



**DOCTORATE IN CLINICAL PSYCHOLOGY**

**The role of positive psychological factors in mediating food addiction and diabetes control: a structural equation approach.**

Karen Poole

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Supervised by: Dr Katy Lobley and Dr Jen Unwin

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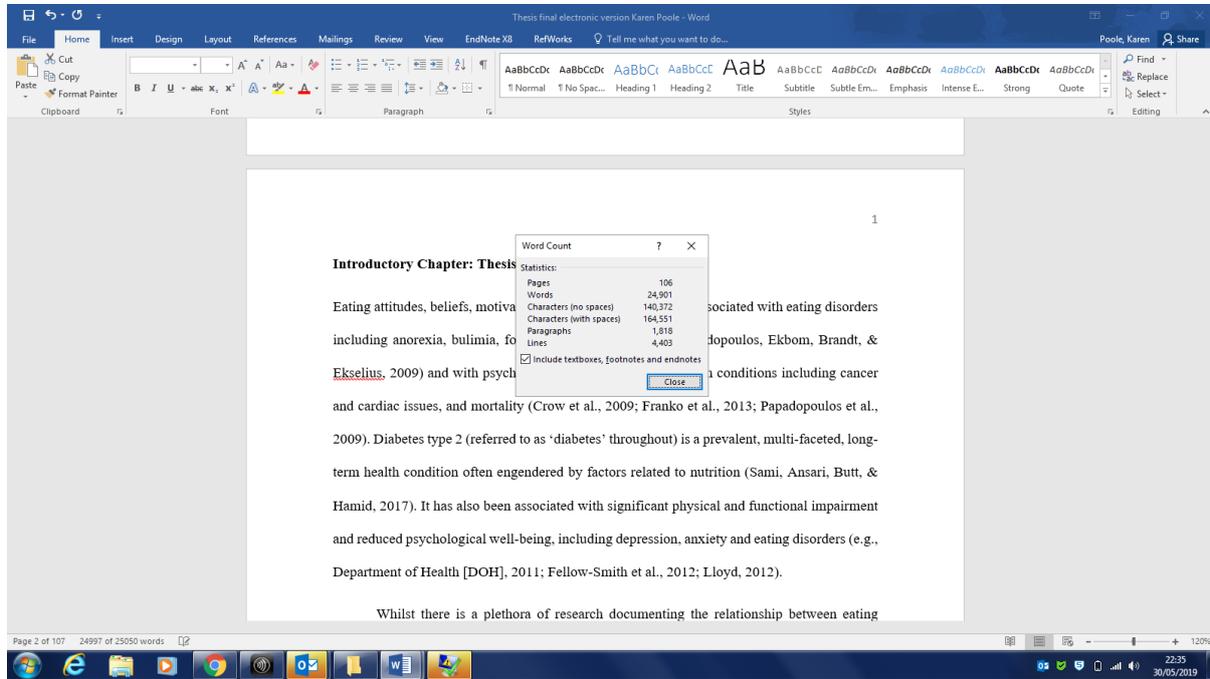
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## **Introductory Chapter: Thesis overview**

Eating attitudes, beliefs, motivations and behaviour have been associated with eating disorders including anorexia, bulimia, food restriction and obesity (Papadopoulos, Ekblom, Brandt, & Ekselius, 2009) and with psychological wellbeing, serious health conditions including cancer and cardiac issues, and mortality (Crow et al., 2009; Franko et al., 2013; Papadopoulos et al., 2009). Diabetes type 2 (referred to as ‘diabetes’ throughout) is a prevalent, multi-faceted, long-term health condition often engendered by factors related to nutrition (Sami, Ansari, Butt, & Hamid, 2017). It has also been associated with significant physical and functional impairment and reduced psychological well-being, including depression, anxiety and eating disorders (e.g., Department of Health [DOH], 2011; Fellow-Smith et al., 2012; Lloyd, 2012).

Whilst there is a plethora of research documenting the relationship between eating pathology and maladaptive psychological outcomes, there has also been a recent surge of research examining the role of positive factors associated with eating behaviour, in particular the role of self-compassion. However, for people living with diabetes, there is clear evidence for the association between eating behaviour, diabetes and poor psychological wellbeing, but the majority of research has investigated the role of maladaptive psychological processes which maintain and perpetuate psychological distress. Few studies have examined the contribution of adaptive or positive psychological processes which lead to the enhancement of psychological well-being within this clinical population. Therefore, the aims of this thesis are twofold. In chapter one the aim is to explore the relationship of self-compassion with eating behaviour by examining and reviewing available literature. In chapter 2, the aim is to examine the effect of eating behaviour on diabetes related outcomes, including body-mass index, average blood sugar levels, anxiety, depression and overall wellbeing. Furthermore, to examine whether self-

compassion and hope mediate this relationship, either reducing or eliminating the effects. The appendices section contains additional information relevant to the two chapters.

Chapter One reports a systematic review of the literature with regard to the relationship between self-compassion and eating behaviours and examines the nature of this relationship to understand the role of self-compassion. In the introduction, the definition and mechanisms that contribute to eating behaviour are discussed. Then, eating related difficulties such as obesity, eating disorders and associated health outcomes are addressed. Current psychological interventions are then introduced and discussed in light of their limitations, followed by an explanation of a recent paradigm shift toward more positive indicators of wellbeing. The role of positive psychological constructs is introduced, with a particular focus on the underpinnings and application of self-compassion. Following methodological information, a review of available empirical research in relation to eating behaviour and self-compassion is provided, in an attempt to identify the current state of the evidence base within this field. Clinical implications and suggestions for future research are discussed.

Chapter 2 contains the empirical paper, which considers the role of positive factors, including self-compassion and hope in relation to eating behaviour and diabetes outcomes. Information about diabetes, obesity and eating behaviour, specifically addiction to food and emotional eating is introduced. Positive factors including self-compassion and hope are then introduced and discussed and study rationale is provided. Structural Equation Modelling (SEM) identifies a statistical model of the constructs, based upon the eating behaviour, diabetes and positive psychological literature. Specifically, the relationship between eating behaviour and diabetes outcomes is examined, and the role of positive factors in relation to these variables is explored. It is hypothesised that self-compassion and hope will mediate the relationships between eating behaviour (addiction to food and emotional eating) and psychological wellbeing in patients living with diabetes. One hundred and ninety-four participants took part,

having fully completed the online study. The SEM model fitted the data well, following minimal modification. The empirical study extends current understanding of the impact of positive psychological processes associated with psychological well-being, in the presence of chronic illness, highlighting the relevance of measuring positive psychological factors in relation to well-being within this cohort.

## **Chapter 1**

### **Self-compassion and eating behaviour: a systematic review of the literature**

## Abstract

Poor eating behaviour has been associated with eating disorders (ED) such as anorexia (AN) and bulimia nervosa (BN) and with clinically significant health problems, including type 2 diabetes, coronary heart disease and cancer. Self-compassion may reduce the risk of eating disordered behaviour and protect against eating disordered behaviours in community and clinical samples. Given the explosive interest in the construct of self-compassion, and developments of self-compassion interventions for use in clinical settings, the current review extended preliminary evidence and explored whether more recent studies upheld the reliability of previous findings. Therefore, this systematic review investigated the relationship between self-compassion and eating behaviour. A systematic search of four electronic databases was conducted utilising terms relating to self-compassion, eating disorders, behaviours, or habits. A total of  $N = 230$  articles were considered as part of the identification process. Eighteen papers, comprising 16 studies, were included in the final review, upon removal of duplicates and application of the review exclusion criteria. The methodological quality of studies varied, though a clear relationship between self-compassion and eating was evident, with higher levels of self-compassion associated with reduced self-reported eating disturbances. Conclusions are drawn in light of limitations and future directions are specified.

## Introduction

Eating behaviour (EB) is a broad term and definitions vary, however accepted descriptions include a complex interplay of biological, environmental, social, attitudinal, physiological, and psychological factors that determine a person's eating pattern (de Graaf, Blom, Smeets, Stafleu, & Hendriks, 2004; Freitas, Albuquerque, Silva, & Oliveira, 2018). Eating attitudes are multidimensional and so can be defined as beliefs, thoughts, feelings, behaviour and relationship with food; consequently, eating attitudes can influence food choices and ultimately a person's health (Alvarenga, Scagliusi, & Philippi, 2012). Biological mechanisms relate to an internal drive for acquiring food, the choice of food and its ingestion (de Graaf et al., 2004; Gahagan, 2012; Viana & Sinde, 2008). Motivation to eat can be a consequence of a biological need to maintain energy, or neural reward via the release of dopamine and serotonin (Cornelius, Tippmann-Peikert, Slocumb, Frerichs, & Silber, 2010; Kenny, 2011). The latter is more likely to be linked to increased craving for palatable, often high fat and high sugar, food (Berridge, 2009; Gahagan, 2012; Rolls, 2011; Small, 2010). This is also influenced by the environment and availability of food (Drewnowski, 2009) social influences (Lumeng & Hillman, 2007) and may have temporary psychological effects such as enhanced mood (Christensen, 2001; Macht & Mueller, 2007; Turner, Luszczynska, Warner, & Schwarzer, 2010) which may contribute to continued use of food to sustain pleasure (Kringelbach, 2015; Kringelbach, Stein, & van Harteveldt, 2012). Neural reward is thought to lead to eating in excess of energy requirements, contributing to overeating (Shomaker et al., 2010; Wammes, French, & Brug, 2007; Wang et al., 2004; Zheng, Lenard, Shin, & Berthoud, 2009).

Overeating is an increasing concern with regard to health, economic and social consequences (National Institute for Health and Clinical Excellence [NICE], 2006). Adult obesity, is typically defined as body mass index (BMI) of 30 or above and deemed as posing a

risk to health (National Heart Lung and Blood Institute [NHLBI], 2010; World Health Organisation [WHO], 2006). Obesity prevalence in the UK is currently 26% for ages 45 and upwards, with the highest age prevalence between 45 and 74 years for men and 45 to 84 years for women (NHS Digital, 2019; Parliament UK, 2018).

Poor eating behaviour has been associated with clinically significant health problems. For instance, obesity has shown to be a leading risk factor for diabetes type 2, coronary heart disease and cancer (Barnes, 2011; De Pergola & Silvestris, 2013; Lavie et al., 2016) and is a global phenomenon affecting both developed and developing countries (Barnes, 2011; WHO, 2017). Overeating and restricted eating are often associated with eating disorders (ED) such as anorexia (AN) and bulimia nervosa (BN), and are associated with increased health complications, morbidity and mortality (Papadopoulos, Ekblom, Brandt, & Ekselius, 2009).

Explanations of overeating point toward a combination of biological (including potential neuronal responses), psychological (i.e., poor self-esteem), environmental (i.e., family dynamics including enmeshment, criticism, parental control and attachment difficulties) and sociocultural factors (i.e., media and peer influences) (Dallos, 2003; Dring, 2015; O'Shaughnessy & Dallos, 2009; Polivy & Herman, 2002). Excessive eating is a required criterion for multiple eating disorder diagnostic categories (e.g., bulimia, binge eating disorder, other specified feeding and eating disorders) and thus research into overeating inevitably overlaps with research into disordered eating behaviour (DSM-5). Eating disorders (EDs) are defined as persistent disturbance of eating behaviour, characterised by attitudes towards food that cause changes in eating behaviour in an attempt to control weight or body shape, often causing physical and psychological dysfunction (Fairburn & Walsh, 2002; Murphy, Straebl, & Cooper, 2010; NHS England, 2015; NICE, 2017). All eating disorders appear to involve a complex interplay of factors, and are likely lead to feelings of guilt, shame, and powerlessness (Duffy & Henkel, 2016). There is a convincing argument supporting the validity of a

transdiagnostic approach to eating disorders rather than differentiating between anorexic, bulimic or binge eating categories (e.g., Fairburn, Cooper, & Shafran, 2003; Fairburn et al., 2015). In addition, clinically the majority of service users present with a mixed pattern of restriction and overeating, rather than pure restriction or bingeing (with or without purging) (Elran-Barak et al., 2015; Milos, Spindler, Schnyder, & Fairburn, 2005).

### **Psychological interventions**

Eating disorders are largely understood from a biopsychosocial perspective, with recommended therapies including family therapy for adolescents diagnosed with anorexia and bulimia nervosa (cf. Le Grange, Crosby, Rathouz, & Leventhal, 2007; Le Grange & Lock, 2007; NICE, 2017), and cognitive behavioural therapy for eating disorders (CBT-ED) endorsed as the most appropriate treatments for adults (NICE, 2004; 2017). Whilst there is abundant evidence supporting the effectiveness of CBT-ED for BN, remission rates are suboptimal and the evidence of CBT is weak for AN (Fairburn et al., 2015; Williams, Tsivos, Brown, Whitelock, & Sampson, 2017). However, all these psychological treatments focus on supporting individuals to make specific changes to their eating behaviour, tackling patterns of restricting and overeating.

Given the limited success of current therapeutic approaches, there has been a recent paradigm shift toward more positive indicators of wellbeing such as hope, resilience, and optimism (Bolier et al., 2013; Iddon, Dickson, & Unwin, 2016; Sin & Lyubomirsky, 2009). Positive factors are considered important in considering the benefits of interventions and dispositions that promote optimal psychological functioning, rather than evaluating levels of distress (Seligman & Csikszentmihalyi, 2000). Many studies of non-clinical populations have identified that the behaviours associated with ED diagnosis are also present to varying degrees, and non-clinical research has explored correlates of over-eating, restriction and compensatory

behaviours (e.g., James et al., 2016; Mantzios & Wilson, 2015a; Schoenefeld & Webb, 2013). Whilst such research identifies negative factors that are associated with eating behaviour such as poor self-esteem, emotional abuse, depression and anxiety (e.g., Brechan & Kvaem, 2015; Herbozo, Schaefer, & Thompson, 2015; Kimber et al., 2017; Rosenbaum & White, 2015) there is also evidence that positive indicators of wellbeing promote positive psychological and behavioural approaches to food and eating (Martyn-Nemeth, Penckofer, Gulanick, Velsor-Friedrich, & Bryant, 2009; Steck, Abrams, & Phelps, 2004). One of the most promising positive factors to emerge is self-compassion, which is attracting attention due to its evidenced validity in improving health behaviour, including eating behaviour (e.g., Egan & Mantzios, 2018).

### **Self-compassion**

Self-compassion is referred to as having the ability to be kind to oneself when experiencing pain, suffering or perceived failure, and to recognise these factors as being common to human experience and not isolated to the individual. Being mindful and open to these experiences, rather than avoiding, suppressing or over-identifying with them is considered part of the self-compassionate experience (Neff, 2003).

There are different types of self-compassion including dispositional self-compassion which is the level of SC that is intrinsic in the individual and is considered to be a trait that naturally occurs within the individual (Bowlin, 2012). Dispositional self-compassion is more likely to occur in individuals who have been raised in safe, secure environments and in individuals who have experienced supportive and validating relationships in early childhood (Neff & Dahm, 2015). Self-compassion involves turning toward, acknowledging, and accepting one's own suffering. If trait self-compassion is low it can be increased through being taught skills that focus on increasing kindness and common humanity, which is often done

through loving-kindness meditation practice, which is designed to increase good will for oneself and others through calling to mind emotionally difficult situations and repeating phrases such as “may I be kind to myself or accept myself as I am” (Grossman, Niemann, Schmidt, & Walach, 2004). Interpersonal exercises are also used to help generate feelings of common humanity and participants might engage in writing self-compassionate letters to themselves (Neff & Germer, 2012). All practice is designed to help people turn toward suffering, engender acceptance and develop an understanding that difficult experiences are common to all (Neff & Dahm, 2015).

There is increasing evidence of a relationship between self-compassion and indicators of wellbeing and healthy psychological functioning, including reduced anxiety, stress, and depression (Barnard & Curry, 2011; Gilbert & Irons, 2005; Krieger, Altenstein, Baettig, Doerig, & Holtforth, 2013; Neff, 2009; 2011; Neff et al., 2018), adaptive coping, coping with failure and negative emotions (Neff, Hsieh, & Dejjitterat, 2005) increased self-worth and lower rumination (Neff & Vonk, 2009). Substantiating this, meta-analyses have reported that self-compassion is related to decreased psychopathology and increased positive well-being (MacBeth & Gumley, 2012; Marsh, Chan, & MacBeth, 2018; Rahimi-Ardabili, Reynolds, Vartanian, McLeod, & Zwar, 2018; Zessin, Dickhäuser, & Garbade, 2015).

Self-compassion has also shown benefits to physical health (Brown, Bryant, Brown, Bei, & Judd, 2016; Dunne, Sheffield, & Chilcot, 2018; Hall, Row, Wuensch, & Godley, 2013; Sirois, 2015), coping with chronic health conditions (Friis, Johnson, Cutfield, & Consedine, 2016; Sirois, Molnar, & Hirsch, 2015) and improved health behaviours (Biber & Ellis, 2017; Dunne et al., 2018; Kelly, Zuroff, Foa, & Gilbert, 2010; Sirois, 2015; Sirois, Kitner, & Hirsch, 2015). Most pertinently for the present review, self-compassion has shown benefits to body image and restricted eating, weight regulation and eating pathology, including disordered eating and negative associations to highly palatable food i.e., fat and sugar (Braun, Park, &

Gorin, 2016; Mantzios & Wilson, 2015b; Rahimi-Ardabili et al., 2018). A recent review found that self-compassion was associated with lower levels of eating pathology and a protective factor against poor body image (Braun et al., 2016).

### **Rationale and review objectives**

A recent review of the relationship between eating disorders and self-compassion focused on a potential mediating role for self-compassion between body image and eating disorders (Braun et al., 2016), and concluded that improved self-compassion may reduce the risk of eating disordered behaviour, particularly with regard to individuals experiencing poor body image. This was described as ‘preliminary support’ (p.124) for the suggestion that self-compassion protects against eating disordered behaviours in community and clinical samples. Given the recent increase in research into the construct of self-compassion, and developments of self-compassion interventions for use in clinical settings (Bluth & Neff, 2018; Germer & Neff, 2013; Kirby et al., 2017) the current review extends this preliminary evidence and confirms whether more recent studies uphold the reliability of previous findings.

The current research systematically reviews the literature regarding relationships between self-compassion, eating behaviour and disordered eating psychopathology. Details of the review aims were registered with the International Prospective Register for Systematic Reviews (PROSPERO) and content is based upon the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles (Moher, Liberati, Tetzlaff, Altman, & Group, 2009).

The aims of the current review are to identify, summarise and appraise studies that report a relationship between self-compassion and eating attitudes, motivation and behaviour and to understand the nature of this relationship and the role of self-compassion in eating. An important aim is also to determine the methodological standards of the results. This will be

done through the systematic search of four databases, and results relevant to the topic will be extracted. The focus will be solely on eating, rather than eating and body image as in previous reviews.

## Method

### Eligibility Criteria

In accordance with a previous review (Braun et al., 2016) mindfulness only studies were excluded. Although compassion has been argued to be an emerged property of mindfulness (Strauss et al., 2016; Williams, Dalgleish, Karl, & Kuyken, 2014) the theoretical foundation of Neff's construct of self-compassion diverges from the theoretical underpinnings of most mindfulness-based interventions. Given that almost without exception studies of self-compassion utilise Neff's psychometric measures of self-compassion, the present study was grounded in Neff's definition and associated psychometric approach to self-compassion. There were minimal qualitative studies available in the area of self-compassion and eating and therefore it was deemed appropriate to use only quantitative data. To ensure all relevant data was reviewed, relevant dissertations were included and prominent authors in the field were contacted via email for any papers not previously identified, for any unpublished work and work due to be published over the next six months. Both dispositional SC and treatment or intervention studies were included as both are thought to have positive impacts on health behaviour (Neff & Dahm, 2015). Intervention and treatment studies are predominantly used in the literature (Bowlin, 2012).

The inclusion criteria for the study were:

- Studies examining the effects of dispositional self-compassion or self-compassion taught through intervention on eating attitudes, motivation, behaviour and pathology.
- Studies that used a validated measure of self-compassion, specifically the original scale Neff (2003) and the short-form scale (Raes, Pommier, Neff, & Van Gucht, 2011).

- Studies that used a validated outcome measure, specifically and for consistency, the EDE and EDE-Q.
- Quantitative studies
- Publication in peer reviewed journals and dissertations that measured the variables of interest.
- Published in English.

### **Search Strategy**

A scoping search was conducted to identify the most appropriate search terms and relevant databases. These terms were chosen on the basis of previous research and included all variations of self-compassion and eating. Terms included SC, trait/dispositional SC, taught SC, compassion-focused therapy, compassionate mind training, SC interventions, and compassion interventions. Scoping on eating included eating behaviour, attitudes, beliefs, motivation, pathology, disorders and habits. The results from the scoping search aided in narrowing the search terms to those listed below as they were most commonly used in the literature. Secondly, the following databases were searched for existing articles and reviews: PsychInfo, MEDLINE, CINAHL Plus, Web of Science. The terms were then entered in three steps to accumulate relevant papers. Firstly, 'self-compassion or self compassion' was entered, followed by AND eating OR eating disorders OR eating behav\* OR eating habits. Next 'AND treat' or therap' OR interven\* OR compassion focused therapy or compassion-focused therap\* or compassionate mind training or cft. No date range was set for the database searches, but interestingly no studies qualifying for inclusion were found prior to 2013. Database email alerts were also set up where possible so as not to exclude newly-published articles. Search terms were also used in Google Scholar and manual searches of the reference lists of included articles was undertaken to ensure any other relevant papers were identified. Duplicate studies were removed through auto and hand-searching methods as recommended (Qi et al., 2013).

Two reviewers independently selected studies for eligibility. This took place in two phases: firstly, papers were selected by title and abstract, secondly selection was based on the full text article. A screening tool was then used to check the articles met the inclusion criteria (appendix 1) and those that did not were removed (Figure 1). There was almost total agreement between both reviewers regarding the final 18 articles included for review; discrepancies (5 items across 3 papers) were resolved through discussion.

## **Measures**

Neff's (2003) self-compassion scale (SCS) and the self-compassion scale short form (SCS-SF) have been identified as reliable and valid measures of self-compassion, particularly when using the total score (Neff, 2003; Neff & Dahm, 2015; Raes et al., 2011), and both are used extensively to research self-compassion, therefore these measures were deemed the most appropriate measures of this construct. The outcome measures used in the studies selected for the current review were the Eating Disorder Examination (Cooper, Cooper, & Fairburn, 1989) and the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994), which are extensively used as reliable and valid measures of disordered eating in clinical and non-clinical research populations (Fairburn, 2008). The measures are based on DSM-IV criteria and tap into aspects of anorexia and bulimia, but more important to the aims of the current study they were chosen because they comprehensively address a broad range of eating behaviours, motivations and attitudes. Using these distinct measures ensured construct validity and reliability of the data, and homogeneity of the studies.

## **Quality Assessment**

The papers selected for inclusion included cross-sectional studies, prospective cohort designs and intervention studies, and therefore the Agency for Healthcare Research and Quality Tool (Williams, Plassman, Burke, Holsinger, & Benjamin, 2010) was adapted to assess the

methodological qualities of these types of study, including risk of bias, omitting some items not relevant to the current review, in line with previous studies using this tool (e.g. Taylor, Hutton, & Wood, 2015; Williams et al., 2010). Categories for assessment included sample size and selection, validation of outcome measures, the use of appropriate analytic methods, and control of confounding variables. Studies were assessed according to four categories: yes, no, partially, not applicable. Two researchers completed the quality checks independently and discrepancies were resolved through discussion.

