity (see Emery & Levine, 2017) and thus future research may benefit from considering how the seemingly related but multi-factorial traits of impulsivity impact on addictive-like eating behaviour.

The current study consulted experts by experience in the design of the study, however, experts by experience were not included in the delivery or interpretation of the findings.

Future research would benefit from utilising experts by experience consultants in the development of a more construct-relevant measures, particularly for sensation seeking, and in all aspects of research design and delivery, so importantly, their unique set of perspectives and lived experiences can contribute meaningfully to the process (Morse, et al., 2021).

Conclusions

The current study found that coping motives mediated the association between psychological distress (anxiety and depression) and addictive-like eating. This suggests that people with higher depression and anxiety, who are motivated to eat to cope to reduce negative affective states, may be at an increased risk of eating behaviours manifesting into addictive-like eating patterns. These findings highlight the need to consider emotion experiences and management in the development of prevention and treatment strategies related to obesity. However, it is important to acknowledge these findings are produced from a predominantly female, well-educated sample, although the age and BMI range was widespread.

Eating motives did not mediate the associations between personality traits (impulsivity or sensation seeking) and addictive-like eating. However, impulsivity was directly associated with addictive-like eating and thus further exploration is needed to explore the underpinning psychological mechanisms, so they may inform treatment strategies.

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Appendices

Appendix A: Scoring guide for the Quality Assessment Tool for Studies with Diverse Designs

Appendix B: Demographic information of participants excluded for analysis

Appendix C: Measures

Hospital Anxiety and Depression Scale

Appendix D: Barratt Impulsiveness Scale

Appendix E: Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale

Appendix F: Palatable Eating Motives Scale; Coping Motives Subscale

Appendix G: Palatable Eating Motives Scale; Coping Motives Subscale

Appendix H: Addiction-like Eating Behaviour Scale

Appendix I: Demographic and Body Mass Index Information Collected

Appendix J: Ethical approval acceptance confirmation letter

Appendix K: Study advert

Appendix L: Participant Information Sheet

Appendix M: Consent form

Appendix N: Debrief leaflet

Appendix O: Comparisons of measures with normative/other non-clinical populations

Appendix P: Unstandardized estimates

Appendix Q: SEM including gender as a covariate

Appendix A

Scoring guide for the Quality Assessment Tool for Studies with Diverse Designs

Table 1 Quality assessment tool and scoring guidance notes

Criteria	0 = Not at all	1 = Very slightly	2 = Moderately	3 = Complete
Explicit theoretical framework	No mention at all.	Reference to broad theoretical basis.	Reference to a specific theoretical basis.	Explicit statement of theoretical framework and/or constructs applied to the research.
Statement of aims/objectives in main body of report	No mention at all.	General reference to aim/objective at some point in the report including abstract.	Reference to broad aims/objectives in main body of report.	Explicit statement of aims/objectives in main body of report.
Clear description of research setting	No mention at all.	General description of research area and background, e.g. 'in primary care'.	General description of research problem in the target population, e.g. 'among GPs in primary care'.	Specific description of the research problem and target population in the context of the study, e.g. nurses and doctors from GP practices in the east midlands.
Evidence of sample size considered in terms of analysis	No mention at all.	Basic explanation for choice of sample size. Evidence that size of the sample has been considered in study design.	Evidence of consideration of sample size in terms of saturation/information redundancy or to fit generic analytical requirements.	Explicit statement of data being gathered until information redundancy/saturation was reached or to fit exact calculations for analytical requirements.
Representative sample of target group of a reasonable size	No statement of target group.	Sample is limited but represents some of the target group or representative but very small.	Sample is somewhat diverse but not entirely representative, e.g. inclusive of all age groups, experience but only one workplace. Requires discussion of target population to determine what sample is required to be representative.	Sample includes individuals to represent a cross section of the target population, considering factors such as experience, age and workplace.
Description of procedure for data collection	No mention at all.	Very basic and brief outline of data collection procedure, e.g. 'using a questionnaire distributed to staff'.	States each stage of data collection procedure but with limited detail, or states some stages in details but omits others.	Detailed description of each stage of the data collection procedure, including when, where and how data were gathered.
Rationale for choice of data collection tool(s)	No mention at all.	Very limited explanation for choice of data collection tool(s).	Basic explanation of rationale for choice of data collection tool(s), e.g. based on use in a prior similar study.	Detailed explanation of rationale for choice of data collection tool(s), e.g. relevance to the study aims and assessments of tool quality either statistically, e.g. for reliability & validity, or relevant qualitative assessment.
Detailed recruitment data	No mention at all.	Minimal recruitment data, e.g. no. of questionnaire sent and no. returned.	Some recruitment information but not complete account of the recruitment process, e.g. recruitment figures but no information on strategy used.	Complete data regarding no. approached, no. recruited, attrition data where relevant, method of recruitment.
Statistical assessment of reliability and validity of measurement tool(s) (Quantitative only)	No mention at all.	Reliability and validity of measurement tool(s) discussed, but not statistically assessed.	Some attempt to assess reliability and validity of measurement tool(s) but insufficient, e.g. attempt to establish test–retest reliability is unsuccessful but no action is taken.	Suitable and thorough statistical assessment of reliability and validity of measurement tool(s) with reference to the quality of evidence as a result of the measures used.
Fit between stated research question and method of data collection (Quantitative)	No research question stated.	Method of data collection can only address some aspects of the research question.	Method of data collection can address the research question but there is a more suitable alternative that could have been used or used in addition.	Method of data collection selected is the most suitable approach to attempt answer the research question
Fit between stated research question and format and content of data collection tool e.g. interview schedule (Qualitative)	No research question stated.	Structure and/or content only suitable to address the research question in some aspects or superficially.	Structure & content allows for data to be gathered broadly addressing the stated research question(s) but could benefit from greater detail.	Structure & content allows for detailed data to be gathered around all relevant issues required to address the stated research question(s).
Fit between research question and method of analysis	No mention at all.	Method of analysis can only address the research question basically or broadly.	Method of analysis can address the research question but there is a more suitable alternative that could have been used or used in addition to offer greater detail.	Method of analysis selected is the most suitable approach to attempt answer the research question in detail, e.g. for qualitative IPA preferable for experiences vs. content analysis to elicit frequency of occurrence of events, etc.
Good justification for analytical method selected	No mention at all.	Basic explanation for choice of analytical method	Fairly detailed explanation of choice of analytical method.	Detailed explanation for choice of analytical method based on nature of research question(s).
Assessment of reliability of analytical process (Qualitative only)	No mention at all.	More than one researcher involved in the analytical process but no further reliability assessment.	Limited attempt to assess reliability, e.g. reliance on one method.	Use of a range of methods to assess reliability, e.g. triangulation, multiple researchers, varying research backgrounds.
Evidence of user involvement in design	No mention at all.	Use of pilot study but no involvement in planning stages of study design.	Pilot study with feedback from users informing changes to the design.	Explicit consultation with steering group or statement or formal consultation with users in planning of study design.
Strengths and limitations critically discussed	No mention at all.	Very limited mention of strengths and limitations with omissions of many key issues.	Discussion of some of the key strengths and weaknesses of the study but not complete.	Discussion of strengths and limitations of all aspects of study including design, measures, procedure, sample & analysis.

Appendix B

Demographic information of participants excluded for analysis

Item	Category	Frequency	Percentage
Gender (n = 79)	Male	16	20
	Female	63	80
	Not reported/Withdrew before question (n = 49)		
Age (n = 81)	18 – 29	32	40
	30 – 39	25	31
	40 – 49	11	14
	50 – 59	7	9
	60+	6	7
	Not reported/Withdrew before question (n = 47)		
Education (n = 82)	None	1	1
	GCSE grade D or below or equivalent	4	5
	GCSE grade C or above or equivalent	15	18
	A-level or equivalent	17	21
	University degree or equivalent	26	32
	Postgraduate qualification or equivalent	13	16
	Masters or equivalent	6	7
	PHD or equivalent	0	0
	Not reported/Withdrew before question (n = 46)		
Income (n = 82)	£5,200 or less	3	4
	£5,200 - £10,399	2	2
	£10,400 - £15,599	6	7
	£15,600 - £20,799	7	9
	£20,800 - £25,999	8	10
	£26,000 - £36,399	12	15
	£36,400 - £51,999	20	24
	£52,000 - £77,999	10	12
	£78,000 or more	14	17
	Not reported/Withdrew before question (n = 46)		
Employment status (n = 82)	Voluntary employment	1	1
	Employed full-time	61	74
	Employed part-time	13	16
	Unemployed and looking for work	2	2
	Unemployed and not looking for work	0	0