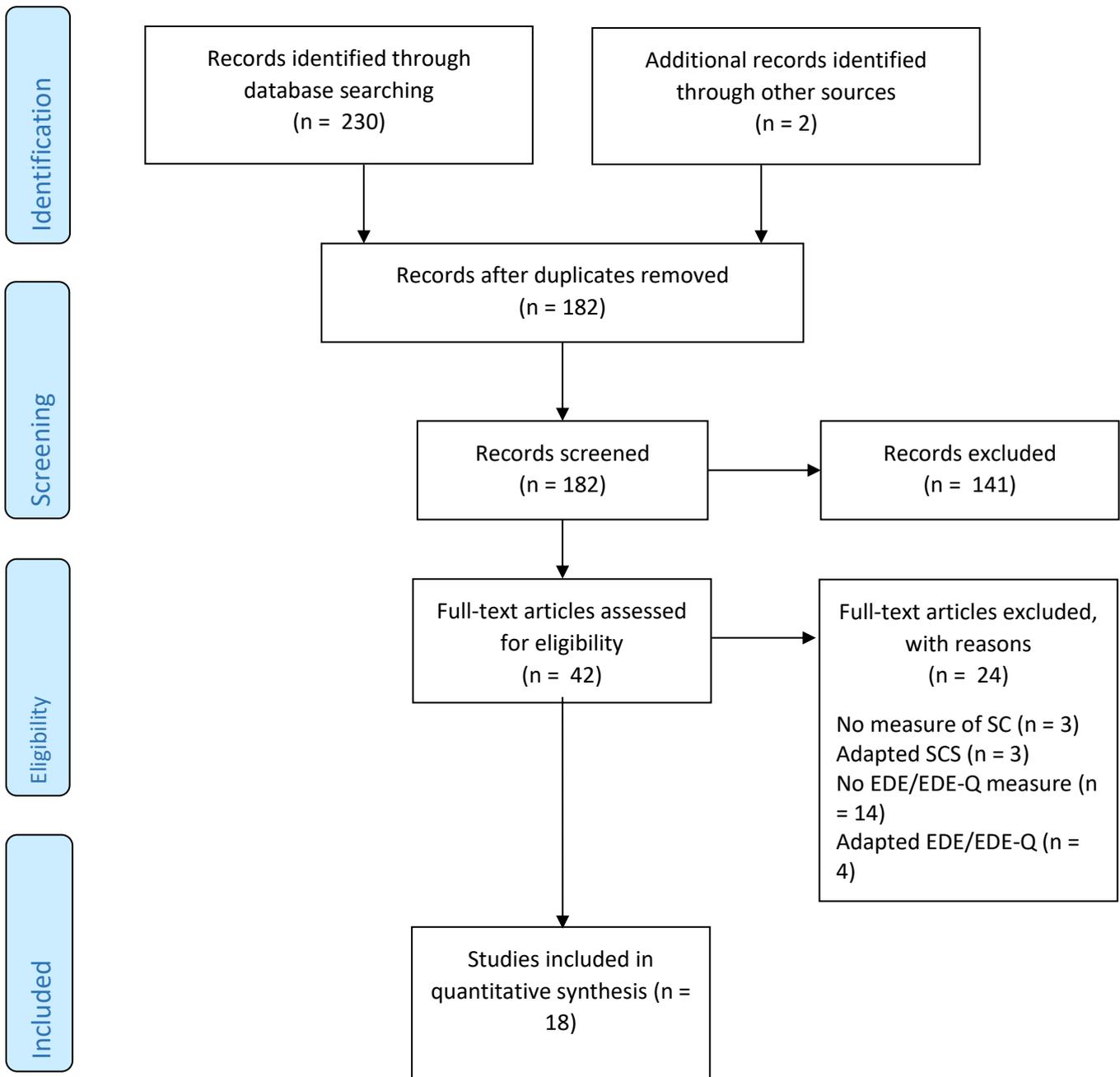
### **Data Extraction**

Extracted data included intervention details, participant characteristics, study design, measures and analyses. Outcome data and study findings were extracted if they were conceptually aligned with the aims and of the review.

## Results

The electronic search yielded 230 records, and 48 duplicates were removed. A further two papers were identified through Google Scholar. A search of reference lists and author communications did not yield any more articles. Of the remaining 182 records assessed during the initial screening phase of title and abstract, 42 were eligible for full-text assessment, following which a further 24 were excluded. Reasons for exclusion included studies that had no measure of SCS or EDE/EDE-Q, or where studies used unvalidated adaptations of those measures. Eighteen papers, with sixteen studies, met the inclusion criteria and were included in the final review. Given the diversity amongst the study designs of the included papers, it was considered that a narrative synthesis of results would appropriately encapsulate the overall findings. The identification and selection process, and reasons for exclusion are reported in Figure 1.

Figure 1: Identification and selection of included studies



## Characteristics of Included Studies

Demographic information and details of included studies are in Table 1. The eighteen studies included a total of  $N = 2,824$  participants, the majority of whom were female (100% for most studies, with two studies reporting 97% and 79.2%). The mean age of participants within individual studies (where reported) ranged from 19.93 to 46 years. Most participants reported being Caucasian (48% being the lowest, then ranging from 70.1% to 100%). Education varied but where reported in comparison populations there were no significant differences in most of the papers, the few differences that were reported are noted below. There were a range of designs including cross sectional, prospective cohort, and intervention studies. Some samples included individuals diagnosed with eating disorders, others included university students and general population.

Table 1: *Demographics information for included studies*

Author	Design	N	Sample	Gender	Age range, (mean; standard deviation)	Ethnicity	Education	Country
Ferreira, Matos, Duarte and Pinto-Gouveia (2014)	Cross-sectional	34	Individuals with an eating disorder diagnosis	Unknown	14-44 (24.56; 7.61)	Unknown	12.74 (SD = 3.58) years of education No significant differences between groups	Portugal
Ferrier, Oliveira, and Mendes (2017)	Cross-sectional	490	General population	100% female	15-54 (24.76; 7.66)	Portuguese	Not reported	Portugal
Ferreira, Pinto-Gouveia, and Duarte (2013)	Cross-sectional/ case-control	225	Females with eating disorder diagnosis (n=102)	100% female	Range not reported (23.62; 7.42)	Portuguese	12.49 (SD=3.01) years of education	Portugal
			General population (n=123)		(23.54; 6.89) No significant differences		12.63 (SD=2.55) years of education. No significant differences	
Geller et al. (2015)	Cross-sectional	131	General population	100% female	Range not reported (28.76; 8.45),	72% Caucasian,	Majority undergraduate (41%)	Canada
Kelly and Carter (2015)	RCT comparison on CFT with behavioural intervention	41 Conditions: SC (n = 15) BH (n = 13) WLC (n = 13).	Individuals diagnosed with binge eating disorder	83% female	Range not reported (45;15)	75.6% Caucasian	Not reported	Canada
Kelly, Vimalakanthan and Miller (2014)	Cross-sectional	153	Undergraduates	100% female	Range not reported (20.2; 3.49)	48.3% Caucasian	Not reported	Canada.

Table 1 Continued

Author	Design	N	Sample	Gender	Age	Ethnicity	Education	Country
Kelly, Carter, Zuroff and Borairi (2013)	Prospective cohort	74* EDE-Q data available for =56 at baseline; data were available for 49 participants at time 1, 39 at T2, 30 T3, 22 T4.	Inpatient and day patients admitted for treatment for ED	97% female	18 to 55 (27.5; 9.3)	79% Caucasian	Not reported	Canada
Kelly, Carter, & Borairi (2014)	Prospective cohort	97*	Inpatient and day patients admitted for treatment for ED	97% female	17 to 57 (28; 9.6)	79.2% Caucasian	Not reported	Canada
Kelly and Tasca (2016)	Prospective cohort	78*	Inpatient and day patients admitted for treatment for ED	97% female	Range not reported (28; 9.6)	79.2% Caucasian	Not reported	Canada
Kelly, Vimalakanthan and Carter (2014)	Prospective cohort	252*	Undergraduates (n = 155)  Inpatient and day patients admitted for treatment for ED (n = 97*).	100% female	Range not reported (20; 5) (28; 9.6).	48.3% Caucasian, 19.4% South Asian, + others.  79.2% Caucasian	Not reported	Canada
Kelly et al. (2017)	RCT comparison with TAU and TAU with CFT	22	Individuals receiving outpatient treatment CFT + TAU	100% female	CFT + TAU (36.73; 12.58).  TAU (27.10; 10.13)  differences noted on age (and illness duration)	100% Caucasian	Majority college Degree and no significant differences between groups on education	Canada

Table 1 Continued

Author	Design	<i>N</i>	Sample	Gender	Age	Ethnicity	Education	Country
Kramer (2018). Study 1	Repeated measures	150	Undergraduate	100% female	Range not reported  (19.93; 2.61)	94.6%Caucasian	Not reported	US
Lockley (2013)	Cross-sectional	53	clinically obese treatment- seeking adults	62?% male; 38% female	27-66  (46; 10.2)	82% Caucasian	Not reported	UK
Maraldo et al. (2016)	Cross-sectional	609	Community ( <i>n</i> = 313)  students ( <i>n</i> = 296)		Range not reported  CS (34.74; 11.36  S (19.44; 1.75).	73.8% Caucasian.  80.1% Caucasian	Majority associates degree or trade school in both samples (community 23%; student 37%). 3 years+ education differed (community 6.7%; student 16.6%). Not reported statistically.	US
Marta-Simoes & Ferreira (2018)	Cross-sectional	387	General population		18-25  (21.64; 1.70).	Portuguese	Not reported	Portugal
Pennesi and Wade (2018)	RCT	107	university students	100% Female	17-28  (20.27; 2.02)	70.1% Caucasian.	Not reported specifically Education inferred as undergraduate sample	Australia
Pinto-Gouveia et al. (2016)**	Prospective intervention	31	Met criteria for binge eating disorder	100% Females	18-55 Mean not reported	Not reported	Not reported	Portugal.
Pinto-Gouveia et al. (2017)**	Controlled longitudinal intervention study	59  (19; 17)	Met the criteria for binge eating disorder. Intervention ( <i>n</i> = 19) wait list control ( <i>n</i> = 17).	100% female	18-55 Mean not reported	Not reported	(14.50; 2.90)  (15.92; .86)  No significant differences in years of schooling	Portugal

\*Same eating disorder sample

\*\* Same sample

## Quality Assessment of Included Studies

The results of the quality assessment are presented in Table 2. There was considerable variability with regard to overall quality, with no studies achieving ‘yes’ for all relevant items. Studies with more yes ratings, indicate higher methodological quality. Power calculation, controlling for confounding, and follow-up periods seemed to be the most common inadequacies relating to quality. Whilst most of the sample sizes seemed adequate for the type of analyses conducted, few reported power and therefore appropriateness was difficult to ascertain. Furthermore, the longest follow-up period was six months, which is considered too short to determine if effects are maintained (Farrington, 2006; Hill, Woodward et al., 2016). The strongest quality element was the use of validated measures, but this was part of the inclusion criteria for the review, and the use of appropriate analyses.

The studies were split between cross-sectional, prospective cohort and intervention designs. Study limitations were centred upon lack of causality inference in the cross-sectional studies and loss of participants in the prospective cohort studies. The number of participants stated was often misleading, with higher numbers being presented initially, for instance the number of participants contacted, rather than the actual number that took part. However, most articles did report a breakdown of participation and the attrition rates clearly. Positively, control groups were included in four of the five intervention studies, with the exception of Pinto-Gouveia et al. (2016) and three of the five (Kelly & Carter, 2015; Kelly et al., 2017; Pennesi & Wade, 2018) randomised participants. In the intervention studies, longer-term follow-ups were not evident; most follow-up periods ranged from three to six months. As mentioned, some studies used the same sample and did not report all relevant detail in each paper; they were also not explicit that the same sample was being used. Overall, researchers mainly reported methodological limitations and provided detailed descriptions of underlying theoretical frameworks. However, quality was average in most studies, with none attaining yes to all

quality standards. The analysis of the QA informs the discussion below regarding overall outcomes.

Table 2: *Agreed outcomes for the quality assessment of study methodology*

Author	Unbiased selection of participants	Selection minimizes baseline differences in prognostic factors	Sample size calculated/5% difference	Adequate description of cohort	Validated method for ascertaining exposure	Validated method for ascertaining clinical outcomes	Outcome assessment blind to exposure	Adequate follow up period	Completeness of follow-up	Analysis controls for confounding	Appropriate analytic method
Ferreira, Matos, Duarte and Pinto-Gouveia (2014)	Partially	n/a	Partially	Partially	n/a	Yes	n/a	n/a	n/a	no	yes
Ferrier, Oliveira, and Mendes (2017)	No	n/a	Yes	partially	Yes	n/a	n/a	n/a	n/a	n/a	yes
Ferreira et al. (2013)	partially	partially	No	No	Partially	Yes	n/a	n/a	n/a	yes	partially
Geller et al. (2015)	Partially	n/a	No	Partially	n/a	Yes	n/a	n/a	n/a	Yes	Yes
Kelly and Carter (2015)	Yes	partially	No	Yes	Yes	Partially	No	no	no	yes	yes/Partially
Kelly, Vimalakanthan and Miller (2014)	Partially	n/a	No	Partially	n/a	Yes	n/a	n/a	n/a	yes	yes
Kelly, Carter, Zuroff and Borairi (2013)	Yes	n/a yes	No	yes/partially	n/a	Yes	n/a	n/a	n/a	partially	yes
Kelly, Carter, & Borairi (2014)	Yes	n/a	No	partially/yes	n/a	Yes	n/a	n/a	n/a	partially/yes	yes
Kelly and Tasca (2016)	Partially	Yes	No	No	n/a	Yes	n/a	n/a	n/a	partially	partially

Table 2 Continued

Author	Unbiased selection of participants	Selection minimizes baseline differences in prognostic factors	Sample size calculated/5% difference	Adequate description of cohort	Validated method for ascertaining exposure	Validated method for ascertaining clinical outcomes	Outcome assessment blind to exposure	Adequate follow up period	Completeness of follow-up	Analysis controls for confounding	Appropriate analytic method
Kelly, Vimalakanthan and Carter (2014)	Partially	partially	No	Yes	n/a	Yes	n/a	n/a	n/a	yes	yes
Kelly et al. (2017)	Yes	partially	Partially	Yes	Yes	Yes	No	No	No	partially	partially
Kramer (2018).	Partially	n/a	No	Yes	n/a	Yes	n/a	n/a	n/a	yes	yes
Lockley (2013)	Yes	n/a	Yes	Partially	n/a	Yes	n/a	n/a	n/a	no	yes
Maraldo et al. (2016)	Partially	n/a	n/a	Yes	n/a	Yes	n/a	n/a	n/a	no	yes
Marta-Simoes & Ferreira (2018)	Yes	n/a	No	Partially	n/a	Yes	n/a	n/a	n/a	partially	yes
Pennesi and Wade (2018)	Partially	Yes	Partially	Partially	Yes	Yes	Partially	No	No	yes	yes
Pinto-Gouveia et al. (2016)	Yes	n/a	Yes	Yes	Partially	Yes	Yes	Partially	partially	no	yes
Pinto-Gouveia et al. (2017)	Yes	No	Yes	Yes	Partially	Yes	Partially	Partially	No	partially	partially

## Overall Outcomes

### Cross-sectional and prospective cohort studies

Overall outcomes are presented in Table 3. Of the seven cross-sectional and four prospective cohort studies, ten reported that self-compassion was negatively associated with eating pathology; the only exception was Maraldo et al. (2016) who did not report correlations. The direction of the self-compassion-eating associations indicated that low self-compassion was associated with poorer eating pathology, whereas higher self-compassion was associated with better outcomes in eating pathology. In exploring these relationships further, the cross-sectional studies indicated self-compassion predicted significant variance in eating pathology (7-63.8%), however most did not consider the direct effects on eating outcomes. For instance, Kramer (2018) found self-compassion and BMI were significant predictors of global EDE-Q accounting for 29% variance in EDE-Q, but they did not consider the predictive validity of self-compassion above BMI. Ferrier et al. (2017) found higher levels of self-compassion and body appreciation predicted lower levels of eating disorder pathology, but did not consider the direct effects or unique variance of SC on EDE-Q, above body appreciation. Given all of the studies combined SC with other variables, this might explain why variance between studies varied so greatly.

All of the prospective cohort studies used the same clinical sample, which may have inflated the evidence base for the findings relating to these studies, and overall outcomes; therefore, the following should be interpreted with caution. In concurrence with the studies above, the prospective cohort studies also reported low SC was predictive of greater eating pathology. For instance, Kelly, Carter, Zuroff, and Borairi (2013) assessed self-compassion, fear of self-compassion and a combination of both in relation to shame and eating disorder pathology; they found that self-compassion and fear of self-compassion were associated with

eating disorder symptoms over time. Individuals higher in SC at baseline experienced a reduction in ED symptoms irrespective of level of fear of SC. Although it appears that high SC affected eating pathology regardless of the level of fear of self-compassion, this was not assessed independently and so cannot be concluded. Also, for individuals with lower baseline self-compassion, eating disorder symptoms decreased only if fear of self-compassion was low, suggesting fear of self-compassion, especially in the presence of low dispositional self-compassion, might attenuate response to mainstream eating disorders treatment. It would, however, be important to consider the unique contribution of self-compassion and fear of self-compassion to eating disorder symptoms. Participants with low SC and high fear of SC at baseline had more eating disorder symptoms, and poorer outcomes, with no change demonstrated over 12 weeks of treatment, controlling for baseline symptoms.

Kelly, Carter, and Borairi (2014) reported participants who had greater increases in their level of self-compassion early in treatments had significant decreases in eating disorder symptoms over 12 weeks. However, in contrast to this suggestion that self-compassion can be increased, Kelly and Tasca (2016) found no within-person's effect of SC on ED, suggesting that levels of self-compassion can be relatively stable in the same person.

In addition to the clinical sample, Kelly, Vimalakanthan, and Carter (2014) examined the differences between the patient group and a student sample in relation to self-compassion and eating disorder pathology. They found the patient sample had higher mean EDE-Q and lower mean self-compassion. However, in contrast to the previous studies conducted by Kelly et al. using the same patient sample, self-compassion was not a significant predictor of EDE-Q global or subscale scores in the patient group, whereas, low SC emerged as the strongest predictor in the student group. In contrast to the other studies in this review, BMI was controlled in this study, which may explain the difference in the findings. This might suggest that BMI eradicates the effects of SC for people diagnosed with ED, possibly due to its established

association with eating pathology, including higher EDE-Q scores in both overweight and underweight presentations (e.g., Gearhardt, Boswell, & White, 2014; Hudson, Hiripi, Pope, & Kessler, 2007; Rø, Reas, & Rosenvinge, 2012). However, this would contradict findings by Kelly, Carter, and Borairi (2014) which suggested higher levels of self-compassion moderated the positive relationship between BMI and global eating disorder pathology, rendering the relationship non-significant. Discrepancies could be attributed to differences in quality control, or the differing combinations of variables being assessed in relation to outcomes.

### **Mediation and moderation effects of self-compassion**

Most cross-sectional studies explored whether self-compassion mediated the effects of risk factors in association with eating behaviour. The majority found that higher levels of SC reduced or prevented the effects of risk factors on eating pathology, explaining part of the relationship. For instance, early memories of warmth and safeness had an indirect effect on eating pathology through self-compassion and body appreciation (Ferrier et al., 2017). In concurrence, Marta-Simoes and Ferreira (2018) found the effect of early memories of warmth and safeness with peers on disordered eating was mediated by self-compassion, social safeness, and body appreciation. Kramer (2018) found that SC mediated the relationship between body dissatisfaction and eating pathology and the relationship between experiential avoidance and eating disorder symptoms, whereby it was no longer a significant predictor. This suggests that SC fully explained the relationship between experiential avoidance and eating disorder symptoms. These findings indicate that lower levels of self-compassion explain all or part of the variance in risk factors associated with eating pathology, whereas high levels may fully, or partially, interrupt the effects. This indicates that self-compassion may interpose known risk factors for greater eating pathology. However, the direct effect of self-compassion was not reported in all of the studies considering SC as a mediator, rather SC was combined with other

variables rendering the full mediation effects of self-compassion difficult to ascertain. Furthermore, cross-sectional studies are inherently limited by their design.

Other studies in the current review considered whether SC moderated the effects of SC on eating pathology. Ferrier et al. (2014) found that high levels of SC moderated the effects of low to moderate shame memory characteristics, but not high levels, on eating pathology, suggesting self-compassion might be a protective factor for individuals with lower over-identification with shameful or traumatic memories. Kelly et al. (2014) found higher levels of self-compassion moderated the positive relationship between BMI and global eating disorder pathology, rendering the relationship non-significant. Suggesting that high levels of protect against the BMI-eating pathology relationship. Similarly, Geller et al. (2015) found that higher levels of SC moderated the effects of distress on disordered eating, stating distress was associated with disordered eating with low SC mindfulness, but not high. This may suggest that high SC provides a buffer against the distress associated with eating disorder symptoms. However, Geller only found this effect for the mindfulness subscale of the SCS on global EDE-Q. The effects for the other two studies were reported as significant for global SC and global EDE-Q.

### **Intervention Studies**

The finding that SC might mitigate or protect against ED has naturally encouraged the development of SC interventions for ED and of the reviewed studies, 5 of these presented intervention studies which included SC as an outcome measure. Two of these studies were randomised controlled trials (RCT) (Kelly & Carter, 2015; Kelly et al., 2017) and most indicated that SC had an effect on eating disorder symptoms post-intervention. Kelly and Carter (2015) found behavioural and self-compassion interventions reduced mean binge days more than the control group. Moreover, SC intervention was more effective in reducing overall

eating disorder pathology than behavioural or control conditions and the rates of change in EDE-Q global, eating concern, and weight concern were significant in the self-compassion condition only. Kelly et al. (2017) compared a compassion-focused therapy (CFT) group as an adjunct to treatment as usual (CFT+TAU) to a TAU condition. The CFT+TAU group demonstrated greater improvements in SC and eating disorder symptoms, with large effect sizes, over 12 weeks of treatment, whereas the TAU group showed no significant changes on all variables. However, this was attributed to changes in both SC and fears of SC, therefore, it might be beneficial to consider unique variance in further studies.

Pennesi and Wade (2018) found participants in their imagery rescripting condition reported significantly higher self-compassion and lower levels of disordered eating than the control condition, post intervention, but there were no effects for the other conditions. Additionally, adjusting for T1 variables, T2 SC mediated the relationship between condition and changes in disordered eating. However, effect size indicated that the model containing both body image acceptance and self-compassion was superior to the models containing body image acceptance or self-compassion alone. This finding gives some indication of the unique contribution of SC and indicates the relationship between self-compassion and eating pathology is complex, and that other factors are important.

Pinto-Gouveia et al. (2016) examined the efficacy of a 12-session group intervention that integrated psychoeducation, mindfulness, compassion and value-based action. Participants had a significant increase in self-compassion and significant decrease in eating pathology from time 1 to time 2. Although there were no significant differences from T2 at 3 and 6 month follow-ups, given the short period it brings into question the validity of the follow-up findings, and whether these effects are truly maintained (Farrington, 2006; Hill, Woodward, Woelfel, Hawkins, & Green, 2016). Pinto-Gouveia et al. (2017) evaluated the effects of the study above, longitudinally and found participants in the intervention condition had significant decreases in

eating psychopathology from T1 to T2, however, differences in self-compassion did not reach statistical significance. This may indicate the positive effects of the intervention were attributable to other variables. However, there was a significant decrease in the negative factors of self-compassion (self-criticism) from T1 to T2 and this was associated with reduced eating pathology. Furthermore, there were no significant changes in the control group. Intervention effects were maintained at three and 6-month follow-up. The findings of these two studies may be inflated as the authors used the same sample.

In line with previous research suggesting higher SC leads to improvements in eating disorder pathology (e.g., Braun et al., 2016; Mantzios and Wilson, 2015b; Rahimi-Ardabili et al., 2018) all of the intervention studies found that SC in part was associated with improvements in eating pathology post-intervention, which may indicate that SC is an important and accessible area to target through interventions for eating disorders. However, as SC was combined with other variables in most studies it was difficult to ascertain the true effects of self-compassion in ameliorating eating disorder pathology.

Table 3: *Outcomes of included studies*

Author	Measures	Control/Conditions	Analysis	Outcomes and effect sizes (where reported)
Ferreira, Matos, Duarte and Pinto-Gouveia (2014)	EDE  SC long-form		Correlation analyses Regression analyses	SC strongly and negatively associated with global eating pathology severity. Self-judgment was positively and moderately linked to EDE global. Positive SC significantly predicted eating disorder pathology, explaining 37.6% of the variance in severity. High levels of SC moderated the effects of low to moderate shame memory characteristics, but not high levels, on eating pathology.
Ferrier, Oliveira, and Mendes (2017)	EDE-Q  SC long-form		Correlation analyses Path analyses	Self-compassion negatively associated with EDE-Q total. All subscales were significant at the <.001 level apart from the restraint subscale ( $p>.05$ ). Higher levels of self-compassion and body appreciation predicted lower levels of eating disorder pathology. Specifically, early memories of warmth and safeness had an indirect effect on EDE-Q through self-compassion and body appreciation.
Ferreira et al. (2013)	EDE  SC long-form	Females with eating disorder diagnosis ( $n=102$ )  General population ( $n=123$ )	T-tests Product-moment Pearson correlation mediation Linear regression	Participants diagnosed with ED had lower self-compassion scores than non-patients. Self-compassion was negatively associated with external shame, general eating pathology, and eating disorder symptoms in both groups but stronger in the ED. External shame and drive for thinness was partially mediated by self-compassion in the general group and fully mediated by SC in the ED group. Body dissatisfaction and drive for thinness was partially mediated by SC in the ED group but not in the general group.
Geller et al. (2015)	EDE-Q  SC long-form		Bivariate correlations Step-wise multiple Regressions	SC total and all subscales with the exception of common humanity were associated with EDE-Q. SC total accounted for 7% of the variance in EDE-Q. SCS self-kindness, self-judgement and isolation subscales accounted for unique variance in weight concerns, SCS over-identification subscale accounted for unique variance in disordered eating after controlling for age and BMI. Higher distress was associated with more disordered eating with low SC mindfulness, but not high, therefore higher levels of SC moderated the effects of distress on disordered eating.