	Retired	0	0
	Student	2	2
	Unable to work due to health or disability	1	1
	Housewife/husband	2	2
	Not reported/Withdrew before question (n = 46)		
BMI (n = 71)	Underweight (<18.5)	0	0
	Healthy weight (18.5 – 24.9)	14	20
	Overweight (25.0 – 29.9)	27	38
	Obese (30.0 – >40.0)	30	42
	Not reported/Withdrew before question (n = 57)		

Note. BMI = Body Mass Index.

Appendix C

Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983)

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:
Total score: Depression (D) _____ Anxiety (A) _____
0-7 = Normal
8-10 = Borderline abnormal (borderline case)
11-21 = Abnormal (case)

Appendix D

Barratt Impulsiveness Scale (Patton, et al., 1995)

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

① Rarely/Never ② Occasionally ③ Often ④ Almost Always/Always

1	I plan tasks carefully.	①	②	③	④
2	I do things without thinking.	①	②	③	④
3	I make-up my mind quickly.	①	②	③	④
4	I am happy-go-lucky.	①	②	③	④
5	I don't "pay attention."	①	②	③	④
6	I have "racing" thoughts.	①	②	③	④
7	I plan trips well ahead of time.	①	②	③	④
8	I am self controlled.	①	②	③	④
9	I concentrate easily.	①	②	③	④
10	I save regularly.	①	②	③	④
11	I "squirm" at plays or lectures.	①	②	③	④
12	I am a careful thinker.	①	②	③	④
13	I plan for job security.	①	②	③	④
14	I say things without thinking.	①	②	③	④
15	I like to think about complex problems.	①	②	③	④
16	I change jobs.	①	②	③	④
17	I act "on impulse."	①	②	③	④
18	I get easily bored when solving thought problems.	①	②	③	④
19	I act on the spur of the moment.	①	②	③	④
20	I am a steady thinker.	①	②	③	④
21	I change residences.	①	②	③	④
22	I buy things on impulse.	①	②	③	④
23	I can only think about one thing at a time.	①	②	③	④
24	I change hobbies.	①	②	③	④
25	I spend or charge more than I earn.	①	②	③	④
26	I often have extraneous thoughts when thinking.	①	②	③	④
27	I am more interested in the present than the future.	①	②	③	④
28	I am restless at the theater or lectures.	①	②	③	④
29	I like puzzles.	①	②	③	④
30	I am future oriented.	①	②	③	④

Appendix E

Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (Lynam, et al., 2006)

UPPS

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree somewhat** circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below. Also, there are a few more questions on the next page

Sensation Seeking Subscale

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
3. I generally seek new and exciting experiences and sensations.	1	2	3	4
7. I'll try anything once.	1	2	3	4
11. I like sports and games in which you have to choose your next move	1	2	3	4
very quickly.	1	2	3	4
15. I would enjoy water skiing.	1	2	3	4
19. I quite enjoy taking risks.	1	2	3	4
21. I would enjoy parachute jumping.	1	2	3	4
25. I welcome new and exciting experiences and sensations, even if they are	1	2	3	4
a little frightening and unconventional.	1	2	3	4
29. I would like to learn to fly an airplane.	1	2	3	4
33. I sometimes like doing things that are a bit frightening.	1	2	3	4
37. I would enjoy the sensation of skiing very fast down a high mountain	1	2	3	4
slope.	1	2	3	4
42. I would like to go scuba diving.	1	2	3	4
44. I would enjoy fast driving.	1	2	3	4

Appendix F

Palatable Eating Motives Scale: Coping subscale (Burgess et al., 2014)

1. I consume these foods/drinks to forget my worries.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

4. I consume these foods/drinks because it helps me when I feel depressed or nervous.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

6. I consume these foods/drinks to cheer up when I am in a bad mood.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

15. I consume these foods/drinks because it helps to lower my stress.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

17. I consume these foods/drinks to forget about my problems.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

Appendix G

Palatable Eating Motives Scale: Enhancement subscale (Burgess et al., 2014)

7. I consume these foods/drinks because I like the feeling.

Never/Almost never	*Never/Almost never*	*Never/Almost never*	*Never/Almost never*	*Never/Almost never*

9. I consume these foods/drinks because it's exciting.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

10. I consume these foods/drinks to get “high-like” or euphoric feelings.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

13. I consume these foods/drinks because it gives me a pleasant feeling.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

18. I consume these foods/drinks because it's fun.

Never/Almost never	*Some of the time*	*Half of the time*	*Most of the time*	*Almost always/Always*

Appendix H

Addiction-like Eating Behaviour Scale (Ruddock, et al., 2017)

The Addiction-like Eating Behaviour Scale (AEBS)

HK Ruddock, P Christiansen, JCG Halford & CA Hardman. The development and validation of the Addiction-like Eating Behaviour Scale. *International Journal of Obesity* advance online publication, 8 August 2017; doi:10.1038/ijo.2017.158

	Never	**Rarely**	**Sometimes**	**Most of the time**	**Always**
1. I continue to eat despite feeling full					
2. I serve myself overly large portions					
3. I find it difficult to limit what/how much I eat					
4. I binge eat					
5. When it comes to food, I tend to over-indulge					
6. I am easily able to make healthy food choices					
7. Once I start eating certain foods, I can't stop until there's nothing left					
8. Despite trying to eat healthy, I end up eating 'naughty' foods					
9. I eat until I feel sick					
10. I continue to eat certain unhealthy foods despite being aware of their effects on my health					
	Strongly disagree	**Disagree**	**Neither agree/disagree**	**Agree**	**Strongly agree**
11. I tend NOT to buy processed foods that are high in fat, salt, & sugar					
12. I don't eat a lot of high fat/sugar foods					
13. I believe I have a healthy diet					
14. I don't tend to overeat					
15. I feel unable to control my weight					

Appendix I

Demographic and Body Mass Index Information Collected

Gender ○Male ○Female

Age _____

Current income (total household income)

9 – point scale: 1 = < £5,200, 2 = £5,200 - £10,399, 3 = 10,400 - £15,599, 4 = £15,600 - £20,7

5 = £20,800 - £25,999, 6 = £26,000 - £36,399, 7 = £36,400 - £51,999, 8 = £52,000 - £77,999,

>£78,000.

Level of educational attainment

8-point scale: 1 none, 2 GCSE grade D or below, 3 GCSE grade C or above, 4 A-level or equivalent, 5 university degree or equivalent, 6 postgraduate qualification or equivalent, 7 Masters or equivalent, 8 PHD or equivalent.

Employment status

9-options: 1 employed full-time, 2 employed part-time, 3 unemployed looking for work, 4 unemployed not looking for work, 5 retired, 6 student, 7 unable to work due to health or disability,

8 housewife/husband, 9 voluntary employment.

Information collected to calculate BMI

Height _____ cm e.g., 177.5cm

or

Height _____ ft _____ in e.g., 5ft 10in

AND

Weight _____ kg e.g., 78.5kg

or

Weight _____ st _____ lb e.g., 12st 5lb

Appendix J

Ethical approval acceptance confirmation letter

Central University Research Ethics Committee A

21 February 2019

Dear Dr Hardman

I am pleased to inform you that your application for research ethics approval has been approved. Application details and conditions of approval can be found below. Appendix A contains a list of documents approved by the Committee.

Application Details

Reference:	3928
Project Title:	The psychology of eating: What contributes to over-consumption?
Principal Investigator/Supervisor:	Dr Charlotte Hardman
Co-Investigator(s):	Mrs Helen Gibson, Dr Paul Christiansen
Lead Student Investigator:	-
Department:	Psychological Sciences
Approval Date:	21/02/2019
Approval Expiry Date:	Five years from the approval date listed above

The application was **APPROVED** subject to the following conditions:

Conditions of approval

- All serious adverse events must be reported to the Committee (ethics@liverpool.ac.uk) in accordance with the procedure for reporting adverse events.
- If you wish to extend the duration of the study beyond the research ethics approval expiry date listed above, a new application should be submitted.
- If you wish to make an amendment to the study, please create and submit an amendment form using the research ethics system.
- If the named Principal Investigator or Supervisor leaves the employment of the University during the course of this approval, the approval will lapse. Therefore it will be necessary to create and submit an amendment form within the research ethics system.
- It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Central University Research Ethics Committee A

ethics@liverpool.ac.uk

CURECA

Appendix K

Study Advert

Advert, version 2, 06.02.19

UNIVERSITY OF LIVERPOOL

Volunteers required for psychology study

Study title: The psychology of eating: What contributes to over-consumption?