Table 3 Continued

Author	Measures	Control/Conditions	Analysis	Outcomes and effect sizes (where reported)
Kelly and Carter (2015)	Long-form	Conditions: SC ( <i>n</i> = 15) BH ( <i>n</i> = 13) WLC ( <i>n</i> = 13).	Multilevel modelling	Behavioural and self-compassion interventions reduced mean binge days, more than the control group. Self-compassion intervention was more effective in reducing overall eating disorder pathology, weight and eating concerns than behavioural or control conditions. Rates of change in EDE-Q Global, Eating Concern, and Weight Concern were significant in the self-compassion condition only. SC intervention increased SC levels in comparison to the two other conditions and led to greater improvements in EDE-Q scores and depressive symptoms.
Kelly, Vimalakanthan and Miller (2014)	EDE-Q  SC long-form		Correlations Hierarchical regressions	SC negatively associated with eating disorder pathology global, weight concerns, shape concerns, eating concerns, and dietary restraint. Self-compassion negatively predicted global eating and combined with BMI did so over and above self-esteem. This applied to all EDE-Q subscales. Higher levels of self-compassion moderated the positive relationship between BMI and global eating disorder pathology rendering the relationship non-significant. This included weight and eating concerns.
Kelly, Carter, Zuroff and Borairi (2013)	EDE-Q  SC short-form	22 (31%) inpatient 52 (69%) day hospital.	Multilevel analyses	SC was associated with EDE-Q at baseline. Participants with low SC and high fear of SC at baseline had more eating disorder symptoms, and poorer outcomes, with no change demonstrated over 12 weeks of treatment. Individuals high in SC and low in fear of SC showed improvement, as did individuals low in SC but also low in fear of SC and individuals high in SC and also high in fear of SC. Individuals higher in SC at baseline experienced a reduction in ED symptoms irrespective of level of fear of SC.
Kelly, Carter, & Borairi (2014)*	EDE-Q  SC short-form	27.8% inpatient 72.2% day hospital.	Pearson zero-order correlations Multilevel Modelling	Participants who had greater increases in their level of self-compassion early in treatments had significant decreases in eating disorder symptoms over 12 weeks. Also, to a lesser degree participants with even small increases in self-compassion early on had significant decreases in ED symptoms.

Table 3 Continued

Author	Measures	Control/Conditions	Analysis	Outcomes and effect sizes (where reported)
Kelly and Tasca (2016)*	EDE-Q SC short-form	(27.8%) inpatient (72.2%) day hospital	Multilevel modelling	SC showed a strong negative relationship with eating pathology ( $r = -.54$ , $p < .001$ ). There was no within-person's effect of SC on ED.
Kelly, Vimalakanthan and Carter (2014)	EDE-Q SC short-form	Undergraduates ( $n = 155$ ) Inpatient and day patients admitted for ED treatment ( $n = 97$ ).	T-tests Multiple regressions	T-tests revealed between-group differences e.g., the patient sample had higher mean EDE-Q and lower mean self-compassion ( $ps < .001$ ). Self-compassion was not a significant predictor of EDE-Q global or subscale scores in the patient group. However, low SC emerged as the strongest predictor in the student group ( $\beta(SE) = -.50(.12)$ , $p < .001$ ). Low SC and fear of SC predicted greater eating concerns in students, whereas fear of self-compassion was the greatest predictor in the patient group.
Kelly et al. (2017)	EDE-Q SC long-form	Outpatient treatment ( $n=22$ )  CFT+TAU ( $n=$ 11)TAU ( $n= 11$ )	Multilevel modelling	CFT+TAU group demonstrated greater improvements in SC and eating disorder symptoms over 12 weeks' treatment. Participants in the CFT + TAU condition experienced better outcomes and significant decreases in eating pathology, with a large effect size whereas, those in the TAU condition did not.
Kramer (2018).	EDE-Q SC long-form		Bivariate Correlations Regression analyses Mediation analyses	SC was associated with global EDE-Q and all EDE-Q subscales. Self-compassion and BMI were significant predictors of Global EDE-Q, accounting for 29% variance. The other variables in the model were non-significant. Significant direct effect of body dissatisfaction in predicting Global EDE-Q while controlling for SC, showing that SC mediated the relationship between body dissatisfaction and global EDE-Q scores. The total model, including BMI, accounted for 63.8% of the variance in Global EDE-Q. Experiential avoidance positively predicted eating disorder symptoms, however, when self-compassion was held constant in the model, experiential avoidance was no longer a significant predictor, suggesting SC explained the relationship between experiential avoidance and eating disorder symptoms (Global EDE-Q). The model, including BMI, explained 22.4% of the variance in EDE-Q.

Table 3 Continued

Author	Measures	Control/Conditions	Analysis	Outcomes and effect sizes (where reported)
Lockley (2013)	EDE-Q  SC long-form		Correlations	SC was associated with EDE-Q global eating pathology. Specifically, negative associations for self-kindness and common humanity. Negative associations were also shown with self-judgment, isolation, and over-identification (scores reversed). Therefore, higher levels of self-compassionate traits were associated with lower levels eating pathology.
Maraldo et al. (2016)	EDE-Q  SC short-form		Correlation analyses Structural Equation Modelling (AMOS)	Self-compassion predicted dietary restraint, though the pathways suggested greater SC was associated with greater restraint and was therefore removed. SC mediated the association between body dissatisfaction and dietary restraint but there was a poor model fit, even when NA was added, therefore the model was rejected.
Marta-Simoes & Ferreira (2018)	EDE-Q  SC long-form		Correlation analyses Path analyses	SC was negatively associated with global EDE-Q scores. There was a positive direct effect of self-compassion on body appreciation and an indirect effect on disordered eating, showing that the relationship between SC and disordered eating was mediated by body appreciation. The effect of early memories of warmth and safeness with peers on disordered eating (EDE-Q) was indirect and mediated by self-compassion, social safeness, and body appreciation.
Pennesi and Wade (2018)	EDE-Q  SC short-form	<i>N</i> =107 Imagery rescripting (T1 <i>n</i> =37; T2 <i>n</i> =35) Cognitive dissonance (T1 <i>n</i> =35; T2 <i>n</i> =34) Control (T1 <i>n</i> =35; T2 <i>n</i> =31)	t-tests One-way ANOVA One-way ANCOVA Hierarchical multiple Mediation analyses	No significant differences between participants at baseline. Between group effect sizes at post-interventions (T2) whilst controlling for baseline (T1) variables, revealed significant effects between imagery rescripting and control for SC and disordered eating. Therefore, participants in the imagery rescripting condition reported significantly higher self-compassion and lower levels of disordered eating than the control condition, at post intervention. Adjusting for T1 variables, T2 SC mediated the relationship between condition and changes in disordered eating singularly and to a greater extent when combined with T2 body image acceptance accounting for 49% and 59% of the variance respectively.

Table 3 Continued

Author	Measures	Control/Conditions	Analysis	Outcomes and effect sizes (where reported)
Pinto-Gouveia et al. (2016)	EDE  SC long-form		T-tests Wilcoxon Signed Rank tests Repeated measures ANOVA Mediation analyses	Participants showed an increase in self-compassion and a significant decrease in eating psychopathology from time 1 to time 2. There were no significant differences from T2 at 3 and 6-month follow-ups. There were no significant within-participants' mediation effects of self-compassion or other variables for eating pathology
Pinto-Gouveia et al. (2017)	EDE  SC long-form	Intervention (T1 <i>n</i> =29; T2 <i>n</i> =19; T3 <i>n</i> =13; T4 <i>n</i> =11) wait list control (T1 <i>n</i> = 25; T2 <i>n</i> =17).	T-tests Repeated measures ANOVA	Participants in intervention condition had significant decreases in eating psychopathology from T1 to T2. Whilst there were increases in self-compassion from T1 to T2 differences in self-compassion did not reach statistical significance. Differences within groups from pre-intervention to post-intervention showed significant decreases in eating psychopathology with moderate to large effect sizes from T1 to T2. There were significant within-group changes for the negative factors of self-compassion (self-criticism) with the intervention group showing decreases from T1 to T2 but there were no significant changes in the control group. Effects were maintained at 3 and 6-month follow-up.

## Discussion

The aim of this review was to identify, summarise and appraise studies that reported the relationship between self-compassion and eating attitudes, motivation and behaviour. Also, to ascertain the nature of this relationship and the role of self-compassion in eating, and to determine the methodological standards of the results. Through the systematic search of four databases, results relevant to the topic were extracted. Eighteen papers, including 16 studies of differing methodologies and designs, were included in the review. This presents a significantly updated evidence base to Braun et al.'s (2016) related review of self-compassion and eating disorders, in that the present review included seven papers also reviewed by Braun, but an additional eleven more recent papers, with the focus solely on eating, rather than body image. Also, six of the seven papers included in Braun's review used the same eating disorder sample and were conducted by Kelly and associated authors, emphasising the breadth of the current review by comparison.

The results demonstrate that the relationship between self-compassion and eating experiences is complex, and that other important factors may interact with SC to determine outcomes. Generally, studies reported the expected direction of results, that higher self-compassion was associated with lower levels of disordered eating, and that lower SC was associated with poor eating pathology. One study (Kelly, Vimalakanthan, & Carter, 2014) reported that SC was lower in the ED sample, compared to the student sample, at baseline. However, more comparative studies would be necessary to conclude whether this is a valid and consistent finding.

The majority of studies reported that global SC was associated with global EDE-Q, with predictive variance ranging from 7-63.8%. This wide range may be a consequence of the variation in methodological quality between studies, or may be because, in the majority of

studies, SC was combined with numerous other variables when assessing its predictive impact. Of the studies that focused on the subscale scores, none of them looked at the subscales for both SC and EDE-Q, which may limit the validity of the findings. Geller et al. (2015) found all SC subscales, with the exception of common humanity, were associated with total EDE-Q, with predictive validity of 7%. Whereas Lockley (2013) found common humanity and self-kindness were associated with lower EDE-Q scores, but self-judgment, isolation, and over-identification were associated with higher EDE-Q scores. For the EDE-Q, Ferreira found that SC total was negatively associated with all EDE-Q subscales, apart from the restraint subscale, whereas Kelly, Vimalakanthan and Miller (2014) and Kramer (2018) reported SC was negatively associated with all subscales. Although studies considering subscale scores are limited, they are largely consistent. Discrepancies could be explained by quality differences, for instance Lockley was adequately powered, whereas Geller did not report this.

Overall, the results offer a mixed picture concerning the relationship of SC to eating experiences, but there are promising signs of a significant relationship between the construct of SC and eating disordered behaviours. However, directionality and specifics cannot yet be demonstrated. For instance, the results raise questions about whether SC relates more to restriction, bingeing, or both as this is not clear. ED theory suggests that restriction inevitably leads to bingeing (Elran-Barak et al., 2015), and so it is possible that SC might have different relationships to those aspects. Also, it is possible that disordered eating leads to high levels of self-criticism and therefore it could be that eating behaviour reduces SC which would be the opposite direction to that presumed in research. Consequently, it could be beneficial to observe whether improvements in eating behaviour impact SC. Moreover, each study varied in its methodological quality ratings, and SC seems to have been consistently combined with other variables and so determining its unique effects remain difficult. Despite this, SC global and EDE-Q global were consistently related and examination of the subscales offered a steady

pattern of results. However, given potential complex interactions with other important factors such as BMI, body appreciation, early experiences, shame memories etc., it may be important to consider the overlap of different constructs. For instance, poor SC may be linked to early experiences (i.e., low parental warmth, emotional abuse, shame experiences) and these experiences may be linked to both disordered eating and to self-compassion. The results point to this and indicate there may be common factors underpinning self-compassion and other aspects shaping eating disorders.

### **Limitations**

As the methodological standards in this review were quite poor, with no study attaining yes on all standards, any conclusions should be treated with caution. The cross-sectional studies noted associations, predictive validity, mediational and moderation effects of self-compassion; however, given the studies are cross-sectional, causality cannot be inferred. Additionally, self-compassion was measured alongside numerous other variables in most studies, making predictive validity difficult to ascertain. Although most studies seemed to have a sufficient sample size in terms of the chosen methodology and data analysis, the majority of studies did not report power calculations or effect sizes. Where these were reported, they ranged from weak, through moderate to large, with little consistency. Therefore, appropriateness of sample size and inferences regarding the magnitude of statistically-significant differences found in these studies cannot be made. There were large attrition rates in most of the prospective cohort and intervention studies, and the majority of studies that used the same sample did not state this explicitly, limiting the ability to evaluate the study quality.

Whilst it is notable that most studies found SC played a positive role in eating pathology, most combined SC with other variables, making it difficult to identify unique variance associated with SC. Furthermore, a limitation of some of the studies included in the

review was the use of a two-factor model of self-compassion. This comprises positive (self-compassion) and negative (self-critical) subscales, rather than the original unitary construct or six factor (subscale) model posited by Neff (2003). Despite the evidence that a two factor model of the SCS is argued to lack validity (Neff et al., 2017), multiple studies (Ferreira et al., 2013; 2014; 2017; Kelly & Tasca, 2016; Kelly et al., 2017; Pinto-Gouveia et al., 2016; 2017) used this two factor model for analysis, thus challenging the validity of their interpretations regarding the SC construct.

There are several limitations of the review procedure, which must be considered when drawing conclusions from the overall findings. The present review focused narrowly on specific inclusion criteria, which limited conclusions to studies using specific psychometric measures (EDE-Q and SCS), and thus it remains possible that broader inclusion criteria with multiple psychometric measures might have presented a more nuanced picture of these two constructs. These measures are not without criticism regarding their validity, factor structure and diagnostic focus (Gilbert, McEwan, Matos, & Ravis, 2011; López et al., 2015; Penelo, Negrete, Portell, & Raich, 2013). The SCS is also partly culturally defined (Neff, Pisitsungkagarn, & Hsieh, 2008) and values of weight and shape are different cross culturally (Westenhofer et al., 2018) therefore there is a potential lack of cultural validity. The EDE-Q also has limited generalisability, for instance for use with males and adolescents, or in comparing eating disorder cases and non-cases (Berg, Peterson, Frazier, & Crow, 2012). Furthermore, the content validity of the EDE-Q should be continually evaluated as diagnostic criteria evolve (Carey, Kupeli, Knight, Troop, Jenkinson, & Preston, 2019). The EDEQ has shown to better evaluate restriction and purging than bingeing and excessive eating. It also adopts a disorder-related perspective, which limits generalisability, for instance, it is possible that people might overeat, and develop type 2 diabetes without associated psychological issues that are associated with ED. Whilst, the EDEQ does capture overeating well, SC could be

explored in relation to excessive eating behaviour, outside of the ED framework. Nonetheless, their dominance in the field with both clinical and non-clinical populations, permits their use. Both the EDE and EDE-Q are considered gold-standard measures (Fairburn, 2008) and the long-form and short-form SCS have been considered equally valid predictors with near-perfect correlations amongst three validation samples (Raes et al., 2011). Most of the reviewed studies (12) employed the original 26-item scale (Neff, 2003); however, six used the 12-item short-form version (Raes et al., 2011).

This protocol driven review underpinned by the PRISMA guidelines (Moher et al., 2009) and facilitated by independent quality review of the papers, provides a summary of the research relating to the complex relationship between self-compassion and eating experiences. Whilst the review benefited from the assessment of methodological and reporting quality of individual studies, it is recognised that there are limitations to any quality assessment tool used as these are not specific to each type of study design. However, there was evident value in confirming and extending the review conducted by Braun et al. (2016), which included seven of the eighteen studies in the current review, with more recent studies upholding the reliability of previous findings.

### **Implications for Clinical Practice**

The relationships found support the validity of self-compassion as important in eating pathology, and the review supports the validity of exploring self-compassion at assessment and as a target for preventing/mitigating against ED issues, providing a useful and accessible treatment option. Results also indicate SC may have a complex interplay with other factors, and thus suggest that clinical work should bear in mind SC interactions with other issues (such as BMI, body image, early experiences etc.) and not assume direct and simplistic relationships. Similarly, this promotes a formulation based approach. The findings also suggest that SC as a

construct appears acceptable to ED clients in that psychometrics produce individual and meaningful variance, so the psychometrics might be usefully used in clinical work. Furthermore, Given the poor outcomes in relation to traditional treatment for eating disorders (e.g., Danielsen, Rekkedal, Frostad, & Kessler, 2016; Fairburn et al., 2015; Le Grange et al., 2007; Williams et al., 2017) findings demonstrating the positive effects of self-compassion may contribute to increased patient choice of psychological treatments.

Self-compassion interventions may also prove fruitful in tackling obesity, and psychoeducation around self-compassion may be a cost-effective and efficient way to help people develop healthier eating habits. This may be particularly relevant in populations diagnosed with pre-diabetes, or in people living with diabetes to help them manage their weight and to increase their psychological wellbeing. The brief nature of self-compassion interventions may fit with the remit of NICE guidance in treating populations with poor eating behaviour or pathology (NICE, 2107) and interventions may have positive clinical implications for both individuals with poor eating habits, diagnosable eating disorders and the wider systems, in terms of the potential cost-effectiveness and treatment efficacy. However, given the unclear picture about the relationship between SC and ED, caution should perhaps be exercised before applying SC interventions.

### **Implications for Future Research**

Given the lack of consensus around how self-compassion is delivered and evaluated in research and through intervention studies, establishing consistent and standardised approaches may be key to ensuring its effectiveness is appropriately recorded. Quality control is important as there were issues of overlapping constructs and methodological quality varied between papers, with power calculation being the weakest area identified in all studies. Discrepancies in delivery and evaluation have clear implications for the quality of the research undertaken,

evident in this review. Standardising approaches may go some way toward rectifying this problem, allowing higher-quality trials to be undertaken to investigate the effectiveness of self-compassion interventions, alongside more-widely used treatments for eating disorders.

Age was not specified in the current review, however only two articles included participants under the age of 18 years. Given the incidence of eating difficulties prevalent amongst young people (NHS Digital, 2019) future research might consider and evaluate the role of self-compassion in eating in this population, both clinically and non-clinically. Also, the majority of research focuses on females as EDs are generally seen as disorders that affect young females and women (Duffy & Henkel, 2016; Puhl & Suh, 2015); however, eating disorders are also growing amongst men and boys (Hamilton, 2007; Lock, 2010; 2015; Marques et al., 2011; Sonnevile & Lipson, 2018). One in three people struggling with an eating disorder is male, and subclinical eating disordered behaviours are reaching the same heights as women, however, this group is currently under-diagnosed and undertreated (Lavender, Brown, & Murray, 2017; Strother, Lemberg, Stanford, & Turberville, 2012). Furthermore, obesity and overweight is prevalent in men aged between 45 and 74 years (Parliament UK, 2018, NHS Digital, 2019) and poses a risk to health including diabetes, coronary heart disease and cancer (Barnes, 2011; De Pergola & Silvestris, 2013; Lavie et al., 2016; NHS Digital, 2019; WHO, 2006). Therefore, future research would be beneficial in the male population.

Given much of the research considered the effects of self-compassion alongside other variables, often reporting results attributed to combined effects, it would be beneficial to consider the unique contribution of self-compassion in predicting, mediating or moderating the effects of eating pathology. Also, more explicit exploration of overlapping constructs and the interplay of factors contributing to ED would be useful.

## **Conclusion**

To the best of the author's knowledge, this review is the first attempt to systematically examine the effects self-compassion solely in relation to eating attitudes, motivation and behaviour, defined as eating pathology. This review summarises the literature currently available within this area that aligns conceptually to a positive psychology framework and that includes gold-standard outcome measures. Furthermore, information has been updated since the most recent review (Braun et al., 2016). The limitations of the evidence-base to date has also been identified, providing a platform for the advancement of future research.

Findings illustrate there is a relationship between self-compassion and eating attitudes, motivation and behaviour, but the directionality and specifics of this relationship are unclear. The findings also offer explanations of the role of self-compassion in predicting eating pathology, mediating and moderating the effects of risk factors in relation to eating, and offer tentative support for the use self-compassion in ameliorating eating pathology through intervention. Researchers should work towards standard delivery of self-compassion to enable more effective evaluation, and to improve services for people with eating difficulties. The review provides a useful summary of the available literature in this area and identifies the relative lack of high quality studies within this field. Moreover, given the apparent lack of quality and nascent nature of this area of research, future research to advance this field appears imperative.

## References

- Alvarenga, M. D. S., Scagliusi, F. B., & Philippi, S. T. (2012). Comparison of eating attitudes among university students from the five Brazilian regions. *Ciencia & saude coletiva, 17*, 435-444.
- Barnard, L. K., & Curry, J. F. (2011). Self-compassion: Conceptualizations, correlates, & interventions. *Review of General Psychology, 15*(4), 289-303.
- Barnes, A. S. (2011). The Epidemic of Obesity and Diabetes: Trends and Treatments. *Texas Heart Institute Journal, 38*(2), 142–144.
- Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2012). Psychometric evaluation of the eating disorder examination and eating disorder examination-questionnaire: A systematic review of the literature. *International Journal of Eating Disorders, 45*(3), 428-438.
- Berridge, K.C. (2009). ‘Liking’ and ‘wanting’ food rewards: brain substrates and roles in eating disorders. *Physiological Behaviour, 97*, 537–50.
- Biber, D., & Ellis, R. (2017). The effect of self-compassion on the self-regulation of health behaviors: A systematic review. *Journal of Health Psychology, 00*(0), 1–12.
- Bluth, K., & Neff, K. D. (2018). New frontiers in understanding the benefits of self-compassion. *Self and Identity, 17*(6), 605-608.
- Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BioMed Central Public Health, 13*(4), 1-20.
- Bowlin, S. L. (2012). *Dispositional Mindfulness and Self-Compassion and their influence on Oxytocin and Parasympathetic Functioning* (Doctoral dissertation, University of Kansas).

- Braun, T. D., Park, C. L., & Gorin, A. (2016). Self-compassion, body image, and disordered eating: A review of the literature. *Body Image, 17*, 117-131.
- Brechan, I., & Kvalem, I. L. (2015). Relationship between body dissatisfaction and disordered eating: Mediating role of self-esteem and depression. *Eating Behaviors, 17*, 49-58.
- Brown, L., Bryant, C., Brown, V., Bei, B., & Judd, F. (2016). Self-compassion, attitudes to ageing and indicators of health and well-being among midlife women. *Aging & Mental Health, 20*(10), 1035-1043.
- Carey, M. A., Kupeli, N., Knight, R. E., Troop, N., Jenkinson, P. M., & Preston, C. E. J. (2019). Eating Disorder Examination Questionnaire (EDE-Q): norms and psychometric properties in UK females and males. *Psychological Assessment, 1-42*.
- Christensen, L. (2001). The effect of food intake on mood. *Clinical Nutrition, 20*, 161-166.
- Cooper, Z., Cooper, P. J., & Fairburn, C. G. (1989). The validity of the eating disorder examination and its subscales. *The British Journal of Psychiatry, 154*(6), 807-812.
- Cornelius J.R., Tippmann-Peikert, M., Slocumb, N.L., Frerichs, C.F., Silber, M.H. (2010). Impulse control disorders with the use of dopaminergic agents in restless legs syndrome: a case-control study. *Sleep, 33*, 81-7.
- Dallos, R. (2003). Using narrative and attachment theory in systemic family therapy with eating disorders. *Clinical Child Psychology and Psychiatry, 8*(4), 521-535.
- Danielsen, Y. S., Rekkedal, G. Å., Frostad, S., & Kessler, U. (2016). Effectiveness of enhanced cognitive behavioral therapy (CBT-E) in the treatment of anorexia nervosa: a prospective multidisciplinary study. *BMC Psychiatry, 16*(1), 342.
- De Graaf, C., Blom, W. A., Smeets, P. A., Stafleu, A., & Hendriks, H. F. (2004). Biomarkers of satiation and satiety. *The American Journal of Clinical Nutrition, 79*(6), 946-961.

- De Pergola, G., & Silvestris, F. (2013). Obesity as a major risk factor for cancer. *Journal of obesity*, 1-12.
- Drewnowski, A. (2009). Obesity, diets, and social inequalities. *Nutrition Reviews*, 67, 36–39.
- Dring, G. (2015). Anorexia runs in families: is this due to genes or the family environment?. *Journal of Family Therapy*, 37(1), 79-92.
- Duffy, M. E., & Henkel, K. E. (2016). Non-specific terminology: Moderating shame and guilt in eating disorders. *Eating Disorders*, 24(2), 161-172.
- Dunne, S., Sheffield, D., & Chilcot, J. (2018). Brief report: Self-compassion, physical health and the mediating role of health-promoting behaviours. *Journal of Health Psychology*, 23(7), 993-999.
- Egan, H. H., & Mantzios, M. (2018). A qualitative exploration of self-kindness and 'treating oneself' in contexts of eating, weight regulation and other health behaviours: Implications for mindfulness-based eating programmes. *Frontiers in Psychology*, 9, 880-890.
- Elran-Barak, R., Sztainer, M., Goldschmidt, A. B., Crow, S. J., Peterson, C. B., Hill, L. L., ... & Le Grange, D. (2015). Dietary restriction behaviors and binge eating in anorexia nervosa, bulimia nervosa and binge eating disorder: Trans-diagnostic examination of the restraint model. *Eating Behaviors*, 18, 192-196.
- England, N. H. S. (2015). Future in mind: Promoting, protecting and improving our children and young people's mental health and wellbeing. *London: Department of Health*.
- Fairburn C. (2008). *Cognitive behavior therapy and eating disorders*. New York, NY: Guilford Press.
- Fairburn, C. G., Bailey-Straebler, S., Basden, S., Doll, H. A., Jones, R., Murphy, R., O'Connor, E.M., & Cooper, Z. (2015). A transdiagnostic comparison of enhanced cognitive behaviour therapy (CBT-E) and interpersonal psychotherapy in the treatment of eating disorders. *Behaviour Research and Therapy*, 70, 64-71.