We are seeking volunteers **aged 18 and above** to take part in our research investigating the psychology of eating; we are interested in the processes that contribute to the over-consumption of food.

You will be asked to complete a full set of questionnaires online and they will remain anonymous. The questionnaires will take approximately 15-20 minutes to complete. You will be asked about your eating habits, your thoughts, feelings and behaviour in general and in relation to your eating behaviour.

Eligibility: Males and females **aged 18 and above who are fluent in English.**

Eligible participants who complete the full set of questionnaires will be offered the opportunity to be entered in to a prize draw for the chance of **winning one of three £80 amazon vouchers.**

If you have any questions regarding the study please contact Helen Gibson by email:
h.gibson2@liverpool.ac.uk

You may access the online questionnaire here:

https://livpsych.eu.qualtrics.com/jfe/form/SV_8unwIA1QBgebZBj

Contact: Helen Gibson
E-mail: h.gibson2@liverpool.ac.uk
The psychology of eating
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The psychology of eating
Contact: Helen Gibson
E-mail: h.gibson2@liverpool.ac.uk
The psychology of eating

Appendix L

Information leaflet

Participant Information Sheet (Version 3, 06/02/2019)

Title of Study: The psychology of eating: What contributes to over-consumption?

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives and GP if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

1. What is the purpose of the study?

This study intends to investigate the psychology of eating; we are interested in the processes that may contribute to the over-consumption of food. We decided to focus on factors such as psychological wellbeing, personality and the function of eating food.

2. Why have I been chosen to take part?

We are looking for volunteers who are aged 18 years or older who are fluent in English.

3. Do I have to take part?

No. Participation in this research is completely voluntary. You are free to withdraw at any time without explanation and without incurring a disadvantage.

4. What will happen if I take part?

You will complete an online questionnaire. You will be asked to answer questions on a website about your eating behaviour, your thoughts, feelings and behaviour in general, and in relation to your eating behaviour. You will also be asked to provide your age, gender, height, weight, employment status, household income and level of educational attainment. We expect that the study will take no longer than 15 – 20 minutes to complete.

5. How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit". Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The Principal Investigator acts as the Data Processor for this study, and any queries relating to the handling of your personal data can be sent to Dr Charlotte Hardman (Charlotte.Hardman@liv.ac.uk).

Further information on how your data will be used can be found in the table below.

How will my data be collected?	Online questionnaire using Qualtrics.
How will my data be stored?	On password-protected computers under the responsibility of the researchers. In the event of the researchers leaving the University of Liverpool, the data will be transferred to the University of Liverpool's Active Datastore and stored indefinitely for future use.
How long will my data be stored for?	Indefinitely.
What measures are in place to protect the security and confidentiality of my data?	Computers will be password-protected.
Will my data be anonymised?	Yes.
How will my data be used?	Student research project, journal article, and conference presentations.
Who will have access to my data?	The investigators. Other organisations or researchers who request access to it.
Will my data be archived for use in other research projects in the future?	Yes.
How will my data be destroyed?	Data will be stored indefinitely.

6. Expenses and / or payments

There are no expenses or payments for taking part in this study, however, anyone who completes the full set of questionnaires will be invited to provide their email address to be entered into a prize draw to win one of three £80 Amazon vouchers should prize winner/s prefer, as reimbursement for taking part in the study. Winners of the prize draw will be notified before December 2019.

7. Are there any risks in taking part?

There are minimal risks to you if you take part. If you experience any discomfort or disadvantage as part of the research, please let the researches know immediately.

8. Are there any benefits in taking part?

There are no direct benefits from taking part apart from the opportunity to contribute to psychology research that may guide future interventions and clinical practice.