- Fairburn, C.G., & Beglin, S.J. (1994). Assessment of eating disorders: interview or self-report questionnaire? *International Journal of Eating Disorders*, *16*, 363-370.
- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A “transdiagnostic” theory and treatment. *Behaviour Research and Therapy*, *41*(5), 509-528.
- Fairburn, C. G., & Walsh, B. T. (2002). Atypical eating disorders (eating disorder not otherwise specified). *Eating Disorders and Obesity: A Comprehensive Handbook*, *2*, 171-177.
- Farrington, D. P. (2006). Key longitudinal-experimental studies in criminology. *Journal of Experimental Criminology*, *2*(2), 121-141.
- Ferreira, C., Matos, M., Duarte, C., & Pinto-Gouveia, J. (2014). Shame memories and eating psychopathology: The buffering effect of self-compassion. *European Eating Disorders Review*, *22*(6), 487-494.
- Ferreira, C., Oliveira, S., & Mendes, A. L. (2017). Kindness toward one’s self and body: exploring mediational pathways between early memories and disordered eating. *The Spanish Journal of Psychology*, *20*, 1-8.
- Ferreira, C., Pinto-Gouveia, J., & Duarte, C. (2013). Self-compassion in the face of shame and body image dissatisfaction: Implications for eating disorders. *Eating Behaviors*, *14*(2), 207-210.
- Freitas, A., Albuquerque, G., Silva, C., & Oliveira, A. (2018). Appetite-Related Eating Behaviours: An Overview of Assessment Methods, Determinants and Effects on Children’s Weight. *Annals of Nutrition and Metabolism*, *73*(1), 19-29.
- Friis, A. M., Johnson, M. H., Cutfield, R. G., & Consedine, N. S. (2016). Kindness matters: a randomized controlled trial of a mindful self-compassion intervention improves depression, distress, and HbA1c among patients with diabetes. *Diabetes Care*, *39*(11), 1963-1971.

- Gahagan, S. (2012). The development of eating behavior-biology and context. *Journal of Developmental and Behavioral Paediatrics, 33*(3), 261-271.
- Gearhardt, A. N., Boswell, R. G., & White, M. A. (2014). The association of “food addiction” with disordered eating and body mass index. *Eating Behaviors, 15*(3), 427-433.
- Geller, J., Srikameswaran, S., & Zelichowska, J. (2015). Resilience to shape and weight concerns and disordered eating: the role of self-compassion. *Advances in Eating Disorders: Theory, Research and Practice, 3*(1), 4-12.
- Germer, C. K., & Neff, K. D. (2013). Self-compassion in clinical practice. *Journal of Clinical Psychology, 69*(8), 856-867.
- Gilbert, P., & Irons, C. (2005). Focused therapies and compassionate mind training for shame and self-attacking. *Compassion: Conceptualisations, Research and use in Psychotherapy, 263-325*.
- Gilbert, P., McEwan, K., Matos, M., & Rivis, A. (2011). Fears of compassion: Development of three self-report measures. *Psychology and Psychotherapy: Theory, Research and Practice, 84*(3), 239-255.
- Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research, 57*, 35-43.
- Hall, C. W., Row, K. A., Wuensch, K. L., & Godley, K. R. (2013). The role of self-compassion in physical and psychological well-being. *The Journal of Psychology, 147*(4), 311-323.
- Hamilton, J. D. (2007). Eating disorders in preadolescent children. *The Nurse Practitioner, 32*(3), 44-48.

- Herbozo, S., Schaefer, L. M., & Thompson, J. K. (2015). A comparison of eating disorder psychopathology, appearance satisfaction, and self-esteem in overweight and obese women with and without binge eating. *Eating Behaviors, 17*, 86-89.
- Hill, K. G., Woodward, D., Woelfel, T., Hawkins, J. D., & Green, S. (2016). Planning for long-term follow-up: Strategies learned from longitudinal studies. *Prevention Science, 17*(7), 806-818.
- Hudson, J. I., Hiripi, E., Pope Jr, H. G., & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. *Biological Psychiatry, 61*(3), 348-358.
- Iddon, J. E., Dickson, J. M., & Unwin, J. (2016). Positive psychological interventions and chronic non-cancer pain: A systematic review of the literature. *International Journal of Applied Positive Psychology, 1*(1-3), 133-157.
- James, D., Sebren, A., DerAnanian, C., Bruening, M., Rooney, L., Araas, T., & Swan, P. D. (2016). Associations among self-compassion, eating behaviors, and stress in college freshmen. *Journal of Basic and Applied Sciences, 12*, 92-97.
- Kelly, A. C., & Carter, J. C. (2015). Self-compassion training for binge eating disorder: A pilot randomized controlled trial. *Psychology and psychotherapy: Theory, Research and Practice, 88*(3), 285-303.
- Kelly, A. C., Carter, J. C., & Borairi, S. (2014). Are improvements in shame and self-compassion early in eating disorders treatment associated with better patient outcomes?. *International Journal of Eating Disorders, 47*(1), 54-64.
- Kelly, A. C., Carter, J. C., Zuroff, D. C., & Borairi, S. (2013). Self-compassion and fear of self-compassion interact to predict response to eating disorders treatment: A preliminary investigation. *Psychotherapy Research, 23*(3), 252-264.

- Kelly, A. C., & Tasca, G. A. (2016). Within-persons predictors of change during eating disorders treatment: An examination of self-compassion, self-criticism, shame, and eating disorder symptoms. *International Journal of Eating Disorders, 49*(7), 716-722.
- Kelly, A. C., Vimalakanthan, K., & Carter, J. C. (2014). Understanding the roles of self-esteem, self-compassion, and fear of self-compassion in eating disorder pathology: An examination of female students and eating disorder patients. *Eating Behaviors, 15*(3), 388-391.
- Kelly, A. C., Vimalakanthan, K., & Miller, K. E. (2014). Self-compassion moderates the relationship between body mass index and both eating disorder pathology and body image flexibility. *Body Image, 11*(4), 446-453.
- Kelly, A. C., Wisniewski, L., Martin-Wagar, C., & Hoffman, E. (2017). Group-Based Compassion-Focused Therapy as an Adjunct to Outpatient Treatment for Eating Disorders: A Pilot Randomized Controlled Trial. *Clinical Psychology & Psychotherapy, 24*(2), 475-487.
- Kelly, A. C., Zuroff, D. C., Foa, C. L., & Gilbert, P. (2010). Who benefits from training in self-compassionate self-regulation? A study of smoking reduction. *Journal of Social and Clinical Psychology, 29*(7), 727-755.
- Kenny, P.J. (2011). Reward mechanisms in obesity: new insights and future directions. *Neuron, 69*, 664-79.
- Kimber, M., McTavish, J. R., Couturier, J., Boven, A., Gill, S., Dimitropoulos, G., & MacMillan, H. L. (2017). Consequences of child emotional abuse, emotional neglect and exposure to intimate partner violence for eating disorders: a systematic critical review. *BioMed Central Psychology, 5*(1), 33.

- Kirby, J. N., Tellegen, C. L., & Steindl, S. R. (2017). A meta-analysis of compassion-based interventions: Current state of knowledge and future directions. *Behavior Therapy, 48*(6), 778-792.
- Kramer, R. A. (2018). *Yoga as an Intervention among College Students: Measuring Changes in Body Dissatisfaction, Disordered Eating, Self-compassion, Mindfulness, and Experiential Avoidance*. Doctoral Dissertation, University of North Dakota.
- Krieger, T., Altenstein, D., Baettig, I., Doerig, N., & Holtforth, M. G. (2013). Self-compassion in depression: Associations with depressive symptoms, rumination, and avoidance in depressed outpatients. *Behavior Therapy, 44*(3), 501-513.
- Kringelbach, M. L. (2015). The pleasure of food: underlying brain mechanisms of eating and other pleasures. *Flavour, 4*(1), 20-32.
- Kringelbach, M. L., Stein, A., & van Hartevelt, T. J. (2012). The functional human neuroanatomy of food pleasure cycles. *Physiology & Behavior, 106*(3), 307-316.
- Lavender, J. M., Brown, T. A., & Murray, S. B. (2017). Men, muscles, and eating disorders: an overview of traditional and muscularity-oriented disordered eating. *Current Psychiatry Reports, 19*(6), 32-39.
- Lavie, C. J., De Schutter, A., Parto, P., Jahangir, E., Kokkinos, P., Ortega, F. B., ... & Milani, R. V. (2016). Obesity and prevalence of cardiovascular diseases and prognosis—the obesity paradox updated. *Progress in Cardiovascular Diseases, 58*(5), 537-547.
- Le Grange, D., Crosby, R. D., Rathouz, P. J., & Leventhal, B. L. (2007). A randomized controlled comparison of family-based treatment and supportive psychotherapy for adolescent bulimia nervosa. *Archives of General Psychiatry, 64*(9), 1049-1056.

- Le Grange, D., & Lock, J. (2007) Treating Bulimia in Adolescents-A Family Based Approach The Guilford Press: New York, USA, pp. 260, ISBN-13: 978-1593854140. *European Eating Disorders Review: The Professional Journal of the Eating Disorders Association*, 16(4), 327-327.
- Lock, J. (2015). An update on evidence-based psychosocial treatments for eating disorders in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, 44(5), 707-721.
- Lock, J. (2010). Treatment of adolescent eating disorders: Progress and challenges. *Minerva Psichiatrica*, 51(3), 207-216.
- Lockley, S. (2013). *Examining shame, self-compassion and eating behaviour in treatment-seeking obese adults: A cross sectional study*. Doctoral Dissertation, University of Leicester.
- López, A., Sanderman, R., Smink, A., Zhang, Y., van Sonderen, E., Ranchor, A., & Schroevers, M. J. (2015). A reconsideration of the Self-Compassion Scale's total score: self-compassion versus self-criticism. *PloS one*, 10(7), e0132940.
- Lumeng, J.C., & Hillman, K.H. (2007). Eating in larger groups increases food consumption. *Archives of Disease in Childhood*, 92(5), 384–387.
- MacBeth, A., & Gumley, A. (2012). Exploring compassion: A meta-analysis of the association between self-compassion and psychopathology. *Clinical Psychology Review*, 32(6), 545-552.
- Macht, M., & Mueller, J. (2007). Immediate effects of chocolate on experimentally induced mood states. *Appetite*, 49, 667–674.
- Mantzios, M., & Wilson, J. C. (2015a). Exploring mindfulness and mindfulness with self-compassion-centered interventions to assist weight loss: theoretical considerations and preliminary results of a randomized pilot study. *Mindfulness*, 6(4), 824-835.

- Mantzios, M., & Wilson, J. C. (2015a). Mindfulness, eating behaviours, and obesity: a review and reflection on current findings. *Current Obesity Reports*, 4(1), 141-146.
- Maraldo, T. M., Zhou, W., Dowling, J., & Vander Wal, J. S. (2016). Replication and extension of the dual pathway model of disordered eating: The role of fear of negative evaluation, suggestibility, rumination, and self-compassion. *Eating Behaviors*, 23, 187-194.
- Marques, L., Alegria, M., Becker, A. E., Chen, C. N., Fang, A., Chosak, A., & Diniz, J. B. (2011). Comparative prevalence, correlates of impairment, and service utilization for eating disorders across US ethnic groups: Implications for reducing ethnic disparities in health care access for eating disorders. *International Journal of Eating Disorders*, 44(5), 412-420.
- Marsh, I. C., Chan, S. W., & MacBeth, A. (2018). Self-compassion and psychological distress in adolescents—a meta-analysis. *Mindfulness*, 9(4), 1011-1027.
- Marta-Simões, J., & Ferreira, C. (2018). Self-to-others and self-to-self relationships: paths to understanding the valence of body image and eating attitudes in emerging adult women. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1-8.
- Martyn-Nemeth, P., Penckofer, S., Gulanick, M., Velsor-Friedrich, B., & Bryant, F. B. (2009). The relationships among self-esteem, stress, coping, eating behavior, and depressive mood in adolescents. *Research in Nursing & Health*, 32(1), 96-109.
- Milos, G., Spindler, A., Schnyder, U., & Fairburn, C. G. (2005). Instability of eating disorder diagnoses: prospective study. *The British Journal of Psychiatry*, 187(6), 573-578.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *Annals of International Medicine*, 151, 264-269.

- Murphy, R., Straebler, S., Cooper, Z., & Fairburn, C. G. (2010). Cognitive behavioral therapy for eating disorders. *Psychiatric Clinics*, 33(3), 611-627.
- National Heart Lung and Blood Institute. Overweight and Obesity. (2010). Available at: [www.nhlbi.nih.gov/health/dci/Diseases/obe/obe\\_whatare.html](http://www.nhlbi.nih.gov/health/dci/Diseases/obe/obe_whatare.html). Accessed March 4, 2019.
- National Institute for Health and Clinical Excellence. (2006). *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children*. Retrieved from: [www.nice.org.uk/guidance/CG43](http://www.nice.org.uk/guidance/CG43). Accessed December 3, 2018.
- National Institute for Clinical Excellence (2004). *Eating disorders: core interventions in the treatment and management of anorexia nervosa, bulimia nervosa and related eating disorders*. Retrieved from: <http://www.nice.org.uk>. Accessed December 3, 2018.
- National Institute for Health and Clinical Excellence. (2017). *Eating disorders: Recognition and treatment*. Retrieved from: <https://www.nice.org.uk/guidance/ng69>. Accessed December 3, 2018.
- Neff, K. D. (2011). Self-compassion, self-esteem, and well-being. *Social and Personality Psychology Compass*, 5(1), 1-12.
- Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity*, 2(3), 223-250.
- Neff, K. D. (2009). The role of self-compassion in development: A healthier way to relate to oneself. *Human Development*, 52(4), 211-214.
- Neff, K. D., & Dahm, K. A. (2015). Self-compassion: What it is, what it does, and how it relates to mindfulness. In *Handbook of Mindfulness and Self-Regulation* (pp. 121-137). Springer, New York, NY.

- Neff, K. D., & Germer, C. K. (2013). A pilot study and randomized controlled trial of the mindful self-compassion program. *Journal of clinical psychology, 69*(1), 28-44.
- Neff, K. D., Hsieh, Y. P., & Dejitterat, K. (2005). Self-compassion, achievement goals, and coping with academic failure. *Self and Identity, 4*(3), 263-287.
- Neff, K. D., Long, P., Knox, M. C., Davidson, O., Kuchar, A., Costigan, A., ... & Breines, J. G. (2018). The forest and the trees: Examining the association of self-compassion and its positive and negative components with psychological functioning. *Self and Identity, 17*(6), 627-645.
- Neff, K. D., Pisitsungkagarn, K., & Hsieh, Y. P. (2008). Self-compassion and self-construal in the United States, Thailand, and Taiwan. *Journal of Cross-Cultural Psychology, 39*(3), 267-285.
- Neff, K. D., Whittaker, T. A., & Karl, A. (2017). Examining the factor structure of the Self-Compassion Scale in four distinct populations: Is the use of a total scale score justified?. *Journal of Personality Assessment, 99*(6), 596-607.
- Neff, K. D., & Vonk, R. (2009). Self-compassion versus global self-esteem: Two different ways of relating to oneself. *Journal of Personality, 77*(1), 23-50.
- NHS Digital. (2019). *Statistics on Obesity, Physical Activity and Diet, England*. Retrieved from: <https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-obesity-physical-activity-and-diet/statistics-on-obesity-physical-activity-and-diet-england-2019/part-3-adult-obesity>. Accessed May 19, 2019.
- O'Shaughnessy, R., & Dallos, R. (2009). Attachment research and eating disorders: A review of the literature. *Clinical Child Psychology and Psychiatry, 14*(4), 559-574.
- Papadopoulos, F. C., Ekbom, A., Brandt, L., & Ekselius, L. (2009). Excess mortality, causes of death and prognostic factors in anorexia nervosa. *The British Journal of Psychiatry, 194*(1), 10-17.

- Parliament UK. (2018). *Obesity Statistics, House of Commons Library*. Available at <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN03336:www.parliament.uk>. Accessed March 4, 2019.
- Penelo, E., Negrete, A., Portell, M., & Raich, R. M. (2013). Psychometric properties of the Eating Disorder Examination Questionnaire (EDE-Q) and norms for rural and urban adolescent males and females in Mexico. *PLoS One*, 8(12), e83245, 1-11.
- Pennesi, J. L., & Wade, T. D. (2018). Imagery rescripting and cognitive dissonance: A randomized controlled trial of two brief online interventions for women at risk of developing an eating disorder. *International Journal of Eating Disorders*, 51(5), 439-448.
- Pinto-Gouveia, J., Carvalho, S. A., Palmeira, L., Castilho, P., Duarte, C., Ferreira, C., ... & Costa, J. (2016). Incorporating psychoeducation, mindfulness and self-compassion in a new programme for binge eating (BEfree): Exploring processes of change. *Journal of Health Psychology*, 1-14.
- Pinto-Gouveia, J., Carvalho, S. A., Palmeira, L., Castilho, P., Duarte, C., Ferreira, C., ... & Costa, J. (2017). BEfree: A new psychological program for binge eating that integrates psychoeducation, mindfulness, and compassion. *Clinical Psychology & Psychotherapy*, 24(5), 1090-1098.
- Polivy, J., & Herman, C. P. (2002). Causes of eating disorders. *Annual Review of Psychology*, 53(1), 187-213.
- Puhl, R., & Suh, Y. (2015). Stigma and eating and weight disorders. *Current Psychiatry Reports*, 17(3), 1-10.
- Qi, X., Yang, M., Ren, W., Jia, J., Wang, J., Han, G., & Fan, D. (2013). Find duplicates among the PubMed, EMBASE, and Cochrane Library Databases in systematic review. *PLoS One*, 8(8), 1-12.

- Raes, F., Pommier, E., Neff, K. D., & Van Gucht, D. (2011). Construction and factorial validation of a short form of the self-compassion scale. *Clinical Psychology & Psychotherapy*, *18*(3), 250-255.
- Rahimi-Ardabili, H., Reynolds, R., Vartanian, L. R., McLeod, L. V. D., & Zwar, N. (2018). A systematic review of the efficacy of interventions that aim to increase self-compassion on nutrition habits, eating behaviours, body weight and body image. *Mindfulness*, *9*(2), 388-400.
- Rø, Ø., Reas, D. L., & Rosenvinge, J. (2012). The impact of age and BMI on Eating Disorder Examination Questionnaire (EDE-Q) scores in a community sample. *Eating Behaviors*, *13*(2), 158-161.
- Rolls, E.T. (2011). Taste, olfactory and food texture reward processing in the brain and obesity. *International Journal of Obesity*, *35*(4), 550–61.
- Rosenbaum, D. L., & White, K. S. (2015). The relation of anxiety, depression, and stress to binge eating behavior. *Journal of Health Psychology*, *20*(6), 887-898.
- Schoenefeld, S. J., & Webb, J. B. (2013). Self-compassion and intuitive eating in college women: Examining the contributions of distress tolerance and body image acceptance and action. *Eating Behaviors*, *14*(4), 493-496.
- Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, *55*(1), 5-14
- Shomaker, L. B., Tanofsky-Kraff, M., Zocca, J. M., Courville, A., Kozlosky, M., Columbo, K. M., ... & Yanovski, S. Z. (2010). Eating in the absence of hunger in adolescents: intake after a large-array meal compared with that after a standardized meal. *The American Journal of Clinical Nutrition*, *92*(4), 697-703.

- Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology, 65*, 467-487.
- Sirois, F. M. (2015). A self-regulation resource model of self-compassion and health behavior intentions in emerging adults. *Preventive Medicine Reports, 2*, 218-222.
- Sirois, F. M., Kitner, R., & Hirsch, J. K. (2015). Self-compassion, affect, and health-promoting behaviors. *Health Psychology, 34*(6), 661.
- Sirois, F. M., Molnar, D. S., & Hirsch, J. K. (2015). Self-compassion, stress, and coping in the context of chronic illness. *Self and Identity, 14*(3), 334-347.
- Small, D. M. (2010). Taste representation in the human insula. *Brain Structure and Function, 214*(5-6), 551-561.
- Sonneville, K. R., & Lipson, S. K. (2018). Disparities in eating disorder diagnosis and treatment according to weight status, race/ethnicity, socioeconomic background, and sex among college students. *International Journal of Eating Disorders, 51*(6), 518-526.
- Steck, E. L., Abrams, L. M., & Phelps, L. (2004). Positive psychology in the prevention of eating disorders. *Psychology in the Schools, 41*(1), 111-117.
- Strauss, C., Taylor, B. L., Gu, J., Kuyken, W., Baer, R., Jones, F., & Cavanagh, K. (2016). What is compassion and how can we measure it? A review of definitions and measures. *Clinical Psychology Review, 47*, 15-27.
- Strother, E., Lemberg, R., Stanford, S. C., & Turberville, D. (2012). Eating disorders in men: underdiagnosed, undertreated, and misunderstood. *Eating Disorders, 20*(5), 346-355.
- Taylor, P. J., Hutton, P., & Wood, L. (2015). Are people at risk of psychosis also at risk of suicide and self-harm? A systematic review and meta-analysis. *Psychological Medicine, 45*(5), 911-926.

- Turner, S. A., Luszczynska, A., Warner, L., & Schwarzer, R. (2010). Emotional and uncontrolled eating styles and chocolate chip cookie consumption. A controlled trial of the effects of positive mood enhancement. *Appetite, 54*(1), 143-149.
- Viana, V., & Sinde, S. (2008). O comportamento alimentar em crianças: Estudo de validação de um questionário numa amostra portuguesa (CEBQ). *Análise Psicológica, 26*(1), 111-120.
- Wammes, B., French, S., & Brug, J. (2007). What young Dutch adults say they do to keep from gaining weight: self-reported prevalence of overeating, compensatory behaviours and specific weight control behaviours. *Public health nutrition, 10*(8), 790-798.
- Wang, G. J., Volkow, N. D., Telang, F., Jayne, M., Ma, J., Rao, M., ... & Fowler, J. S. (2004). Exposure to appetitive food stimuli markedly activates the human brain. *Neuroimage, 21*(4), 1790-1797.
- Westenhoefer, J., von Katzler, R., Jensen, H. J., Zyriax, B. C., Jagemann, B., Harth, V., & Oldenburg, M. (2018). Cultural differences in food and shape related attitudes and eating behavior are associated with differences of Body Mass Index in the same food environment: cross-sectional results from the Seafarer Nutrition Study of Kiribati and European seafarers on merchant ships. *BMC Obesity, 5*(1), 1-10.
- Williams, M. O., Tsivos, Z., Brown, S., Whitelock, N. S., & Sampson, M. (2017). Compassion-Focused Therapy for Bulimia Nervosa and Bulimic Presentations: A Preliminary Case Series. *Behaviour Change, 34*(3), 199-207.
- Williams, M. J., Dalgleish, T., Karl, A., & Kuyken, W. (2014). Examining the factor structures of the five facet mindfulness questionnaire and the self-compassion scale. *Psychological Assessment, 26*(2), 407.

Williams, J. W., Plassman, B. L., Burke, J., Holsinger, T., & Benjamin, S. (2010). Preventing Alzheimer's disease and cognitive decline. *Evidence Report/Technology Assessment, 193*(1), 1-727.

World Health Organization. (2017). *Global Report on Diabetes*. WHO Press: Switzerland.

World Health Organization. (2006). *Obesity and overweight*. Available at: [www.who.int/mediacentre/factsheets/fs311/en/index.html](http://www.who.int/mediacentre/factsheets/fs311/en/index.html). Accessed March 28, 2019.

Zessin, U., Dickhäuser, O., & Garbade, S. (2015). The relationship between self-compassion and well-being: A meta-analysis. *Applied Psychology: Health and Well-Being, 7*(3), 340-364.

Zheng, H., Lenard, N.R., Shin, A.C., & Berthoud, H.R. (2009). Appetite control and energy balance regulation in the modern world: reward-driven brain overrides repletion signals. *International Journal of Obesity, 33*(2), 8–13.

## **Chapter 2**

**The role of positive psychological factors in mediating food addiction and diabetes control: a structural equation approach.**

### **Abstract**

Type 2 diabetes is the fastest growing chronic illness and it has a high toll on services and government budgets, due to associated complications, diseases, and increased mortality rates. Given its prevalence, the average spend on diabetes, and the impact upon quality of life, diabetes is considered a grave public health concern and an important area of research. Research indicates complex relationships between emotional eating, food addiction and diabetes symptomatology, however there is at present little evidence regarding the potential mediating factors that might attenuate those relationships. Therefore, the present study explored the relative contributions of self-compassion and hope. Participants ( $N = 194$ ) took part in an online study and a cross sectional design was employed to investigate the relationships between variables in a population of individuals diagnosed with Type 2 diabetes. Findings suggested that food addiction (FA) and emotional eating (EE) were directly associated with BMI, anxiety, stress, depression in the positive direction, and satisfaction with life in the negative direction. Additionally, higher levels of FA and EE were associated with lower levels of SC and hope, suggesting lower hope and lower self-compassion are associated with poorer eating behaviour. Limitations are discussed and implications for future research explored.

## Introduction

Representing 60% of all deaths across the world, chronic diseases are the leading cause of mortality (World Health Organisation [WHO], 2017). The fastest growing chronic illness is diabetes type 2, with a 25% increase from 2005 to 2011, and a 50% increase from 2011 to 2016. Type 2 diabetes accounts for between 90-95% of all diagnosed diabetes in adults, and so the term diabetes, as used throughout the text, refers to type 2 diabetes only. It is estimated that there are currently 415 million people living with diabetes across the world; this is expected to rise to 642 million by 2040, with the prediction that one person in 10 will be affected (Diabetes UK, 2016). It is also estimated that one in two individuals with type 2 diabetes are undiagnosed. Diabetes is one of a small number of long-term health conditions, alongside coronary heart disease and coronary obstructive pulmonary disorder, which has a high toll on services and government budgets. Costs often spiral due to complications associated with diabetes, including eye conditions, kidney problems, nerve damage, amputations, surgery, dental problems, stroke, heart conditions and cancer (Bommer et al., 2017; Diabetes UK, 2014; 2016; Hex, Bartlett, Wright, Taylor, & Varley, 2012; Ogurtsova et al., 2017). In addition to the 1.5 million deaths from diabetes globally, blood glucose levels and high Haemoglobin A1c levels (HbA1c; average blood sugar levels over three months) also caused an additional 2.2 million deaths, by increasing the risks of cardiovascular and other diseases (WHO, 2017). Given its prevalence, the average spend on diabetes, and the impact upon quality of life (QoL), diabetes is considered a grave public health concern and an important area of research.

Obesity has shown to be a leading risk factor for diabetes and is a global phenomenon (Barnes, 2011) affecting both developed and developing countries, and paradoxically coexisting with undernutrition (WHO, 2017). Obesity is defined as an abnormal or excessive accumulation of body fat that poses a risk to health (National Heart Lung and Blood Institute [NHLBI], 2010; NHS Digital, 2019; World Health Organisation [WHO], 2006). Whilst the

medical definition of obesity is clear, the causes are complex and ill understood, and described differently from each domain of research (Agha & Agha, 2017). Numerous factors have been shown to affect obesity including, but not limited to, environmental (i.e., available food) socioeconomic (i.e., area deprivation which is particularly pertinent to women; NHS Digital, 2019), employment status (Parliament UK, 2018), neural rewards (Cornelius et al, 2010; Kenny, 2011), emotional regulation (Gianini, White, & Masheb, 2013; Leehr, Krohmer, Schag, Dresler, Zipfel, & Giel, 2015), and some recent neurobiological research suggests addiction to food might be implicated in the development of obesity (Gearhardt, et al., 2013). However, such research is sparse, varied, and controversial (Long, Blundell, & Finlayson, 2015; Westwater, Fletcher, & Ziauddeen, 2016).

Addiction has been defined as a process by which people become dependent on a substance or behaviour, irrespective of its harmful effects. It involves engaging in a behaviour that reaches desired effects, loss of control over the behaviour, increased tolerance for the substance, experiencing withdrawal symptoms if the substance is discontinued, and ultimately, experiencing negative consequences (Grant & Chamberlain, 2016; Sussman & Sussman, 2011). Psychologically, addictions may become a method of coping with difficulties such as stress, emotional or physical conditions (Garland, Boettiger, & Howard, 2011; Sinha, 2008; Valentino, Lucki, Van Bockstaele, 2010). Literature conceptualising over eating as ‘food addiction’ has explored various aspects of eating behaviour, in attempts to understand the compulsion to eat excessively and there is some debate around whether compulsive overeating should be termed an ‘addiction’ in the same way as alcohol and other substances (e.g., Gearhardt, Corbin & Brownell, 2009; Lacroix, Tavares, & von Ranson, 2018; Schulte & Gearhardt, 2017; Schulte, Joyner, Schiestl, & Gearhardt, 2017a; Schulte, Potenza, & Gearhardt, 2017b; Ziauddeen & Fletcher, 2013). However, there is some compelling neurobiological evidence which suggests that addiction to food involves similar mechanisms to drugs and

alcohol addiction, particularly that excessive intake of highly palatable foods has similar effects on brain and behaviour (Avena, Gold, Kroll, & Gold, 2012; Avena, Rada, & Hoebel, 2008). However, much of this evidence has come from laboratory studies with animals, although some clinical evidence is emerging and indicates consumption of palatable food is regulated partly by the same brain regions that are activated in response to drugs and alcohol (Grant & Chamberlain, 2016).

The common factor in addiction is the activation of the brain's reward circuitry (Grant & Chamberlain, 2016). The release of dopamine has been implicated in the proposed overlap between obesity and addiction (Epstein, Temple, Neaderhiser, Salis, Erbe, & Leddy, 2007; Wang et al., 2004) and has been associated with the intake of high fat, high sugar foods (Gearhardt, Corbin, & Brownell, 2009). The perceived value of the substance (e.g., food/drug) is thought to be associated with the level of dopamine released, whereby a higher perception of reward leads to a greater release of dopamine (Volkow et al., 2002). As food appears to have a chemical impact on the body, it could be argued that using the term food addiction should not be scrutinised in the same way as gambling, for which there is evidence of habitual choices rather than biological processes that are beyond the control of the individual (Blaszczynski, Anjoul, Shannon, Keen, Pickering, & Wiczorek, 2015; McMahon, Thomson, Kaner, & Bamba, 2018).

Whilst research in this area is developing, it is important to be mindful of its limitations. However, the similar neurobiological processes involved in food and drug intake offer support for the concept of food addiction, and indicate the area is worthy of more research which may provide the opportunity to tailor treatments and develop new insights into promoting healthier eating behaviours. For the purposes of the current research, the term food addiction will be used and is defined in the context of each of the diagnostic criterion for dependence as defined above, including tolerance, withdrawal, and loss of control for high fat/sugar food, in

accordance with the Diagnostic and Statistical Manual, 5th Edition (DSM-5; American Psychiatric Association, 2013) and the scale developed by Gearhardt et al. (2009).

In addition to its association with obesity, food addiction has been associated with eating disorders and emotional eating, with some evidence suggesting that emotional eating underpins food addiction in a causal direction (Arnold, Kenardy, & Agras, 1995; Davis & Carter, 2009; Davis et al., 2011; Gearhardt et al., 2009), resulting in poorer psychological wellbeing and QoL (Burmeister, Hinman, Koball, Hoffmann, & Carels, 2013; Long et al., 2015; Raymond & Lovell, 2016). However, food addiction has not been considered in relation to its likely sequelae of diabetes.

Moreover, whilst there is clear evidence for the association between diabetes and poor psychological wellbeing, there is minimal research into how positive psychological functioning might be related to the experience of diabetes. Positive factors have been associated with wellbeing (López et al., 2015), coping with chronic illness (Milne et al., 2009; Pinto-Gouveia, Duarte, Matos, & Fráguas, 2014), and hope-based interventions have been found to significantly increase levels of wellbeing, including positive affect and optimism (Howell, Jacobson & Larsen, 2015; Huffman, DuBois, Millstein, Celano, & Wexler, 2015; Iddon et al., 2016). Hope has also been shown to affect eating behaviour (Nothwehr, Clark, & Perkins, 2013) and positive factors including hope have been shown to be associated with better outcomes in diabetes management (Joyce, Hilliard, Cochrane, & Hood, 2012; Vieth et al., 1997). For instance, in a review by Joyce et al. (2012) that measured the impact of positive factors on outcomes in diabetes it was concluded that hope influenced HbA1c. However, this was measured in relation to youths with type 1 diabetes (Lloyd, Cantell, Pacaud, Crawford, & Dewey, 2009) and the other studies that discussed hope appear to use hope and optimism interchangeably. Whilst these constructs overlap they are still considered distinct and so the concluding results need to be questioned (Neff, Rude, & Kirkpatrick, 2007).

Furthermore, positive factors such as self-compassion, have been associated with lower levels of stress, anxiety and depression, increased positive affect and QoL, and consistently with subjective wellbeing. Whereas, self-criticism (which can be conceptualised as the inverse of self-compassion; Neff, 2016) has shown the reverse effect for individuals with a chronic health condition (Barnard & Curry, 2011; Friis, Johnson, Cutfield, & Consedine, 2015; Friis, Johnson, Cutfield, & Consedine, 2016; MacBeth & Gumley, 2012; Neff et al., 2007; Pinto-Gouveia et al., 2014; Shapiro, Brown, & Biegel, 2007). Friis, et al (2016) found self-compassion was associated with decreased HbA1c in people with diabetes, in addition to reductions in depression and distress related to diabetes, compared to no change in the wait list control, and Ferrari, Dal Cin, and Steele (2017) found self-compassion was associated with better self-management and wellbeing outcomes in people diagnosed with diabetes.

Conversely, self-criticism has been associated with poorer eating behaviour (Adams & Leary, 2007), and research has shown that overeating and emotional eating are associated with lower self-compassion (Poole, Lobley, & Unwin, 2019; Taylor, Daiss, & Krietsch, 2015). For instance, individuals reporting lower self-compassion are more likely to continue overeating if they have indulged temporarily, whereas individuals with higher self-compassion are less likely to continue (Ferreira, Pinto-Gouveia, & Duarte, 2013; Leary, Tate, Adams, Batts Allen, & Hancock, 2007; Taylor et al., 2015). Adams and Leary (2007) investigated whether inducing self-compassion attenuated the tendency for restrained eaters to overeat after eating an unhealthy food preload. Participants with high restrictive eating and higher eating guilt had lower self-compassionate attitudes toward eating, however this effect was attenuated when exposed to the self-compassion manipulation, suggesting self-compassion can be increased via intervention. They found that participants in the preload/self-compassion condition reported more self-compassionate attitudes and consumed less candy than the preload/no self-compassion condition.

As both self-compassion and hope have been shown to be associated with eating behaviour and are emerging in relation to their importance in managing chronic conditions, including minimal research into diabetes, they deserve further investigation. Also, given the evidence that self-compassion is positively associated with constructs such as optimism (Neff, Rude, & Kirkpatrick, 2007), it is theorised that ‘hope’, a construct overlapping with optimism, would also be positively associated with self-compassion. These hypothesised relationships warrant further investigation and indicate that positive factors may play a mediating role between food behaviours, diabetes symptomology and quality of life.

A further impetus for exploring the role of self-compassion in mediating eating behaviours arises from intervention studies which explore whether improving self-compassion can reduce harmful behaviours in the realm of alcohol and drug addictions, binge eating, emotional eating and improving health behaviours (Brooks, Kay-Lambkin, Bowman, & Childs, 2013; Terry & Leary, 2011; Webb & Forman, 2012). A number of psychological interventions have been implemented in attempts to improve diabetes symptomology and distress including motivational interviewing (Harvey, 2015; Rubak, Sandbæk, Lauritzen, & Christensen, 2005), Cognitive Behavioural Therapy (CBT) (Gonzalez & McCarl, 2010; Safren et al., 2014) and Mindfulness (Fanning, Osborn, Lagotte, & Mayberry, 2018; Hartmann et al., 2012; Rosenzweig et al., 2007; van Son et al., 2013). The findings have been mixed and only one or two studies have measured the construct of self-compassion directly in relation to diabetes (Friis et al., 2016; Ferrari et al., 2017). These studies have shown promise and given self-compassion may be an effective, low-cost intervention that can potentially increase self-care and management of diabetes symptomology, it appears worthy of further investigation.

As outlined above, there is growing evidence in relation to positive psychological constructs, with regard to treatment and to positive attributes being a buffer against poor eating behaviour and associated distress. The definition of positive psychological constructs varies,

and theoretical frameworks are in their infancy (Bolier, Haverman, Westerhof, Riper, Smit, & Bohlmeijer, 2014; Schueller, Kashdan & Parks, 2014), therefore it is recommended that researchers are guided by overall aims of the research (Parks & Biswas-Diener, 2013). The outcomes of research that include positive psychological variables such as self-compassion also vary and a number of reviewers suggest the outcomes relating to positive constructs or interventions should conceptually fit within the positive framework (e.g., Schueller et al., 2014), whereas others suggest the measurement of depression alongside well-being is relevant (Bolier et al., 2014). This supports the argument that wellbeing and mental illness are distinct but correlated constructs, rather than the opposite end of a single continuum (Keyes, 2005). The absence of distress does not mean the presence of wellbeing, it is suggested each can co-occur during times of stress or difficulty (Folkman, 2008; Keyes, 2005). Consequently, it is considered important to measure both mental illness (i.e., depression or anxiety) and wellbeing, which infers optimum functioning rather than simply the absence of distress (Keyes & Lopez, 2009). In accordance with this, both positive and negative outcome variables will be considered in the current research, including a measure of depression, anxiety and stress, and a measure of satisfaction with life which has shown to be an indication of wellbeing (Busseri, 2018; Dolan, Peasgood, & White, 2008; Pavot & Diener, 2008).

The current literature indicates that there are complex relationships between emotional eating, food addiction and the diabetes symptomatology, however there is at present little evidence regarding the potential mediating factors that might attenuate those relationships, therefore the present study has explored the relative contributions of self-compassion and hope. In accordance with the literature, it is anticipated that self-compassion and hope will reduce the size of the relationship between addiction to food and emotional eating, and the outcome variables including BMI, HbA1c, stress, depression, anxiety and satisfaction with life. Based on previous findings the following hypotheses have been formed:

*H<sub>1</sub>* Higher levels of food addiction and emotional eating scores will be associated with higher HbA1c, BMI, anxiety, stress, depression, and lower self-compassion, hope and satisfaction with life (SWL).

*H<sub>2</sub>* Higher levels of hope and self-compassion will be associated with lower HbA1c, BMI, anxiety, and depression and improved SWL.

*H<sub>3</sub>* The relationship between food addiction/emotional eating and outcomes will be mediated by hope and self-compassion.

## Method

### Design and Procedure

A cross sectional study design was employed to investigate the relationships between variables in a population of individuals diagnosed with Type 2 diabetes. Prior to the study gaining University sponsorship and ethical approval, researchers consulted with a service-user led support group to shape the focus and procedural elements of the research in line with service user experience and priorities, to increase accessibility and participation.

Individuals representing a clinical population of people with diabetes were recruited to an online study through diabetes.co.uk, which has the largest online community in the world, at a rate of approximately 25,000 new members each month. Inclusion criteria were: adults, aged 18 years or over with type 2 diabetes; being a resident of the United Kingdom. Exclusion criteria were: individuals with type 1 diabetes. Information about participation and the nature of the research was accessible online and self-report measures were completed via Qualtrics. Once participants accessed the link on diabetes.co.uk they were given detailed information about the study (appendix 2.1). They also had to consent (appendix 2.2) to the study before they could complete it. Participants were then asked to complete initial demographic questions including time since diagnosis, height, weight, latest HbA1c (average blood sugar levels over three months), comorbid medical conditions and current use of medication. Each measure was then presented on a separate page in the following order: Yale food addiction scale (YFAS); depression, anxiety and stress scale (DASS-21), hope scale, self-compassion scale (SCS) and satisfaction with life scale (see Appendix 3 for the study questionnaires). Participants were informed that they could withdraw from the research at any time by closing the internet browser and were made aware that incomplete responses would be deleted and excluded from the study analysis.

Upon completion of the questionnaires, participants were presented with debriefing information and a list of useful contacts should they require support. As compensation for their time, participants were entered into a prize draw for Amazon vouchers (x2 £100, and x4 £50). Whilst it was stipulated that individual results would not be provided, a summary of the findings will be shared with diabetes.co.uk for them to share on their website and via their magazine. Feedback will also be shared with the service-user led support group.

## **Participants**

The present sample comprised  $N = 194$  participants. Of the 494 participants who undertook the Qualtrics survey, the responses of 300 participants were ineligible for data analysis due to incomplete data. Although that would appear a substantial loss of participants, it cannot be assumed that these were all separate individuals. The majority of participants only completed the demographic data, and it is possible they either were unable to continue responding, or when starting the questionnaires decided to withdraw from the study, alternatively they may have intended to return to the study at a more convenient time but were unable. The majority of the participants were female (143 female; 51 male), ages ranged from 18 to 86 years ( $m = 57$ ;  $SD = 11.70$ ) and almost all were Caucasian (96.4%).

Education level varied between participants with the highest percentage having completed a degree (28.4%), which is consistent with the general population (27.2), followed by GCSE's (18.6%), Master's qualifications or equivalent (16%), A' levels (13.4%), post-secondary non-tertiary qualifications (14.4%), Doctoral (3.1%) and no qualifications (1.5%). The majority of the sample were employed (50%) or retired (38%), with only 5.7% not working. Most participants earned the national average wage (38.1%), with 28.8% earning above average wage and 19% earning less than £20,000. These figures are consistent with the general population, however less people in the current sample were not working and more

people were earning above average wage (28.8% vs 22.5% for the general population; Office for National Statistics [ONS], 2018) suggesting the current sample may be slightly more advantaged than the general population.

In terms of health, 74% of participants had comorbid physical health conditions; this is similar to previous research, for instance Bralić Lang and Bergman Marković (2016) found 77% of people with type 2 diabetes also had a comorbid condition. Of the current sample, 87% relied on medication and 43% of participants experienced mental health difficulties including anxiety and depression, this is a little less than the 64% reported by Diabetes UK (2017; 2018) and but consistently higher than the general population (18.5%). The highest percentage of participants had been diagnosed for more than 10 years (22%), followed by 5 years (21.6%), 18% had been diagnosed for a year or less, 13% for two years and 11% for 20+ years.

## **Measures**

### ***Predictive measures:***

#### *Demographics*

Demographic information included gender, age, ethnicity, education level, occupation, household income, physical and mental health conditions, medication and time since diagnosis to determine any impact on the outcome variables. These variables were collected as research has shown that socioeconomic status has been associated with glycaemic control (Houle et al., 2016) and often individuals with diabetes have comorbid conditions (Bralić Lang & Bergman Marković, 2016). Furthermore, time since diagnosis and medication use and adherence may impact diabetes symptomology and control (e.g., Lin, Sun, Heng, Chew, & Chong, 2017). As the demographic variables were only sporadically associated with the outcome variables in the

current study, they are not reported in the results. However, the information can be used to compare the sampled population to future research.

*The Yale Food Addiction Scale (YFAS)* (Gearhardt, Corbin, & Brownell, 2009)

The YFAS was designed to identify signs of addiction towards high fat and high sugar foods, including substance dependence criteria (e.g. tolerance, withdrawal, and loss of control). Each criterion is scored and indicates whether an individual meets the criteria for addiction. The YFAS has 25 items and has shown good internal reliability ( $\alpha = .75$  to  $.86$ ), convergent validity ( $r = .46$  to  $.61$ ) and discriminant validity (non-significant to small but significant correlations with related but independent constructs). Incremental validity was also demonstrated above and beyond the Emotional Eating Scale (Arnou et al., 1995), the Eating Attitudes Test (Garner, Olmsted, Bohr, & Garfinkel, 1982) and the Binge Eating Scale (Gormally, Black, Daston, & Rardin, 1982). In the current study internal reliability was good ( $\alpha = .88$ ) for the total score. The measure was not used to diagnose 'food addiction', rather it provided quantitative data on the level and type of difficulties experienced, rather than categorising people as meeting diagnostic criteria. Therefore, it was assessed on total number of symptoms (range = 0 – 7) with the higher scores representing more symptoms (Gearhardt, Corbin & Brownell, 2012).

*The Emotional Eating Scale (EES)* (Arnou, Kenardy, & Agras, 1995)

The EES has 25 items and is measured on a 5-point Likert scale (0 – 4). It has three subscales including Anger/Frustration, Anxiety, and Depression ( $\alpha = .78$ ;  $.78$ ;  $.72$  respectively) and it is used to assess overeating initiated by emotional stimuli, and as a coping mechanism. As indicated, the subscales have demonstrated acceptable internal validity and this has shown to be good for the total scale ( $\alpha = .81$  to  $.95$ ), the scale also has good construct, discriminate, and criterion validity (Arnou et al., 1995; Gearhardt et al., 2009). In the current study internal

reliability for the total scale ( $\alpha = .97$ ) and subscales anger/frustration, anxiety and depression ( $\alpha = .95; .93; .91$ ) were excellent. This is an important measure in line with the aims of the current research, to determine whether it has predicative validity and unique contribution to diabetes symptomology, above and beyond YFAS, and to further explore its relationship with hope and self-compassion.

### ***Predictive/Mediation Measures***

*The Adult Hope Scale (AHS)* (Snyder et al., 1991).

The AHS comprises 12-items and the response format is an eight-point Likert Scale (1= definitely false to 8= definitely true). Higher scores (range 8 to 64) indicate higher levels of goal-focused hope. The scale, based upon Snyder, Irving and Anderson et al. (1991) cognitive model of hope, comprises two subscales: Agency and Pathway (score range 4 – 32) with four items in each scale; the remaining four items are fillers and therefore not scored. The Pathway subscale measures the ability to plan how a goal may be accomplished, and the Agency subscale measures an individual's motivation to achieve the goal. Whilst distinct constructs, Snyder et al. (1991) suggest both are interactive and need to be present for goal-directed behaviour to occur. The scale has shown high internal reliability and test-retest reliability ( $\alpha = .84$  and  $.85$ ) and factor analysis supports the use of the two-factor model showing good internal consistency ( $\alpha = .80$  and  $\alpha = .76$ ) for Pathway and Agency respectively. This is replicated in the current study ( $\alpha = .89$  total scale;  $\alpha = .83$  Pathway;  $\alpha = .82$  Agency). The scale has also demonstrated good convergent and discriminant validity with concepts such as optimism.

*Self-Compassion Scale* (Neff, 2003)

Self-compassion was measured using Neff's (2003) scale, which has 26 items and is scored on a five-point Likert scale. There are six factors: Self-kindness, Common humanity,

Mindfulness (self-compassion), and Self-judgment, Isolation, and Over-identification (lack of self-compassion). Whilst there have been questions about the validity of using a total score (Gilbert, McEwan, Matos, & Rivis, 2011; López et al., 2015), Neff, Whittaker, and Karl (2017) have found the total score to be a reliable and valid test of a general self-compassion measure. The measure has demonstrated good internal consistency ( $\alpha = .75$  to  $.81$ ) which was replicated in the current study ( $\alpha = .94$ ) for overall score. Internal consistency of the subscales was also considered and demonstrated good internal consistency ( $\alpha = .87$ ;  $\alpha = .85$ ;  $\alpha = .75$ ;  $\alpha = .83$ ;  $\alpha = .80$ ;  $\alpha = .79$ ) for self-kindness, self-judgement, common humanity, isolation, mindfulness and over-identification respectively. Lower scores represented higher SCS for negative items and higher scores represented higher SCS for positive items. To establish the total SCS score, negative items were recoded so that a higher total score represented higher SCS.

The use of the total score has been called into question with some researchers arguing the use of a bidimensional construct (Costa, Marôco, Pinto-Gouveia, Ferreira, & Castilho, 2016; López et al., 2015) and others advocating the use of the six-factor correlated model (Williams, Dalglish, Karl, & Kuyken, 2014). The use of both the total score and six-factor model have shown validity across numerous populations and in several areas such as happiness (Hollis-Walker & Colosimo, 2011), optimism (Neff, Rude, & Kirkpatrick, 2007) life satisfaction (Neff, Kirkpatrick, & Rude, 2007) and consistently with wellbeing (Neff et al., 2018). However, in response to criticisms, Neff et al. (2017) used confirmatory factor analysis (CFA) to examine a bidimensional two-factor correlated model (Costa et al., 2016; Lopez et al., 2015), a six-factor correlated model, a one factor, higher order model (Williams et al., 2014) and a single factor model, in four different samples including student, community, retrospective clinical sample (from Williams et al., 2014) and a mediator sample with meditation experience. They found the internal consistency estimates associated with the subscales and the overall self-compassion scale ranged from  $.70$  to  $.95$  with the majority falling above  $.80$ . Thus, the

SCS total and subscale scores demonstrated acceptable internal reliability estimates of Cronbach alpha and accounted for 90% to 95% of the reliable variance (i.e., not due to error) in the total scores. In terms of model fit, the findings of the CFA for the two-factor models were poor, suggesting the use of a bidimensional model would not be supported. The factor loadings for the six-factor correlational model were good and demonstrated the best fit across all samples, suggesting the use of the six subscales is an appropriate way to measure self-compassion. The findings were mixed for the hierarchical model. The RMSEA and the SRMR indicated adequate fit but the CFI and TLI indices suggested inadequate fit. This suggests that the higher order model does not represent the relationships among items satisfactorily, and may not be the best way to understand the relationship between subscales or to justify the use of a total SCS score. In contrast, the single factor model, which simultaneously examined the contribution of the general factor (total scores) to item variance, was found to demonstrate better fit to the data than the higher order model. The single factor model demonstrated acceptable fit according to most of the fit indices in all samples except the clinical sample, - rendering the total score, useful. Consistent with Neff et al. (2017) in the current research the single factor model was the best fit and therefore used to generate a factor score. Factor scores are deemed superior to the total score as they represent latent variables that take account of each item and consequently each subscale (Byrne, 2010); also, as clinical populations with regards to psychopathology, were not being measured in the current sample, it was deemed appropriate to use the factor score in the current SEM model. However, the subscales, and the total scale, were considered at bivariate level. Fit indices for the SEM model were acceptable (CFI = .90, TLI = .89; RMSEA = .07) with the exception of Chi Square, which could be due to sample size, to which chi-square tends to be highly sensitive, and is therefore not recommended as a good measure of fit (Byrne, 2010; Marsh, Balla, & McDonald, 1988; Schumacker & Lomax, 2004) (see statistical analysis below for details of fit indices).

***Outcome measures:***

Weight/height was obtained to determine BMI. This ranged from 5% underweight (BMI 15-18), 8.8% ideal healthy weight (BMI 18.5 – 25), 26.8% overweight (BMI 25-30), 27.8% extremely overweight (BMI 30+) and 34% classed as morbidly obese (BMI 35+). BMI is important in managing diabetes, higher weight and higher BMI would indicate a person is at a higher risk of complications such as coronary heart disease, heart attack, stroke, kidney failure, nervous system disorders and eye problems amongst other complications; this applies even if the increase in BMI is moderate (Gray, Picone, Sloan, & Yashkin, 2015).