9. What will happen to the results of the study?

All the information collected about you during the course of the research will be kept strictly confidential. Your data will be stored in an anonymized format (identified by a random number only). We plan to publish the results from this study in a scientific journal. We will also make the anonymized data available to any other organisations or researchers who request access to it. It is important that you understand that your results will be completely anonymous, so there is no way that you can be identified.

10. What will happen if I want to stop taking part?

You are under no obligation to take part in this study; it is completely your choice. If you do decide to take part, you are free to withdraw at any time and without giving any reason or explanation. Please note that once you submit your data (i.e., at the end of the study) your data will be anonymised, and you will no longer be able to withdraw it, because we will be unable to identify it.

11. What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting the Principal Investigator, Dr Charlotte Hardman (Charlotte.Hardman@liv.ac.uk) and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Ethics and Integrity Office at ethics@liv.ac.uk. When contacting the Research Ethics and Integrity Office, please provide details of the name or description of the study (so that it can be identified), the researchers involved, and the details of the complaint you wish to make.

The University strives to maintain the highest standards of rigour in the processing of your data. However, if you have any concerns about the way in which the University processes your personal data, it is important that you are aware of your right to lodge a complaint with the Information Commissioner's Office by calling 0303 123 1113.

12. Who can I contact if I have further questions?

Helen Gibson, Doctorate in Clinical Psychology Training Programme, Whelan Building, University of Liverpool, Liverpool, L69 3GB. Email: h.gibson2@liverpool.ac.uk Tel: 0151 794 5530

Appendix M

Consent Form

Online participant consent form

Version number & date: **Version 3, 06/02/19**
Research ethics approval number:
Title of the research project: The psychology of eating: What contributes to over-consumption?
Name of researchers: Helen Gibson, Dr Charlotte Hardman and Dr Paul Christiansen

I confirm that I have read and have understood the information sheet dated 06/02/2019 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

I understand that taking part in the study involves completing an online questionnaire. ☐

I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study prior to submitting my responses without giving any reason and without my rights being affected. ☐

I understand that once my responses have been submitted, the data will be anonymous and therefore I will not be able to request access to it or withdraw the information I provide. ☐

I understand that the information I provide will be held securely and in line with the General Data Protection Regulation (GDPR) and Data Protection Act 2018 at the University of Liverpool and then anonymised information will be deposited in a relevant archive for sharing and use by other authorised researchers to support other research in the future. ☐

I understand that my anonymised data will be retained indefinitely on password-protected computers at the University of Liverpool. ☐

I agree to take part in the above study. ☐

Please tick the box below to confirm you agree with all of the above points.

☐

Appendix N

Debrief Letter

Debrief

Thank you for taking part in this study.

What was the study about?

This study intends to investigate the psychology of eating; we are interested in the processes that contribute to the over-consumption of food. This study is looking at whether anxiety, depression, losing control and seeking sensory pleasure and excitement are connected to eating behaviour. This study is also interested in the function of eating, such as eating as a strategy to cope with difficult feelings or eating as a strategy to enhance positive feelings.

The questionnaires you have completed allow us to investigate this and see what processes are most important in understanding the over-consumption of food.

The findings are likely to have important implications for health improvement strategies and support services.

Please feel free to ask the researcher if you have any further questions.

What if I want advice or I am worried about my health or wellbeing following the research?

We are not qualified to offer advice ourselves. We would recommend that you talk to your GP if you are worried about your health or wellbeing. The following information from these sources may also be informative:

NHS
https://www.nhs.uk/Conditions/stress-anxiety-depression/

Anxiety UK: Charity providing support if you've been diagnosed with an anxiety condition.
03444 775 774
www.anxietyuk.org.uk

Depression Alliance: Charity for sufferers of depression. Has a network of self-help groups.
www.depressionalliance.org

Samaritans: Confidential support for people experiencing feelings of distress or despair.
116 123
www.samaritans.org.uk

Where can I find information about eating disorders?
Beat: 0808 801 0677
www.b-eat.co.uk

Where can I calculate my own Body Mass Index?
https://www.nhs.uk/Tools/Pages/Healthyweightcalculator.aspx

Who can I contact if I have further questions about the research?