There are limitations to using BMI as an outcome measure for controlling diabetes, for instance it does not take account of muscle mass or visceral fat (the fat that is stored around organs in the abdomen) which, if high, increases the risk of insulin resistance and heart disease (Adab, Pallan, & Whincup, 2018). Therefore, HbA1c was obtained via self-report to determine average blood sugar levels. HbA1c is an important indicator of diabetes management, it is a metric for evaluating blood glucose concentrations over 3–4 months, and is the only metric of glycaemic control that has been strongly associated with diabetes vascular complications (Beck, Connor, Mullen, Wesley, & Bergenstal, 2017). In terms of HbA1c 31% of the current sample had good control (48mmol\* or less), 23% had acceptable control but according to diabetes.co.uk needed some improvement (<64mmol) and 21% were at a higher risk of diabetes complications (>64mmol). High risk is indicated when HbA1c levels are above 48 mmol/mol (National Institute for Health and Clinical Excellence [NICE], 2015).

***Depression Anxiety and Stress Scale -21 (DASS-21) (Henry & Crawford, 2005)***

The DASS-21 is a popular tool used in clinical and non-clinical research, and has been chosen on the basis of its use in previous research and robust reliability and validity (e.g., Beaufort, De Weert-Van Oene, Buwalda, de Leeuw, & Goudriaan, 2017; Henry & Crawford, 2005; Sinclair, Siefert, Slavin-Mulford, Stein, Renna, & Blais, 2012). It comprises 21 items

and has three subscales: depression, anxiety, and stress. Each subscale has 7-items and internal consistency has been reported to be good ( $\alpha = .72$ ;  $\alpha = .77$ ;  $\alpha = .77$ ;  $\alpha = .88$ ) for depression, anxiety, stress and overall score respectively. This was replicated in the current study ( $\alpha = .94$ ;  $\alpha = .84$ ;  $\alpha = .86$ ;  $\alpha = .95$ ). As each subscale taps into distinct aspects of mental health it is not recommended that the scores be combined to form a total (Henry & Crawford, 2005; Lovibond & Lovibond, 1995).

*Satisfaction with Life Scale (SWLS)* (Diener, Emmons, Larsen, & Griffin, 1985).

The SWLS is a widely used measure designed to assess an individual's subjective satisfaction with life. It comprises five positive statements (e.g., "In most ways my life is close to my ideal"). The response format is a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree; range 5 to 35). This measure was chosen based on its robust reliability and use in previous research, and its value as an indicator of wellbeing (e.g., Busseri, 2018). The measure has elicited good internal consistency ( $\alpha = .87$ ) and test-retest correlation ( $r = .82$ ) (Diener et al., 1985). In the current study the reliability was excellent ( $\alpha = .92$ ).

### **Ethical Considerations**

Institutional and ethical approval was obtained from the University of Liverpool (Ref: IPHS-2803) (appendix 5). In accordance with the British Psychological Society Ethical Guidelines (2014), participants read an information sheet designed to inform them about the study and provided consent before proceeding. Participants were advised the measures were not for clinical use and assured their anonymity and confidentiality would be maintained. An e-mail address for the main researcher was provided in case the participants experienced any distress upon completion, they were also directed to [diabetes.co.uk](http://diabetes.co.uk) for further support if necessary.

## Statistical analysis

SPSS 22 (IBM Corp., 2013) was used to manage the dataset and undertake the initial statistical analyses. Data analysis included descriptive and inferential statistics. All data were tested for assumptions in relation to normality, reliability and the potential for type 1 errors was accounted. Correlation analyses were used to test the hypotheses and parametric statistics were engaged as the assumptions of normality were fulfilled, and levels of skewness (-.038 to 1.192) and kurtosis (0.35 to 2.483) were consistently low. Missing data that was not random were excluded from the analysis; random missing data were included and left blank. This did not affect Cronbach's alpha but it is possible these missing values may have depleted the correlations (Taylor, Ruhaak, Kelly, Weiss, & Kim, 2016).

The study's hypotheses were tested at bivariate level through correlation analyses and the data were examined to ensure the statistical assumptions required for structural equation modelling (SEM) were met. AMOS (Arbuckle, 2011) was used to analyse the SEM *a priori* model, which was developed considering existing theory and literature. First the shape of the model was configured in AMOS and then the relevant variables were brought over from SPSS. The factor scores were developed by conducting factor analyses for each construct; the factor scores were calculated in AMOS first, they were then inserted into SPSS so they could be imputed back into AMOS in the SEM model. Although latent variables were used these were represented by rectangles in the main model because AMOS will not interpret an ellipse as a measurement model without the manifest indicators (Byrne, 2010). An advantage of using SEM is that the levels of variance are enhanced when measurement error is controlled. Additionally, a number of regressions can be incorporated into one model, making the output more informative than with regression. Using factor scores ensured the latent structure of each construct was represented in a parsimonious model. Running factor models independent of the

final model also enabled factor loadings to be checked for each construct. The factor loadings are presented in the results section and the factor models are illustrated in appendix 7.

Model fit was assessed via a range of fit statistics. For a model to be regarded as an acceptable fit, the chi-square statistic ( $\chi^2$ ) should be non-significant ( $p > .05$ ) (Byrne, 2010), the Root Mean Square-Error of Approximation (RMSEA; Steiger, 1990) and the Standardised Root Mean Square Residual (SRMR) should be  $< .06$  to  $< .08$  for good and adequate fit respectively, finally the Comparative fit index (CFI; Bentler, 1990) should be  $> .95$  (Byrne, 2010; Hu and Bentler, 1999). In the current study, 95% bias-corrected bootstrap confidence intervals were calculated to examine the indirect effects of the hypothesised mediator variables in the SEM model (Preacher & Hayes, 2008) and over fitting the model was avoided by setting the modification index to 10 (Byrne, 2010; Hayes, 2013).

The minimum requirement for SEM is  $N=150$  to  $N=200$ , based on normally distributed variables (Boomsma & Hoogland, 2001; Hooper, Coughlan, & Mullen, 2008; Kline, 2005; Muthén & Muthén, 2002; Tabachnick & Fidell, 2007; Comrey & Lee, 2013). The sample size in this study was  $N=194$  indicating that the SEM analysis was adequately powered.

## Results

### Descriptive Statistics

Mean descriptive statistics for all variables are presented in Table 1. The mean for YFAS demonstrated that most participants had over half the symptoms of food addiction. Whilst clinical significance was not being measured, it is important to note that the mean was above the clinically significant threshold of  $>3$  (Gearhardt et al., 2012) however, there was widespread variation around the mean.

The score range for EES anger/frustration is 0-44, and the mid-point was 22. The mean fell below this at 16.12, indicating participants were moderately affected by emotional eating in response to anger/frustration. This pattern was replicated for anxiety, with responses falling below the mid-point (18) but not within the lower ranges, indicating moderate emotional eating in response to anxiety. With regard to depression, the mean fell just below the mid-point of 10 (9.7) indicating quite high emotional eating in response to depression. Consequently, the total mean fell below the mid-point but, as with each subscale, there was widespread variation. Overall, the mean scores indicated moderate emotional eating.

The mean scores for Agency and Pathway on the AHS were above the mid-point (16) suggesting respondents had a high sense of goal-directed motivation, or determination to achieve their goals (Agency) and perceived themselves able to plan how their goals might be accomplished (Pathway). This led to the total goal-focused hope falling above the mid-point of 32 ( $m = 42.88$ ). There was also good variation around the means indicating individual differences.

For the positive subscales of the SCS higher mean scores indicated higher self-compassion, whereas for the negative subscales, higher scores indicated lower self-compassion (Neff, 2003). In the current sample, the negative items were reversed to get the mean total SC

so that higher total scores indicated higher self-compassion; the current means for total SC indicated moderate levels of self-compassion in the sample population (2.78). There was variation around the mean indicating a range of responses and individual differences.

For DASS-21, the mean scores for depression fell within the moderate range (7-10), anxiety fell between the mild and moderate range (mild = 4 – 5; moderate = 6 – 7) and stress within the normal to mild range (normal range = 0 – 7; mild = 8 – 9). The categories were defined by the authors of the scale and indicated the current sample were within the normal range (Henry & Crawford, 2005; Lovibond & Lovibond, (1995). There was expected spread around the mean indicating individual variance (see appendix 4 for full score range).

Participants scored just below the Satisfaction with Life scale midpoint (17) suggesting they had some level of life satisfaction. However, Diener (2006) suggests that scoring between 15 and 19 (this sample scored 18.11) indicates slightly below average life satisfaction, indicative of either small but significant problems in several areas of their lives, or one particular area that is challenging. There was good spread around the mean indicating a range of scores across the sample. See appendix 4 for the scoring guide. Skewness and kurtosis were consistently low for all measures and therefore not departing from normality which indicates the good quality of the data. Acceptable values fall between  $-3$  and  $+3$  (Kline, 2005).

Table1: Means, Standard Deviations, Skewness and Kurtosis for all Variables

	Mean	SD	SK	Kurtosis	Min-Max Range	Midpoint
YFAS	3.39	1.902	.254	-.924	0-7	3.5
EES Anger/Frustration	16.12	11.35	.211	-.940	0-44	22
EES Anxiety	13.36	8.72	.302	-.822	0-36	18
EES Depression	9.73	5.28	-.048	-.908	0-20	10
EES Total	39.11	24.09	.143	-.873	0-100	50
AHS Agency	20.52	6.14	-.443	-.161	4-32	16
AHS Pathway	22.37	5.42	-.678	.939	4-32	16
AHS Total	42.88	10.75	-.428	.096	8-64	32
SCS Self-kindness	2.37	.941	.706	.035	1-5	2.5
SCS Self-judgement	3.27	.966	-.136	-.625	1-5	2.5
SCS Common Humanity	2.83	.899	.373	-.148	1-5	2.5
SCS Isolation	3.02	1.08	-.144	-.859	1-5	2.5
SCS Mindfulness	2.89	.943	.466	-.554	1-5	2.5
SCS Over-identification	2.97	1.08	-.038	-.806	1-5	2.5
SCS Total	2.78	.778	.282	-.423	1.12 – 4.65 (1-5)	2.5
DASS-21 Anxiety	5.30	4.72	1.192	1.032	0-21	10.5
DASS-21 Depression	7.74	6.26	.572	-.781	0-21	10.5
DASS-21 Stress	7.71	5.02	.519	-.292	0-21	10.5
SWLS	18.11	8.2	.230	-1.042	5 – 35	20
HbA1c	52.28	21.35	.549	2.483	2.6 - 144	NR (73.3)
BMI	33.55	8.41	1.178	1.972	17.7 - 65	NR (41.35)

*Note:* YFAS = Yale Food Addiction Scale; EES = Emotional Eating Scale; AHS = Adult Hope Scale; SCS = Self-Compassion Scale; DASS = Depression, Anxiety & Stress Scale; SWL = Satisfaction With Life Scale  
HbA1c = glycated haemoglobin; BMI = Body Mass Index

## Correlations

Pearson's correlations were calculated for all study variables and are displayed in Table 2. The demographic variables were in the expected direction with mental health being the strongest, and associated with all other variables (range:  $r = -.228$ ,  $p < .01$  to  $r = -.504$ ,  $p < .001$ ). Other correlations were as expected for instance occupation was associated with anxiety ( $r = .184$ ,  $p < .05$ ) household income was associated with stress ( $r = .153$ ,  $p < .05$ ) and satisfaction with life ( $r = .183$ ,  $p < .05$ ) suggesting the higher a person's income the more stress they might experience but conversely, they might have better satisfaction with life. Medication was also weakly and negatively associated with Agency and SC Mindfulness ( $r_s = -.192$ ;  $-.185$ ,  $p_s < .05$ ). As the demographic variables were weak and intermittent they will not be included in the SEM model, as it is not expected they would impact the outcome variables of interest. Furthermore, as the mental health variable for demographic information was categorised, the analysis only included the outcome variables that were more specific to anxiety, depression and stress.

Intra-correlations for each scale were in the expected range and direction. Inter-correlations between each scale were also in the expected direction and ranged from moderate to strong (weak  $< .29$ ; moderate  $.3$  to  $.49$ ; strong  $> .5$ ). Concurrent with previous research (e.g., He et al., 2018), BMI and HbA1c were significantly correlated ( $r = .256$ ,  $p < .01$ ). However, whilst BMI was weakly associated with some of the predictor, mediation, and outcome variables ( $r_s = .197$  to  $.220$ ,  $p_s < .05$  to  $< .01$ ), HbA1c was not, and therefore was not included in the SEM model.

Most predictor and outcome variables were significantly correlated and ranged from weak to strong. Using EES as the predictor variable, BMI was weakly associated with EES anxiety ( $r = .15$ ,  $p < .05$ ), EES-total ( $r = .19$ ,  $p < .001$ ), EES-depressive trigger ( $r = .21$ ,  $p < .001$ ) and EES-anger trigger ( $r = .20$ ,  $p < .01$ ). The strongest associations using EES as the predictor

variable were with the DASS-21 stress subscale ( $r_s = .486; .507; .514, p < .001$ ) for EES-anger, EES-anxiety and EES-total. However, the EES-Depression trigger was most strongly associated with DASS-21 depression subscale ( $r = .498, p < .001$ ). Whilst both the EES and DASS-21 subscales measured depression both are conceptually different; the EES assesses emotional eating in response to depression, whereas DASS-21 measures the symptoms of depression. Using the YFAS as the predictor variable, BMI was weakly associated ( $r = .23, p < .001$ ) and DASS-21 depression was the strongest association ( $r = .56, p < .001$ ). There were no associations between the predictor variables and HbA1c suggesting emotional eating and food addiction do not impact HbA1c.

The proposed mediation variables were associated with both the predictor and outcome variables in the expected direction and ranged from weak to strong. For the predictor variables EES-anger and common humanity was the weakest association ( $r = -.15, p < .05$ ) and EES total and over-identification the strongest ( $r = .53, p < .001$ ). For the outcome variables common humanity and anxiety was the weakest association ( $r = -.18, p < .05$ ) whilst isolation and DASS-21 depression was the strongest to ( $r = .64, p < .001$ ).

Whilst there was a strong positive association between YFAS and EES it was not a perfect correlation and so each scale was clearly tapping into different concepts, therefore it was considered important to address them independently in the SEM model.

Table 2: *Correlations*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Age																			
2 Path	.73*																		
3 AHSt	.94*	.92*																	
4 SWLS	.63*	.55*	.64*																
5 Dep	-.55*	-.54*	-.59*	-.58*															
6 Anx	-.40*	-.39*	-.42*	-.41*	.70*														
7 Stress	-.40*	-.40*	-.43*	-.42*	.71*	.75*													
8 SK	.48*	-.42*	.49*	.45*	-.39*	-.24*	-.38*												
9 SJ	-.42*	-.32*	-.40*	-.35*	.52*	.40*	.49*	-.49*											
10 CH	.48*	.51*	.54*	.43*	-.37*	-.18*	-.27*	.61*	-.21*										
11 ISOL	-.59*	-.51*	-.59*	-.53*	.64*	.47*	.56*	-.49*	.71*	-.44*									
12 MF	.60*	.60*	.63*	.52*	-.45*	-.27*	-.38*	.74*	-.35*	.70*	-.51*								
13 OI	-.48*	-.48*	-.49*	-.38*	.50*	.43*	.53*	-.46*	.74*	-.35*	.77*	-.51*							
14 SCSt	.65*	.65*	.67*	.56*	-.62*	-.44*	-.57*	.81*	-.77*	.67*	-.84*	.79*	-.81*						
15 Anger	-.34*	-.23*	-.31*	-.28*	.48*	.45*	.49*	-.24*	.42*	-.15*	.49*	-.32*	.35*	-.45*					
16 Anx	-.32*	-.22*	-.29*	-.29*	.49*	.50*	.51*	-.21*	.42*	-.09	.45*	-.30*	.46*	-.41*	.88*				
17 Dep	-.32*	-.27*	-.32*	-.35*	.50*	.43*	.48*	-.27*	.41*	-.19*	.49*	-.39*	.50*	-.47*	.82*	.82*			
18 EESSt	-.34*	-.23*	-.31*	-.31*	.51*	.48*	.51*	-.25*	.44*	-.14	.50*	-.34*	.53*	-.46*	.97*	.96*	.90		
19 YFAS	-.38*	-.26*	-.35*	-.37*	.56*	.49*	.51*	-.28*	.37*	-.20*	.46*	-.30*	.43*	-.44*	.69*	.62*	.65	.69	
20 BMI	-.22*	-.11	-.18*	-.10	.20*	.13	.07	-.05	.11	-.06	.15*	-.15*	.09	-.13	.20*	.15*	.21*	.19*	.23*

\* p&lt;.05

Adult Hope Scale (AHS): 1=Agency, 2=Pathway, 3=AHS total; 4=Satisfaction with Life Scale; Depression and Anxiety Scale (DASS-21): 5=Depression, 6=Anxiety, 7=Stress; Self-compassion Scale (SCS): 8=Self-Kindness, 9 = Self-Judgement, 10=Common Humanity, 11=Isolation, 12=Mindfulness, 13=Over Identification, 14=SCS Total; Emotional Eating Scale (EES): 15=Anger/Frustration, 16=Anxiety, 17=Depression, 18=EES Total; 19=Yale Food Addiction Scale (YFA).

## SEM Analysis

SEM was used to test a proposed theoretical model whereby self-compassion (comprising self-kindness, self-judgement, common humanity, isolation, mindfulness and over-identification subscales) and hope (comprising agency and pathway subscales) mediated the relationships between the predictor variables: food addiction, emotional eating, and the outcome variables: BMI, anxiety, depression, stress and satisfaction with life.

Before conducting the final model, factor scores were developed by producing a factor-analysis for each construct. Through doing this it was possible to check factor loadings for each construct and to compute a factor score that could be used in the SEM to make the presentation of the model more parsimonious. Factor loadings for each construct are presented in Table 3 below. All factor models were conducted separately and all factor loadings were statistically significant for all measures. No cross-factor loadings were suggested by the modification index indicating all items loaded on to their appropriate factors in the appropriate direction. Negative direction shows an inverse correlation between the factors in the CFA, likely because the items were reverse scored in the data so that higher scores were equivalent to higher self-compassion. The factor scores were calculated in account of this. Items 15 and 16 of the YFAS are not included in the path diagrams or Table 3 as scoring guidelines stipulated they should not be included for reasons other than diagnosis (Gearhardt et al., 2012). Items 3, 5, 7 11 from the Hope Scale were removed as these are filler items, and so not included in the analyses. The factor models are presented in appendix 7.

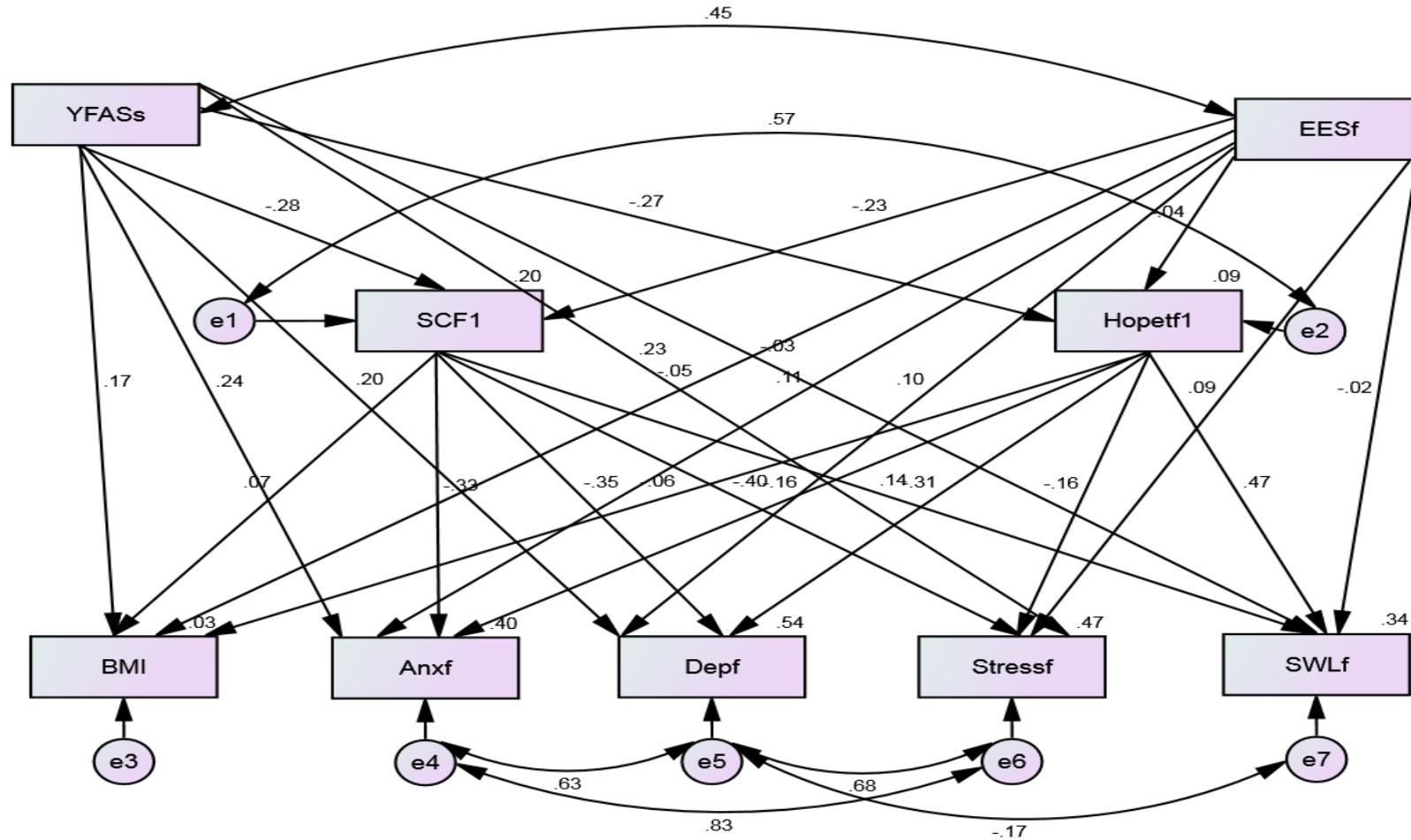
Table 3: *Factor loadings for all constructs*

Item	Factor loading										
YFAS	Alpha = p.001	EES	Alpha = p.001	SCS	Alpha = p.001	HOPE	Alpha = p.001	DASS	Alpha = p.001	SWL	Alpha = p.001
1	.81	1	.75	1	.68	1	.71	1	.60	1	.90
2	.86	2	.79	2	.78	2	.78	2	.45	2	.90
3	.78	3	.53	3	.41	4	.71	3	.82	3	.91
4	.57	4	.55	4	.71	6	.70	4	.49	4	.81
5	.79	5	.78	5	-.51	8	.83	5	.76	5	.68
6	.79	6	.41	6	.76	9	.69	6	.75		
7	.81	7	.66	7	-.31	10	.75	7	.57		
8	.78	8	.83	8	.60	12	.75	8	.59		
9	.70	9	.68	9	-.33			9	.79		
10	.53	10	.83	10	-.50			10	.87		
11	.44	11	.82	11	.48			11	.82		
12	.74	12	.81	12	-.67			12	.79		
13	.82	13	.62	13	.62			13	.86		
14	.78	14	.80	14	-.67			14	.70		
17	.70	15	.83	15	-.60			15	.89		
18	.67	16	.79	16	.70			16	.86		
19	.62	17	.75	17	-.71			17	.84		
20	.63	18	.86	18	.60			18	.80		
21	.51	19	.83	19	-.66			19	.60		
22	.33	20	.80	20	.44			20	.70		
23	.40	21	.83	21	.60			21	.81		
24	.49	22	.73	22	-.62						
25	.84	23	.68	23	-.70						
		24	.83	24	.59						
		25	.80	25	.75						
				26	-.56						

In the main model the Maximum Likelihood method was used to estimate the parameters of the hypothesised model. The model fit indices were highly acceptable as shown by the following criteria: RMSEA = .047 (Confidence Intervals = .00 to .112); CFI = .997; TLI = .984. Chi-square also indicated good fit ( $\chi^2 = 8.53$ ,  $df = 6$ ,  $p > .05$ ) as did the SRMR (.0275). Only a few correlated residuals were required (as suggested by the modification indices) to improve the model fit, this was between the three subscales of the DASS-21, as expected, because the variables are part of the same construct, and also between depression and SWL. The model is further justified by the clearly non-trivial effect sizes on the outcome variables.

The SEM presented in figure 1 shows the associations between YFAS, EES, SC, hope, and BMI, depression, anxiety, stress and SWL. The factor scores have been used for each variable. Figure 1 displays the main model complete with the standardised regression weights, significance values and  $R^2$  values. Table 4 lists the direct effects, the indirect effects through SCS and hope, and total effects.

Figure 1. Structural Equation Model output diagram: YFAS and EES mediated by SCS and Hope to BMI, Anxiety, Depression, Stress and SWL.



Note: Standardised regression slopes for direct effects are represented by single-headed arrows. Covariance between variables is depicted by curved double-headed arrows. Correlations are between the variables and the residuals, not just between the variables. The total standardised proportion of variance accounted for ( $R^2$ ) is reported to the top right-hand corner for each endogenous variable. f=factor score. Latent variables represented by rectangles.