If you have any questions please contact me: Helen Gibson, Doctorate in Clinical Psychology Training Programme, Whelan Building, University of Liverpool, Liverpool, L69 3GB. Email: h.gibson2@liverpool.ac.uk Tel: 0151 794 5530.

If you do not feel you can come to me you can alternatively contact my supervisor Dr Charlotte Hardman Tel: 0151 794 1480 Email: charlotte.hardman@liverpool.ac.uk. If you remain unhappy or have a complaint which you feel you cannot come to me with then you should contact the Research Governance Officer at ethics@liv.ac.uk. When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

Appendix O

Comparisons of measures with normative/other non-clinical populations

Addiction-like Eating Behaviour

The mean score of the AEBS was 44.32 (SD 10.236), with a range of 17 – 71, indicating widespread around the mean. When compared to other recent non-clinical studies, participants in the current study scored similar, for example, Demir et al. (2021) and Ruddock et al. (2017) ranged from 40.95 (SD = 9.05) to 46.77 (SD 10.67).

Psychological Distress: Anxiety and Depression

The mean score of the HADS Anxiety was 8.83, with a range of 0 - 20; this is within the borderline abnormal range (8–10). When compared to a normative sample (mean 6.14, SD = 3.76; Crawford et al., 2001), participants in the current study scored higher, indicating higher levels of anxiety than a normative population.

The mean score of the HADS Depression was 4.69, with a range of 0 - 16; this is within the normal range (0 - 7). When compared to a normative sample (mean 3.68, SD = 3.07; Crawford et al., 2001), participants in the current study scored within the same range.

Impulsivity

The mean score of the BIS-11 was 62.47 (SD 10.184), with a range of 35 – 99, indicating widespread around the mean. When compared to a normative sample (mean 61.92, SD = 10.29; Malloy-Diniz et al., 2015), participants in the current study scored similar.

Sensation Seeking

The mean score of the UPPS: Sensation Seeking was 2.58 (SD .69), with a range of 1 – 4. When compared to other recent non-clinical studies, participants in the current study scored similar (for example, mean 3, SD .6; Schulte and Gearhardt, 2020).

Eating Motives: Coping and Enhancement

The mean score of the PEMS: Coping was 2.18 (SD 1.019), with a range of 1 – 5. When compared to other recent non-clinical studies, participants in the current study scored similar (for example**,** Boggiano, 2016, mean 1.87, SD 0.87).

The mean score of the PEMS: Enhancement was 2.33 (SD .912), with a range score of 1 – 5. When compared to other recent non-clinical studies, participants in the current study scored similar (for example, Boggiano, 2016, mean 2.04, SD .85).