Table 4: *Direct effects, indirect effects through SCS and hope, and total effects, including significance levels.*

Predictor	Outcome	Standardised estimates		
		Direct	Indirect (CI)	Total
YFAS	BMI	-17	-.03 (-.05 to .07)	.20*
	ANX	.24**	.14 (.03 to .21)**	.38**
	DEP	.20**	.18 (.05 to .27)**	.39**
	STRESS	.23**	.16 (.03 to .23)**	.39**
	SWL	-.03	.17 (-.27 to -.06)**	-.18*
EES	BMI	-.05	-.01 (-.05 to .04)	-.06
	ANX	.11	.08 (.02 to .20)**	.19*
	DEP	.10	.09 (.01 to .23)*	.19**
	STRESS	.09	.10 (.03 to .22)**	.19*
	SWL	-.02	-.05 (-.19 to .03)	-.07

\*\*p<.01 \*p<.05 BMI R<sup>2</sup> = .03, DEP R<sup>2</sup> = .54, ANX R<sup>2</sup> = .40, STRESS R<sup>2</sup> = .47, SWL R<sup>2</sup> = .34, SCS R<sup>2</sup> = .20, HOPE R<sup>2</sup> = .09.

In the expected direction, the model illustrates significant direct effects between food addiction, emotional eating, and all outcome variables, with the exception of BMI. The two predictors account for 3% ( $p>.05$ ) of the variance in BMI, 40% ( $R^2=.40$ ), 54% ( $R^2=.54$ ), 47% ( $R^2=.47$ ) and 34% ( $R^2=.40$ ;  $ps<.01$ ) for anxiety, depression, stress and SWL respectively. YFAS appears to be the strongest predictor, with EES still contributing significance but with weaker direct effects. There is incremental variance for each predictor, as evidenced by each predictor remaining significant (from correlations as each predictor is added to the model), and as indicated through the total effects, therefore there is added variance through regression. Furthermore, whilst YFAS and EES had a high covariance, a separate model was conducted independently and demonstrated unique regression effects from each predictor variable to each outcome (Table 5, appendix 6).

With the exception of EES to Hope, significant direct effects were present between the predictor variables and the mediation variables (SCS -.28, -.23,  $ps<.01$ ; Hope -.27,  $p<.01$ , .04,  $p>.05$ ) for YFAS and EES respectively. Also, between the mediation variables and outcome variables (SCS .07,  $p>.05$ , -.33, -.35, -.40, -.14; Hope -.06, -.16, -.31, -.16, -.47,  $ps. <.05$  to  $<.01$ ) for BMI, anxiety, depression, stress and SWL respectively (see appendix 6, Table 6).

Bootstrapping revealed significant indirect effects from YFAS through SCS and Hope to anxiety, depression, stress and SWL ( $\beta$ s = .14, .18, .16, .17,  $p$ s<.01). Also, from EES through SCS and Hope to anxiety, depression and stress (.08,  $p$ <.01, .09,  $p$ <.05, .10,  $p$ <.01). The direct effects between the predictor variables and outcome variables were higher in the correlations (Table 2) and in the direct path analysis (appendix 6, Table 7.) and have weakened as a consequence of adding SCS and Hope. This indicates that the direct effects have been partially mediated by SCS and Hope, as the effects have weakened but not disappeared completely. However, it is not possible to determine whether SCS or Hope has had the biggest mediation effect, therefore separate mediation models for SCS and Hope were conducted. These models indicated slightly stronger mediation effects between YFAS and SCS for anxiety, depression and stress and slighter stronger effects from Hope for SWL; however, both SCS and Hope were significant mediators for YFAS. For the EES however, all the mediation effects appeared to be coming from SC as the indirect effects between EES and Hope were non-significant (see Table 8, appendix 6).

## Discussion

Findings from the current study are in accordance with previous findings on the relationship between eating behaviour and diabetes outcomes, including BMI and wellbeing, (e.g., Herpertz-Dahlmann et al., 2008; Snoek, Engels, Van Strien & Otten, 2013; Viana, Sinde, & Saxton, 2008) and between eating behaviour, positive factors and diabetes management, including wellbeing (e.g., Adams & Leary, 2007; Barnard & Curry, 2011; Howell et al., 2015; Iddon et al., 2016; Joyce et al., 2012; López et al., 2015; Taylor et al., 2015). The findings add to the emerging evidence that interventions to increase self-compassion might be beneficial for treating addiction, binge eating, emotional eating and improving health behaviours (Brooks et al., 2013; Terry & Leary, 2011; Webb & Forman, 2012) specifically in relation to food addiction and emotional eating in the diabetic population, who has had minimal attention. Individuals with higher self-compassion may be able to recover more quickly from setbacks in relation to eating behaviour (Ferreira et al., 2013; Leary et al., 2007; Taylor et al., 2015) and may also have internal resources that lead to improved coping, despite the difficulties they face (Neff, 2003). In accordance with the hypotheses, food addiction (FA) and emotional eating (EE) were directly associated with BMI, anxiety, stress, depression in the positive direction, and satisfaction with life in the negative direction as expected. However, FA and EE were not significantly associated with BMI in the main SEM model, this could be because the predictor variables were only weakly correlated with BMI, thus reducing the effect in the main model. This might also indicate that the effects in correlational studies may be overinflated (i.e., Bishara & Hittner, 2015; Ferreira et al., 2017). Additionally, higher levels of FA and EE were associated with lower levels of SC and hope. This is consistent with the hypotheses, and with previous research that suggested lower hope and self-compassion was associated with poorer eating behaviour (i.e. overeating and emotional eating) (Adams & Leary, 2007; Nothwehr et al., 2013; Taylor et al., 2015).

In contrast to research suggesting that hope and self-compassion influenced HbA1c. (Friis, et al., 2016; Joyce et al., 2012; Lloyd et al., 2009) HbA1c was excluded from the main analysis (SEM) as this was non-significant at correlation level for all variables. A possible explanation for this could be that in the current sample HbA1c seemed to be well-managed, with only 21% of people identified as having high HbA1c and being at risk for developing complications associated with diabetes, compared to 31 and 23% of people identified as having acceptable and good control respectively. This may coincide with time since diagnosis and may partially explain why HbA1c was non-significant in the current sample. This may also explain why BMI was not significantly associated with YFAS or EES in the main SEM model, given that the highest percentage of participants had been diagnosed for more than 10 years (22%), 21.6% for 5 years, and 11% for 20+ years, with only 18% diagnosed for a year or less. This effect was also indicated by the intermittent correlations. It is also possible that good control including HbA1c and BMI is related to medication adherence (Lin et al., 2017; Polonsky & Henry, 2016), which may mitigate against the physical impact of eating in response to emotions or for psychological reasons (Kalra, Jena, & Yeravdekar, 2018). Good control has also been linked with socioeconomic status. Houle et al. (2016) found that lower education level and living in poverty were associated with poor glycaemic control among patients with type 2 diabetes. The current sample were educated consistent with the general population (28% vs 27.2% for the current sample and population respectively). However, there was a lower percentage of people not working (5.7% vs 22%) and a higher percentage of people earning above average wage (28.8% vs 22.5%) in the current sample, compared with the UK population (ONS, 2018) which might indicate they were relatively advantaged.

Consistent with the hypotheses and with previous research (e.g., Barnard & Curry, 2011; Friis et al., 2015; 2016; MacBeth & Gumley, 2012; Neff et al., 2007; Pinto-Gouveia et al., 2014) self-compassion and hope were negatively associated with anxiety, depression and

stress and positively associated with SWL. Again, BMI was non-significant. In partial accordance with the final hypothesis, the relationship between food addiction/emotional eating and outcomes was partially mediated by hope and self-compassion. The research further supports the findings of Ferrari et al. (2017) which suggests self-compassion was associated with better self-management and wellbeing outcomes for people diagnosed with diabetes, and with Friis et al. (2016) who found self-compassion was associated with reductions in depression and distress related to diabetes. The direct associations in the current research between SC and the outcome variables comply with these findings, with the addition that SC may mediate the close relationship between eating behaviour and wellbeing outcomes. Findings indicate that self-compassion may be a protective factor against over-eating whether this be a consequence of addiction or emotion. Hope on the other hand may be a protective factor against addiction to food, but no buffering effects were evident in relation to emotional eating. This could be due to the majority of participants only being moderately affected by EES (Arnow et al., 1995), whereas they scored high (above clinical significance) on the YFAS (Gearhardt et al., 2012). However, the difference in significance from hope also suggests that whilst self-compassion and hope are strongly associated as suggested by Neff, Rude and Kirkpatrick (2007), they are tapping into different concepts. Moreover, this indicates there may be different mechanisms involved in eating as a consequence of potential food addiction and eating in response to emotions, which is contrary to evidence suggesting food addiction is underpinned by emotional eating (Arnow, et al., 1995; Davis & Carter, 2009; Davis et al., 2011) and may, instead, endorse the evidence for classifying certain types of overeating, such as compulsive overeating, as addiction (Avena et al., 2008; 2012). However, whilst this corroborates research suggesting different mechanisms are involved in this type of overeating (Avena et al., 2012; Westwater et al., 2016) this should be considered with caution as the evidence is only beginning to emerge.

Whilst an important finding, irrespective of the underlying mechanisms, overeating including addiction to food and eating in response to emotion are still grave concerns for this cohort. The findings of the current research indicate that people with more hope and more self-compassion may be less likely to engage in ruminative eating and potentially may be more able to control their food intake. It may be they are more able to regulate their emotions and find healthier responses to distress. The findings are consistent with research that suggests positive factors have been associated with wellbeing (López et al., 2015) and coping with chronic illness (Milne et al., 2009; Pinto-Gouveia et al., 2014), and adds to this research by indicating the relevance of positive factors in people diagnosed with diabetes. Hope has been found to increase levels of wellbeing (Howell et al., 2015; Huffman et al., 2015; Iddon et al., 2016) and self-compassion has been associated with lower levels of stress, anxiety and depression and increased wellbeing (e.g., Barnard & Curry, 2011; Friis et al., 2016; Neff et al., 2007; Pinto-Gouveia, et al., 2014). These findings were corroborated by the current research, with the addition that hope and self-compassion reduce the negative effects of overeating and associated distress, by partially mediating this pathway to improve wellbeing and satisfaction with life amongst people diagnosed with diabetes.

### **Limitations**

Although the SEM model was based upon hypotheses generated from relevant theory, the principal limitation of this study was its cross-sectional design, which means it is not possible to fully infer the direction of effects (Maxwell & Cole, 2007). It is plausible therefore, that increased psychological wellbeing leads to improved eating behaviours and to increased levels of hope and self-compassion. Consequently, it is important to interpret the findings of the current study with this in mind.

In relation to the use of the SEM model, a second limitation may have been the use of combined factor scores in the model. It was not possible to include the subscales of each

measure and maintain parsimony, however, the use of factor scores includes latent variables that takes account of each item and consequently each subscale; furthermore, some indication of this is giving in the correlations. For instance, common humanity had weaker correlations with the outcome variables than isolation for SCS, however all SCS subscales were weak to moderate and significant. Pathway and agency were also contributing similar effects in association with the outcome variables, which makes the use of the factor score more reasonable and in accordance with recommendations by Snyder et al. (1991) which suggest both are interactive and need to be present for goal-directed behaviour to occur.

Also, in relation to the SEM model, it was not possible to determine whether the mediation effects were coming from self-compassion or hope as the regression weights in SEM are an aggregate of all the endogenous variables. However, the indirect effects in the model indicated that the predominant mediation effects were coming from self-compassion, and this was confirmed in a separate model that did not form part of the main analysis (appendix 6, Table 8). Furthermore, whilst significant indirect effects indicate a mediation effect between the predictor variables (in the current study YFAS and EES) and the outcome variables (e.g., depression, anxiety, satisfaction with life) it was not possible in the main model to check how much the direct effects had been reduced by adding the mediation variables without conducting a model for the direct effects only. In doing this it was clear the mediation variables reduced the direct effects between the predictor variables (YFAS and EES) and the outcome variables considerably i.e., by 50% for depression (from  $\beta=.40$  to  $\beta=.20$ ), demonstrating the valid contribution of the positive factors (appendix 6, Table 7).

A further limitation could be that comorbid health conditions were not controlled, 74% of participants had comorbid physical health conditions, 87% relied on medication and 43% of participants experienced mental health difficulties including anxiety and depression. Also, recruitment was through diabetes.co.uk which may have limited engagement from people not

affiliated with this site. However, diabetes.co.uk does reach a wide audience and may have attracted a wide range of individuals. The use of online recruitment has received multiple criticisms, including limited participant retention (Koo & Skinner, 2005; Lane, Armin, & Gordon, 2015). However, recruiting in this way may have made the study more accessible for larger numbers. However, it may have been less accessible for older people or people not familiar with the internet. Recruiting through an online system meant it was also not possible to confirm whether individuals met the study criteria. However, attempts to address this included clear inclusion criteria, recruiting only through diabetes.co.uk, and asking diabetes related questions such as HbA1c, time since diagnosis and BMI. Future research might address this sampling issue further by recruiting through a variety of means, for instance through diabetes clinics, community sampling, wider advertisement, in addition to online recruitment.

### **Clinical implications and future recommendations**

Whilst lower levels of distress (i.e., depression) have been shown to be associated with lower FA/EE, it is useful to find evidence that hope and self-compassion are correlated as expected, and that they mediate the direct pathway between eating behaviour and distress. It is perhaps more meaningful clinically to consider actively fostering hope and self-compassion than it is to consider just reducing and eliminating negativity. Clinical work is underpinned by having to identify helpful alternative thinking and behaviour, not just eliminating distress. Research can often miss this, whereas the current research clearly shows that fostering positive factors can not only reduce the negative effects between eating and distress, but that it can also foster and improve wellbeing, thus potentially helping people with diabetes to live well (Keyes & Lopez, 2009).

Hope-based interventions may also contribute to improvements in psychological wellbeing in response to eating behaviour. Emerging evidence advocates the use of measuring

positive constructs which act as buffers against poor wellbeing (Morgan & Zigliom, 2017) and hope-based interventions have shown to influence eating behaviour, increase wellbeing and contribute to improved diabetes management (Joyce et al., 2012; Nothwehr et al., 2013; Vieth et al., 1997). It is proposed that individuals with higher levels of goal-focused hope, comprising the ability to plan how a goal may be accomplished (pathway), and an individual's motivation to achieve the goal, may be better able to adopt and maintain the perception of psychological wellbeing, and achieve their goals in relation to eating behaviour. Individuals with higher goal-focused hope may additionally be more likely to pursue their valued goals, despite the experience of diabetes, which in turn may contribute to effective coping (O'Connell, 2005; Snyder, 1991; 1996).

The clear mediation effects of self-compassion and hope on depression, stress, anxiety and satisfaction with life demonstrate the utility of employing positive psychological constructs to the clinical area of diabetes. The direction of effects in relation to the positive constructs indicate that self-compassion and hope may be protective factors that provide a buffer against distress associated with eating behaviour. Whilst this effect may not be clear in relation to BMI or HbA1c, for instance HbA1c was not correlated with any of the variables of interest (with the exception of BMI as expected) and therefore not included in the main analysis. BMI was weakly correlated with hope, SWL, two of the self-compassion subscales (isolation and mindfulness), EES and YFAS, but this effect was subsumed in the main model, rendering the relationship between FA/EE and BMI non-significant. This could be due to factors such as time since diagnosis, medical adherence and potential management of these objective measures. Whilst this was beyond the scope of the current research, it might be beneficial for future researchers to consider whether food addiction and emotional eating are more likely to be associated with HbA1c and BMI in people with a recent diagnosis. However, it could be that

managing BMI and HbA1c does not translate to managing the distress caused by diabetes, particularly in relation to eating behaviour.

Whilst these links were unclear in the current research, there were clear mediation effects from eating behaviour to wellbeing, indicating that promoting the development of positive factors through self-compassion or hope-based interventions or providing information on how to develop positive psychological skills at the time of diagnosis might be beneficial. It might also be important to harness these skills in preventing the onset of diabetes in people who have difficulties with eating behaviour, particularly those with prediabetes. This may lead to increased wellbeing and improved clinical outcomes in this population. Furthermore, as evidence suggests commonalities amongst positive psychological constructs (Neff et al., 2007) it might be important in future research to continue to evaluate the unique contributions of each construct in relation to eating behaviour, wellbeing and therapeutic change in the management of diabetes. The utility of looking at two individual, yet related constructs was evidenced in the current research by self-compassion and hope relating differently to emotional eating and food addiction, with SCS being an important mediator for both, but hope only for addiction to food.

There is evidence to suggest that psychological health is a distinct theoretical, statistical and neurobiological concept from mental illness (Huber, Suman, Biasi, & Carli, et al., 2008; Keyes, 2002; Keyes, 2005). Psychological health has been described as flourishing, rather than simply the absence of distress (Pulvers & Hood, 2013), however, the way in which research is currently measured is to determine whether distress is present or not, and the levels of that distress or reductions in symptomology. Measuring in this way may neglect meaningful clinical outcomes that indicate improvements in wellbeing and quality of life. Therefore, in future research it may be important to be mindful of including positive constructs to measure these changes. Also, longitudinal studies may be required to determine if self-compassion and hope improve wellbeing and diabetes management in relation to eating behaviour over time.

## **Conclusion**

In conclusion, the outcomes of the current study demonstrate the utility of measuring positive constructs in relation to eating behaviour and wellbeing outcomes in relation to diabetes management. Whilst there is clear evidence for the association between diabetes and poor psychological wellbeing, this is the first study to demonstrate that eating behaviour is directly associated with wellbeing (e.g., depression and satisfaction with life) and that this relationship is mediated by positive factors in people with diabetes. Thus indicating that hope and self-compassion reduce the negative effects of overeating and associated distress.

The current study also provides tentative evidence that different mechanisms underlie food addiction and emotional eating, and that whilst self-compassion might be beneficial for treating both, hope may be more relevant for treating food addiction. The findings also offer tentative support for the concept of food addiction, and given these emerging insights, indicate the potential importance of tailoring treatments and promoting healthier eating behaviours. The current study extends the literature pertaining to the use of positive psychology and highlights potential benefits of positive psychological intervention to improve food beliefs and behaviours, thus increasing wellbeing in individuals living with diabetes.

## References

- Adab, P., Pallan, M., & Whincup, P. H. (2018). Is BMI the best measure of obesity? *British Medical Journal*, *360*, 1-2.
- Adams, C. E., & Leary, M. R. (2007). Promoting self-compassionate attitudes toward eating among restrictive and guilty eaters. *Journal of Social and Clinical Psychology*, *26*(10), 1120-1144.
- Agha, M., & Agha, R. (2017). The rising prevalence of obesity: part A: impact on public health. *International Journal of Surgery. Oncology*, *2*(7), e17.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.
- Arbuckle, J. L. (2011). *IBM SPSS AMOS 20.0 user's guide*. Chicago (IL): IBM Corporation.
- Arnou, B., Kenardy, J., & Agras, W. S. (1995). The Emotional Eating Scale: The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders*, *18*(1), 79-90.
- Avena, N. M., Gold, J. A., Kroll, C., & Gold, M. S. (2012). Further developments in the neurobiology of food and addiction: update on the state of the science. *Nutrition*, *28*(4), 341-343.
- Avena, N. M., Rada, P., & Hoebel, B. G. (2008). Evidence for sugar addiction: behavioral and neurochemical effects of intermittent, excessive sugar intake. *Neuroscience & Biobehavioral Reviews*, *32*(1), 20-39.
- Barnard, L. K., & Curry, J. F. (2011). Self-compassion: Conceptualizations, correlates, & interventions. *Review of General Psychology*, *15*(4), 289-303.

- Barnes, A. S. (2011). The Epidemic of Obesity and Diabetes: Trends and Treatments. *Texas Heart Institute Journal*, 38(2), 142–144.
- Beck, R. W., Connor, C. G., Mullen, D. M., Wesley, D. M., & Bergenstal, R. M. (2017). The fallacy of average: how using HbA1c alone to assess glycemic control can be misleading. *Diabetes Care*, 40(8), 994-999.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107, 238-246.
- Beaufort, I. N., De Weert-Van Oene, G. H., Buwalda, V. A., de Leeuw, J. R. J., & Goudriaan, A. E. (2017). The Depression, Anxiety and Stress Scale (DASS-21) as a Screener for Depression in Substance Use Disorder Inpatients: A Pilot Study. *European Addiction Research*, 23(5), 260-268.
- Bishara, A. J., & Hittner, J. B. (2015). Reducing bias and error in the correlation coefficient due to nonnormality. *Educational and psychological measurement*, 75(5), 785-804.
- Blaszczynski, A., Anjoul, F., Shannon, K., Keen, B., Pickering, D., & Wieczorek, M. (2015). Gambling harm minimisation report. *Sydney: The University of Sydney Gambling Treatment Clinic*.
- Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2014). Looking at the bowl of fruit or focussing on the apples? Reply to the comments of Schueller et al. *International Journal of Wellbeing*, 4(1), 99-105.
- Bommer, C., Heesemann, E., Sagalova, V., Manne-Goehler, J., Atun, R., Bärnighausen, T., & Vollmer, S. (2017). The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study. *The Lancet Diabetes & Endocrinology*, 5(6), 423-430.

- Boomsma, A., & Hoogland, J. J. (2001). The robustness of LISREL modeling revisited. *Structural equation models: Present and future. A Festschrift in honor of Karl Jöreskog*, 2(3), 139-168.
- Bralić Lang, V., & Bergman Marković, B. (2016). Prevalence of comorbidity in primary care patients with type 2 diabetes and its association with elevated HbA1c: A cross-sectional study in Croatia. *Scandinavian journal of primary health care*, 34(1), 66-72.
- Brooks, M., Kay-Lambkin, F., Bowman, J., & Childs, S. (2012). Self-compassion amongst clients with problematic alcohol use. *Mindfulness*, 3(4), 308-317.
- Burmeister, J. M., Hinman, N., Koball, A., Hoffmann, D. A., & Carels, R. A. (2013). Food addiction in adults seeking weight loss treatment. Implications for psychosocial health and weight loss. *Appetite*, 60, 103-110.
- Busseri, M. A. (2018). Examining the structure of subjective well-being through meta-analysis of the associations among positive affect, negative affect, and life satisfaction. *Personality and Individual Differences*, 122, 68-71.
- Byrne, B. M. (2010). Structural equation modeling with AMOS: basic concepts, applications, and programming (multivariate applications series). *New York: Taylor & Francis Group*, 396, 7384.
- Cornelius, J. R., Tippmann-Peikert, M., Slocumb, N. L., Frerichs, C. F., & Silber, M. H. (2010). Impulse control disorders with the use of dopaminergic agents in restless legs syndrome: a case-control study. *Sleep*, 33, 81-7.
- Costa, J., Marôco, J., Pinto-Gouveia, J., Ferreira, C., & Castilho, P. (2016). Validation of the psychometric properties of the Self-Compassion Scale. Testing the factorial validity and factorial invariance of the measure among borderline personality disorder, anxiety

disorder, eating disorder and general populations. *Clinical Psychology & Psychotherapy*, 23(5), 460-468.

Comrey, A. L., & Lee, H. B. (2013). *A first course in factor analysis*. Psychology Press.

Davis, C., & Carter, J. C. (2009). Compulsive overeating as an addiction disorder. A review of theory and evidence. *Appetite*, 53(1), 1-8.

Davis, C., Curtis, C., Levitan, R. D., Carter, J. C., Kaplan, A. S., & Kennedy, J. L. (2011). Evidence that 'food addiction' is a valid phenotype of obesity. *Appetite*, 57(3), 711-717.

Diabetes UK. (2016). *Facts and Stats*. Retrieved from: [https://www.diabetes.org.uk/Documents/Position%20statements/DiabetesUK\\_Facts\\_Stats\\_Oct16.pdf](https://www.diabetes.org.uk/Documents/Position%20statements/DiabetesUK_Facts_Stats_Oct16.pdf). Accessed March 3, 2019.

Diabetes UK. (2018). *Diabetes and Mental Health*. Retrieved from: <https://www.diabetes.org.uk/resources-s3/2018-08/Diabetes%20and%20Mental%20Health%20%28PDF%2C%205.7MB%29.pdf>. Accessed March 3, 2019.

Diabetes UK. (2014). *The Cost of Diabetes: Report*. Retrieved from: <https://www.diabetes.org.uk/resources-s3/2017-11/diabetes%20uk%20cost%20of%20diabetes%20report.pdf>.

Diabetes UK (2017). *The Future of Diabetes*. Retrieved from: [https://www.diabetes.org.uk/resources-s3/2017-11/1111B%20The%20future%20of%20diabetes%20report\\_FINAL\\_.pdf](https://www.diabetes.org.uk/resources-s3/2017-11/1111B%20The%20future%20of%20diabetes%20report_FINAL_.pdf).

Diener, E. (2006). Guidelines for national indicators of subjective well-being and ill-being. *Applied Research in Quality of Life*, 1(2), 151-157.

- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment, 49*, 71-75.
- Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology, 29*(1), 94-122.
- Epstein, L. H., Temple, J. L., Neaderhiser, B. J., Salis, R. J., Erbe, R. W., & Leddy, J. J. (2007). Food reinforcement, the dopamine D<sub>2</sub> receptor genotype, and energy intake in obese and nonobese humans. *Behavioral Neuroscience, 121*(5), 877.
- Fanning, J., Osborn, C. Y., Lagotte, A. E., & Mayberry, L. S. (2018). Relationships between dispositional mindfulness, health behaviors, and hemoglobin A1c among adults with type 2 diabetes. *Journal of Behavioral Medicine, 1*-8.
- Ferrari, M., Dal Cin, M., & Steele, M. (2017). Self-compassion is associated with optimum self-care behaviour, medical outcomes and psychological well-being in a cross-sectional sample of adults with diabetes. *Diabetic Medicine, 34*(11), 1546-1553.
- Ferreira, C., Pinto-Gouveia, J., & Duarte, C. (2013). Self-compassion in the face of shame and body image dissatisfaction: Implications for eating disorders. *Eating Behaviors, 14*(2), 207-210.
- Folkman, S. (2008). The case for positive emotions in the stress process. *Anxiety, stress, and coping, 21*(1), 3-14.
- Friis, A. M., Johnson, M. H., Cutfield, R. G., & Consedine, N. S. (2015). Does kindness matter? Self-compassion buffers the negative impact of diabetes-distress on HbA1c. *Diabetic Medicine, 32*(12), 1634-1640.