Appendix P

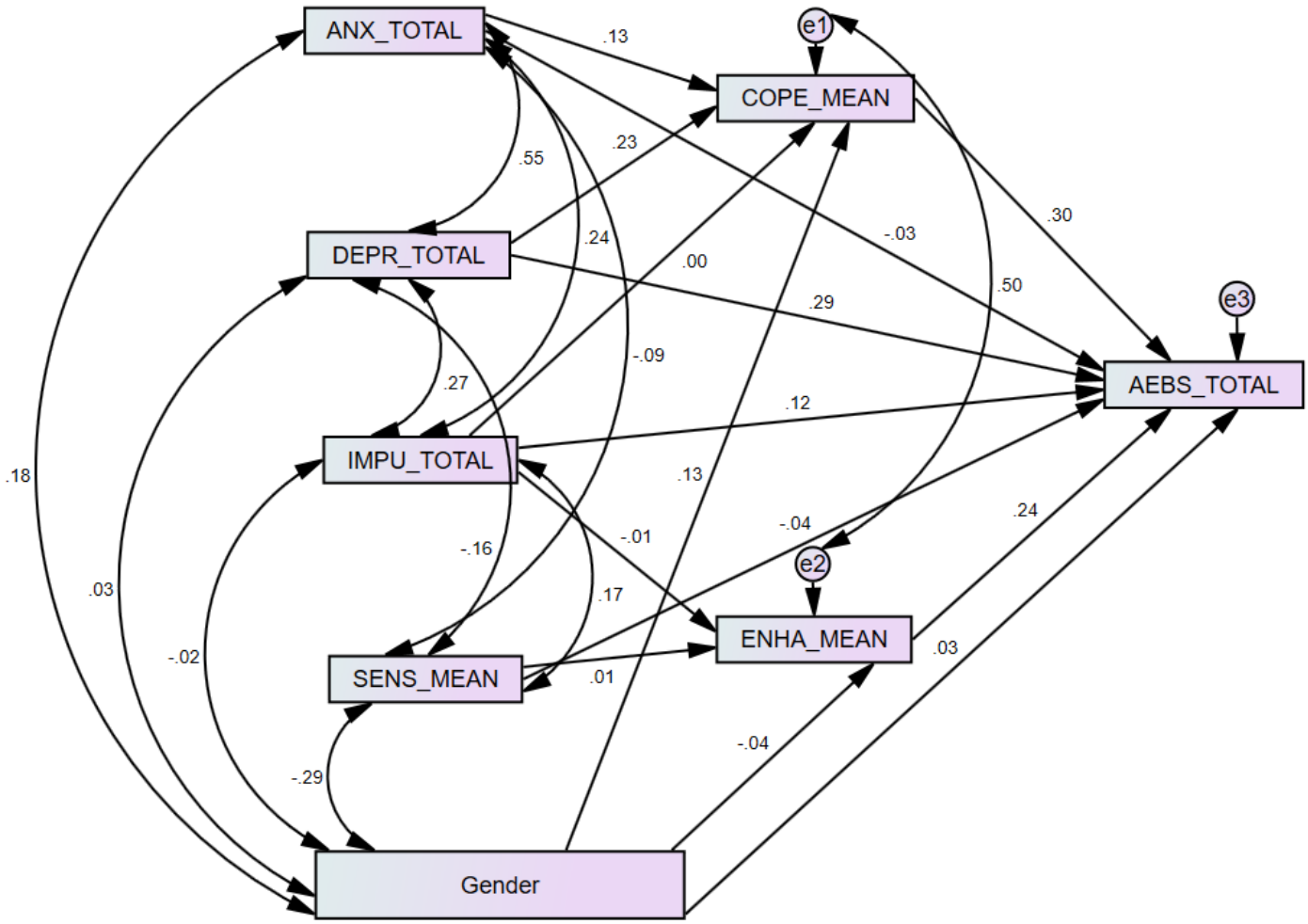
Standardized Estimates

Standardised Direct Effects and Indirect Effects

Significant results *Italicised;* *** p<0.001; ** p<0.01; * p<0.05.

H	Effect type	Model Pathways Tested	*β*	p	CI (90%)
H1	Direct	*Anxiety → Coping*	*.171***	*.003*	*.076 - .266*
		Coping → AEB	*.306***	*.002*	*.217 - .405*
		Anxiety → AEB	-.024	.654	-.110 - .082
	Indirect	*Anxiety → Coping → AEB*	*.052***	*.002*	*.023 - .090*
	Direct	*Depression → Coping*	*.218***	*.002*	*.110 - .309*
		Coping → AEB	*.306***	*.002*	*.217 - .405*
		Depression → AEB	*.288***	*.002*	*.187 - .389*
	Indirect	*Depression → Coping → AEB*	*.067****	*.001*	*.036 - .107*
H2	Direct	Sensation seeking → Enhancement	.042	.385	-.043 - .128
		Enhancement → AEB	*.235***	*.002*	*.139 - .322*
		Sensation seeking → AEB	-.045	.286	-.127 - .038
	Indirect	Sensation seeking → Enhancement → AEB	.010	.358	-.009 - .032
H3	Direct	Impulsivity → Coping	-.009	.778	-.103 - .074
		Impulsivity → Enhancement	-.014	.759	-.118 - .089
		Coping → AEB	*.306***	*.002*	*.217 - .405*
		Enhancement → AEB	*.235***	*.002*	*.139 - .322*
		Impulsivity → AEB	*.121***	*.008*	*.034 - .205*
	Indirect	Impulsivity → Coping and Enhancement → AEB	-.006	.802	-.050 - .039

Notes: H = Hypothesis; CI = Confidence Intervals; AEB = Addiction-like eating behaviour.

Appendix Q

SEM including gender as a covariate