- Friis, A. M., Johnson, M. H., Cutfield, R. G., & Consedine, N. S. (2016). Kindness matters: a randomized controlled trial of a mindful self-compassion intervention improves depression, distress, and HbA1c among patients with diabetes. *Diabetes Care*, *39*(11), 1963-1971.
- Garland, E. L., Boettiger, C. A., & Howard, M. O. (2011). Targeting cognitive-affective risk mechanisms in stress-precipitated alcohol dependence: an integrated, biopsychosocial model of automaticity, allostasis, and addiction. *Medical Hypotheses*, *76*(5), 745-754.
- Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The eating attitudes test: psychometric features and clinical correlates. *Psychological Medicine*, *12*(4), 871-878.
- Gearhardt, A.N., Corbin, W.R., & Brownell, K.D. (2009). Preliminary validation of the Yale Food Addiction Scale. *Appetite*, *52*, 430-436.
- Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2012). *Yale Food Addiction Scale (YFAS)*. Measurement Instrument Database for the Social Science.
- Gearhardt, A. N., White, M. A., Masheb, R. M., & Grilo, C. M. (2013). An examination of food addiction in a racially diverse sample of obese patients with binge eating disorder in primary care settings. *Comprehensive Psychiatry*, *54*(5), 500-505.
- Gianini, L. M., White, M. A., & Masheb, R. M. (2013). Eating pathology, emotion regulation, and emotional overeating in obese adults with binge eating disorder. *Eating Behaviors*, *14*(3), 309-313.
- Gilbert, P., McEwan, K., Matos, M., & Rivis, A. (2011). Fears of compassion: Development of three self-report measures. *Psychology and Psychotherapy: Theory, Research and Practice*, *84*(3), 239-255.

- Gonzalez, J. S., & McCarl, L. A. (2010). Cognitive behavioral therapy for adherence and depression (CBT-AD) in type 2 diabetes. *Journal of Cognitive Psychotherapy*, 24(4), 329.
- Gormally, J., Black, S., Daston, S., & Rardin, D. (1982). The assessment of binge eating severity among obese persons. *Addictive Behaviors*, 7(1), 47-55.
- Grant, J. E., & Chamberlain, S. R. (2016). Expanding the definition of addiction: DSM-5 vs. ICD-11. *CNS Spectrums*, 21(4), 300-303.
- Gray, N., Picone, G., Sloan, F., & Yashkin, A. (2015). The relationship between BMI and onset of diabetes mellitus and its complications. *Southern medical journal*, 108(1), 29.
- Hartmann, M., Kopf, S., Kircher, C., Faude-Lang, V., Djuric, Z., Augstein, F., ... & Herzog, W. (2012). Sustained effects of a mindfulness-based stress-reduction intervention in type 2 diabetic patients: design and first results of a randomized controlled trial (the Heidelberger Diabetes and Stress-study). *Diabetes care*, 35(5), 945-947.
- Harvey, J. N. (2015). Psychosocial interventions for the diabetic patient. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 8, 29-43.
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guildford Press.
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*, 44(2), 227-239.
- Herpertz-Dahlmann, B., Wille, N., Hölling, H., Vloet, T. D., Ravens-Sieberer, U., & BELLA Study Group. (2008). Disordered eating behaviour and attitudes, associated psychopathology and health-related quality of life: results of the BELLA study. *European Child & Adolescent Psychiatry*, 17(1), 82-91.

- Hex, N., Bartlett, C., Wright, D., Taylor, M., & Varley, D. (2012). Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. *Diabetic Medicine*, 29(7), 855-862.
- Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Articles*, 2.
- Houle, J., Lauzier-Jobin, F., Beaulieu, M. D., Meunier, S., Coulombe, S., Côté, J., ... & Lambert, J. (2016). Socioeconomic status and glycemic control in adult patients with type 2 diabetes: a mediation analysis. *BMJ Open Diabetes Research and Care*, 4(1), e000184.
- Hollis-Walker, L., & Colosimo, K. (2011). Mindfulness, self-compassion, and happiness in non-meditators: A theoretical and empirical examination. *Personality and Individual Differences*, 50(2), 222-227.
- Howell, A. J., Jacobson, R. M., & Larsen, D. J. (2015). Enhanced psychological health among chronic pain clients engaged in hope-focused group counseling. *The Counseling Psychologist*, 43(4), 586-613.
- Hu, L., & Bentler, P. M. (1999). Cut off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.
- Huber, A., Suman, A. L., Biasi, G., & Carli, G. (2008). Predictors of psychological distress and well-being in women with chronic musculoskeletal pain: Two sides of the same coin? *Journal of Psychosomatic Research*, 64, 169-75.
- Huffman, J. C., DuBois, C. M., Millstein, R. A., Celano, C. M., & Wexler, D. (2015). Positive psychological interventions for patients with type 2 diabetes: rationale, theoretical model, and intervention development. *Journal of Diabetes Research*, 1-19

- IBM Corporation. (2013). *IBM SPSS statistics for windows, version 21.0*. New York: IBM Corporation.
- Iddon, J. E., Dickson, J. M., & Unwin, J. (2016). Positive psychological interventions and chronic non-cancer pain: A systematic review of the literature. *International Journal of Applied Positive Psychology, 1*(1-3), 133-157.
- Joyce, P., Hilliard, M., Cochrane, K., & Hood, K. K. (2012). The impact of positive psychology on diabetes outcomes: a review. *Psychology, 3*(12), 1116.
- Kalra, S., Jena, B. N., & Yeravdekar, R. (2018). Emotional and psychological needs of people with diabetes. *Indian Journal of Endocrinology and Metabolism, 22*(5), 696.
- Kenny, P. J. (2011). Reward mechanisms in obesity: new insights and future directions. *Neuron, 69*(4), 664-679.
- Keyes, C. L. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Behavior, 43*, 207-222
- Keyes, C. L. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology, 73*(3), 539-548.
- Keyes, C. L., & Lopez, S. J. (2009). Toward a science of mental health. *Oxford Handbook of Positive Psychology, 89-95*.
- Kline, T. (2005). *Psychological testing: A practical approach to design and evaluation*. Sage.
- Kline, R. B. (2005). *Principles and practice of structural equation modelling*. (2nd ed). New York: Guilford.
- Koo, M., & Skinner, H. (2005). Challenges of internet recruitment: a case study with disappointing results. *Journal of Medical Internet Research, 7*(1).

- Lacroix, E., Tavares, H., & von Ranson, K. M. (2018). Moving beyond the “eating addiction” versus “food addiction” debate: Comment on Schulte et al. (2017). *Appetite, 130*, 286-292.
- Lane, T. S., Armin, J., & Gordon, J. S. (2015). Online recruitment methods for web-based and mobile health studies: a review of the literature. *Journal of Medical Internet Research, 17*(7), 1-13.
- Leary, M. R., Tate, E. B., Adams, C. E., Batts Allen, A., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: the implications of treating oneself kindly. *Journal of Personality and Social Psychology, 92*(5), 887.
- Leehr, E. J., Krohmer, K., Schag, K., Dresler, T., Zipfel, S., & Giel, K. E. (2015). Emotion regulation model in binge eating disorder and obesity-a systematic review. *Neuroscience & Biobehavioural Reviews, 49*, 125-134.
- Lin, L. K., Sun, Y., Heng, B. H., Chew, D. E. K., & Chong, P. N. (2017). Medication adherence and glycemic control among newly diagnosed diabetes patients. *BMJ Open Diabetes Research and Care, 5*(1), e000429.
- Long, C. G., Blundell, J. E., & Finlayson, G. (2015). A systematic review of the application and correlates of YFAS-diagnosed ‘food addiction’ in humans: are eating-related ‘addictions’ a cause for concern or empty concepts?. *Obesity Facts, 8*(6), 386-401.
- Lloyd, S. M., Cantell, M., Pacaud, D., Crawford, S., & Dewey, D. (2009). Brief report: Hope, perceived maternal empathy, medical regimen adherence, and glycemic control in adolescents with type 1 diabetes. *Journal of Pediatric Psychology, 34*(9), 1025-1029.
- López, A., Sanderman, R., Smink, A., Zhang, Y., van Sonderen, E., Ranchor, A., & Schroevers, M. J. (2015). A reconsideration of the Self-Compassion Scale’s total score: self-compassion versus self-criticism. *PloS one, 10*(7), e0132940.

- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour research and therapy*, 33(3), 335-343.
- MacBeth, A., & Gumley, A. (2012). Exploring compassion: A meta-analysis of the association between self-compassion and psychopathology. *Clinical Psychology Review*, 32(6), 545-552.
- Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin*, 103(3), 391.
- Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*, 12(1), 23-44.
- McMahon, N., Thomson, K., Kaner, E., & Bamba, C. (2018). Effects of prevention and harm reduction interventions on gambling behaviours and gambling related harm: An umbrella review. *Addictive Behaviors*.
- Milne, L., Moyle, W., & Cooke, M. (2009). Hope: a construct central to living with chronic obstructive pulmonary disease. *International Journal of Older People Nursing*, 4(4), 299-306.
- Morgan, A., & Ziglio, E. (2007). Revitalising the evidence base for public health: An assets model. *Promotion and Education*, 14(2), 17-22.
- Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling*, 9(4), 599-620.
- National Heart Lung and Blood Institute. Overweight and Obesity. (2010). Available at: [www.nhlbi.nih.gov/health/dci/Diseases/obe/obe\\_whatare.html](http://www.nhlbi.nih.gov/health/dci/Diseases/obe/obe_whatare.html). Accessed March 4, 2019.

- National Institute for Health and Clinical Excellence. (2015). *Type 2 diabetes in adults: management*. London, NICE clinical guidelines.
- Neff, K. D. (2016). The self-compassion scale is a valid and theoretically coherent measure of self-compassion. *Mindfulness*, 7(1), 264-274.
- Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity*, 2(3), 223-250.
- Neff, K. D., Long, P., Knox, M. C., Davidson, O., Kuchar, A., Costigan, A., ... & Breines, J. G. (2018). The forest and the trees: Examining the association of self-compassion and its positive and negative components with psychological functioning. *Self and Identity*, 17(6), 627-645.
- Neff, K. D., Rude, S. S., & Kirkpatrick, K. L. (2007). An examination of self-compassion in relation to positive psychological functioning and personality traits. *Journal of Research in Personality*, 41(4), 908-916.
- Neff, K. D., Whittaker, T. A., & Karl, A. (2017). Examining the factor structure of the Self-Compassion Scale in four distinct populations: Is the use of a total scale score justified?. *Journal of Personality Assessment*, 1-12.
- NHS Digital. (2019). *Statistics on Obesity, Physical Activity and Diet, England*. Retrieved from: <https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-obesity-physical-activity-and-diet/statistics-on-obesity-physical-activity-and-diet-england-2019/part-3-adult-obesity>. Accessed May 19, 2019.
- Nothwehr, F., Clark, D. O., & Perkins, A. (2013). Hope and the use of behavioural strategies related to diet and physical activity. *Journal of Human Nutrition and Dietetics*, 26, 159-163.

- Parliament UK. (2018). *Obesity Statistics, House of Commons Library*. Available at <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN03336;www.parliament.uk>. Accessed March 4, 2019.
- O’Connell, B. (2005). Introduction to the solution-focused approach. In B. O’Connell (Ed.), *Solution-focused therapy* (2nd ed., pp. 1–11). London: Sage.
- Office for National Statistics. (2018). *Employee earnings in the UK: 2018*. Retrieved from: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2018>. Accessed March 4, 2019.
- Ogurtsova, K., da Rocha Fernandes, J. D., Huang, Y., Linnenkamp, U., Guariguata, L., Cho, N. H., ... & Makaroff, L. E. (2017). IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes Research and Clinical Practice*, *128*, 40-50.
- Parks, A. C., & Biswas-Diener, R. (2013). Positive interventions: Past, present and future. *Mindfulness, acceptance, and positive psychology: The Seven Foundations of Wellbeing*, 140-165.
- Pavot, W., & Diener, E. (2008). The satisfaction with life scale and the emerging construct of life satisfaction. *The Journal of Positive Psychology*, *3*(2), 137-152.
- Pinto-Gouveia, J., Duarte, C., Matos, M., & Fráguas, S. (2014). The protective role of self-compassion in relation to psychopathology symptoms and quality of life in chronic and in cancer patients. *Clinical psychology & psychotherapy*, *21*(4), 311-323.
- Polonsky, W. H., & Henry, R. R. (2016). Poor medication adherence in type 2 diabetes: recognizing the scope of the problem and its key contributors. *Patient Preference and Adherence*, *10*, 1299.

- Poole, K., Lobley, K., & Unwin, J. (2019). *Self-compassion and eating behaviour: a systematic review of the literature*. Unpublished manuscript.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891.
- Pulvers, K., & Hood, A. (2013). The role of positive traits and pain catastrophizing in pain perception. *Current Pain and Headaches Reports, 17*, 330-347.
- Raymond, K. L., & Lovell, G. P. (2016). Food addiction associations with psychological distress among people with type 2 diabetes. *Journal of Diabetes and its Complications, 30*(4), 651-656.
- Rosenzweig, S., Reibel, D. K., Greeson, J. M., Edman, J. S., Jasser, S. A., McMearty, K. D., & Goldstein, B. J. (2007). Mindfulness-based stress reduction is associated with improved glycemic control in type 2 diabetes mellitus: a pilot study. *Alternative Therapies in Health and Medicine, 13*(5), 36-39.
- Rubak, S., Sandbæk, A., Lauritzen, T., & Christensen, B. (2005). Motivational interviewing: a systematic review and meta-analysis. *British Journal of General Practice, 55*(513), 305-312.
- Safren, S. A., Gonzalez, J. S., Wexler, D. J., Psaros, C., Delahanty, L. M., Blashill, A. J., ... & Cagliero, E. (2014). A randomized controlled trial of cognitive behavioral therapy for adherence and depression (CBT-AD) in patients with uncontrolled type 2 diabetes. *Diabetes Care, 37*(3), 625-633.

- Schueller, S. M., Kashdan, T. B., & Parks, A. C. (2014). Synthesizing positive psychological interventions: Suggestions for conducting and interpreting meta-analyses. *International Journal of Wellbeing, 4*(1), 91-98.
- Schulte, E. M., & Gearhardt, A. N. (2017). Development of the modified Yale food addiction scale version 2.0. *European Eating Disorders Review, 25*(4), 302-308.
- Schulte, E. M., Joyner, M. A., Schiestl, E. T., & Gearhardt, A. N. (2017a). Future directions in “food addiction”: Next steps and treatment implications. *Current Addiction Reports, 4*(2), 165-171.
- Schulte, E. M., Potenza, M. N., & Gearhardt, A. N. (2017b). A commentary on the “eating addiction” versus “food addiction” perspectives on addictive-like food consumption. *Appetite, 115*, 9-15.
- Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. New Jersey: Lawrence Erlbaum Associates.
- Shapiro, S. L., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and Education in Professional Psychology, 1*(2), 105.
- Sinclair, S. J., Siefert, C. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., & Blais, M. A. (2012). Psychometric evaluation and normative data for the depression, anxiety, and stress scales-21 (DASS-21) in a nonclinical sample of US adults. *Evaluation & the Health Professions, 35*(3), 259-279.
- Sinha, R. (2008). Chronic stress, drug use, and vulnerability to addiction. *Annals of the New York Academy of Sciences, 1141*(1), 105-130.

- Snoek, H. M., Engels, R. C., Van Strien, T., & Otten, R. (2013). Emotional, external and restrained eating behaviour and BMI trajectories in adolescence. *Appetite, 67*, 81-87.
- Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T.,...Harney, P.(1991). The will and the ways: Development and validation of an individual-differences measure of hope. *Journal of Personality and Social Psychology, 60*, 570-585.
- Snyder, C. R., Sympson, S. C., Ybasco, F. C., Borders, T. F., Babyak, M. A. & Higgins, R. L. (1996). Development and validation of the State Hope Scale. *Journal of Personality and Social Psychology, 70*, 321-335.
- Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioural Research, 25*, 173-180.
- Sussman, S., & Sussman, A. N. (2011). Considering the definition of addiction. *International Journal of Environmental Research and Public Health, 8*, 4025-4038.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics*. Pearson Education. Boston, MA.
- Taylor, M. B., Daiss, S., & Krietsch, K. (2015). Associations among self-compassion, mindful eating, eating disorder symptomatology, and body mass index in college students. *Translational Issues in Psychological Science, 1*(3), 229.
- Taylor, S. L., Ruhaak, L. R., Kelly, K., Weiss, R. H., & Kim, K. (2016). Effects of imputation on correlation: implications for analysis of mass spectrometry data from multiple biological matrices. *Briefings in Bioinformatics, 18*(2), 312-320.
- Terry, M. L., & Leary, M. R. (2011). Self-compassion, self-regulation, and health. *Self and Identity, 10*(3), 352-362.

- British Psychological Society. (2014). *Code of human research ethics*. British Psychological Society.
- Valentino, R. J., Lucki, I., & Van Bockstaele, E. (2010). Corticotropin-releasing factor in the dorsal raphe nucleus: Linking stress coping and addiction. *Brain research, 1314*, 29-37.
- van Son, J., Nyklíček, I., Pop, V. J., Blonk, M. C., Erdtsieck, R. J., Spooren, P. F., ... & Pouwer, F. (2013). The effects of a mindfulness-based intervention on emotional distress, quality of life, and HbA1c in outpatients with diabetes (DiaMind): a randomized controlled trial. *Diabetes Care, 36*(4), 823-830.
- Viana, V., Sinde, S., & Saxton, J. C. (2008). Children's Eating Behaviour Questionnaire: associations with BMI in Portuguese children. *British Journal of Nutrition, 100*(2), 445-450.
- Vieth, A. Z., Hagglund, K. J., Clay, D. L., Frank, R. G., Thayer, J. F., Johnson, J. C., & Goldstein, D. E. (1997). The contribution of hope and affectivity to diabetes-related disability: An exploratory study. *Journal of Clinical Psychology in Medical Settings, 4*(1), 65-77.
- Volkow, N. D., Wang, G. J., Fowler, J. S., Logan, J., Jayne, M., Franceschi, D., ... & Pappas, N. (2002). "Nonhedonic" food motivation in humans involves dopamine in the dorsal striatum and methylphenidate amplifies this effect. *Synapse, 44*(3), 175-180.
- Wang, G. J., Volkow, N. D., Telang, F., Jayne, M., Ma, J., Rao, M., ... & Fowler, J. S. (2004). Exposure to appetitive food stimuli markedly activates the human brain. *Neuroimage, 21*(4), 1790-1797.
- Webb, J. B., & Forman, M. J. (2013). Evaluating the indirect effect of self-compassion on binge eating severity through cognitive–affective self-regulatory pathways. *Eating Behaviors, 14*(2), 224-228.

Westwater, M. L., Fletcher, P. C., & Ziauddeen, H. (2016). Sugar addiction: the state of the science. *European Journal of Nutrition*, *55*(2), 55-69.

Williams, M. J., Dalgleish, T., Karl, A., & Kuyken, W. (2014). Examining the factor structures of the five facet mindfulness questionnaire and the self-compassion scale. *Psychological assessment*, *26*(2), 407.

World Health Organization. (2017). *Global Report on Diabetes*. WHO Press: Switzerland.

World Health Organization. (2006). *Obesity and overweight*. Available at:

[www.who.int/mediacentre/factsheets/fs311/en/index.html](http://www.who.int/mediacentre/factsheets/fs311/en/index.html). Accessed March 28, 2019.

Ziauddeen, H., & Fletcher, P. C. (2013). Is food addiction a valid and useful concept?. *Obesity Reviews*, *14*(1), 19-28.

## Appendices

### Appendix 1. Quality Assessment Tool

General instructions: Grade each criterion as “Yes,” “No,” “Partially,” or “Can’t tell.”

Factors to consider when making an assessment are listed under each criterion. Where appropriate (particularly when assigning a “No,” “Partially,” or “Can’t tell” score), please Criteria marked *italics* are considered the most essential quality indicators for our purposes.

#### 1) *Unbiased selection of the cohort?*

Factors that help *reduce* selection bias:

- Prospective study design and recruitment of subjects
- Inclusion/exclusion criteria
  - o Clearly described (especially re: age and cognitive status)
  - o Assessed using valid and reliable measures
- Recruitment strategy
  - o Clearly described
  - o Relatively free from bias (selection bias might be introduced, e.g., by recruitment via advertisement)

#### 2) *Selection minimizes baseline differences in prognostic factors?*

- Was selection of the comparison group appropriate?
- In addition to selecting the cohort in an unbiased way, did study investigators do other things to ensure that exposed/unexposed groups were comparable, e.g., by using stratification, matching, or propensity scores?

#### 3) *Sample size calculated/5% difference?*

- Did the authors report conducting a power analysis or describe some other basis for determining the adequacy of study group sizes for the primary outcome(s) of interest to us?
- Was the sample size sufficiently large to detect a clinically significant difference of 5% in event rates or an OR/RR increase of  $\geq 1.5$  or decrease of  $\geq 0.67$  between groups in at least one primary outcome measure of interest to us?

Appendix 1 continued.

4) Adequate description of the cohort?

Consider whether the cohort is well-characterized in terms of baseline:

- Age • Sex • Race • Educational level • Cognitive status

5) *Validated method for ascertaining exposure?*

- Was the method used to ascertain exposure clearly described?
- Was a valid and reliable measure used to ascertain exposure?

6) Validated method for ascertaining clinical outcomes?

- Were primary outcomes assessed using valid and reliable measures?
- Were these measures implemented consistently across all study participants?

7) Outcome assessment blind to exposure?

- Were the study investigators who assessed outcomes blind to the intervention or exposure status of participants?

8) Adequate follow-up period?

- Minimum adequate follow-up period is 2 years for AD and 1 year for cognitive decline
- Follow-up period should be the same for all groups
  - o In cohort studies, length of follow-up should be the same across all groups.

9) *Completeness of follow-up?*

- Did attrition from any group exceed 30%
- Did attrition differ between groups by more than 10% percent?

10) *Analysis controls for confounding?*

- Did the analysis control for any baseline differences between groups?
- Does the study identify and control for important confounding variables and effect modifiers?

11) *Analytic methods appropriate?*

- ? • Was the kind of analysis done appropriate for the kind of outcome data?
- Was the number of variables used in the analysis appropriate for the sample Size?

## Appendix 2: Participant Forms

### 2.1. Participant Information



#### **The role of positive psychological factors in food addiction and diabetes management.**

##### **PARTICIPANT INFORMATION SHEET**

We would like to invite you to take part in a research project. Before you decide whether you would like to participate, you need to understand why this research is being done and what it will involve for you. Please take time to read the following information carefully and please contact me if there is anything that is not clear or if you would like more information.

##### **WHAT IS THE PURPOSE OF THE RESEARCH?**

The purpose of this study is to investigate whether positive psychological factors such as self-compassion and hope influence the relationship between eating behaviour and diabetes management.

##### **WHAT ARE THE RESEARCH OBJECTIVES?**

To understand whether the positive psychological factors mentioned above provide an explanation for eating behavior and how a person manages their diabetes, in order to inform research and clinical practice.

##### **WHO IS DOING THE RESEARCH?**

The research is being coordinated by Karen Poole, Katy Lobley, Jen Unwin and through diabetes.co.uk. This research will be written up part of the requirements for a doctorate in clinical psychology and may be disseminated through peer reviewed journals and conferences. Please contact me if you would like any further information about this.

##### **WHY HAVE I BEEN INVITED TO PARTICIPATE?**

You have been invited to participate as you have been diagnosed with type 2 diabetes and you are a member of diabetes.co.uk. Anyone who has been diagnosed with type 2 diabetes can take part. This project is **not** suitable for individuals who have been diagnosed with type 1 diabetes.

##### **DO I HAVE TO TAKE PART?**

No. Completion of the questionnaires is entirely voluntary, you are free to withdraw at any time, without explanation. If you do withdraw or if you do not wish to take part, it will not adversely affect your rights.

**WHAT DOES INVOLVEMENT MEAN FOR ME?**

You will be invited to complete a few questionnaires via an online link. Before you are directed to the questionnaires it will be important that you consent to take part by ticking the appropriate boxes on the consent form. The questionnaires should take between approximately 15-30 minutes. If you choose to enter your email on a separate form you will be entered into a prize draw for Amazon vouchers (x2 £100, and x4 £50). Your data will still be anonymous and no personal information will be identified. You will only be able to access the prize draw if you fully complete the questionnaires.

**WILL MY RESULTS BE KEPT CONFIDENTIAL?**

All information you provide will be anonymised, no personal identifiable information will be required from you. We are interested in themes that emerge from the data as opposed to individualised responses and as such you will not be identified in the final report. It is important to note that due to the data being completely anonymised, once you have completed the questionnaires you will not be able to withdraw consent to participate, as we will not be able to identify your individual responses.

**HOW WILL MY INFORMATION BE STORED?**

Anonymised data will be entered onto a spreadsheet which will be stored securely on a University of Liverpool computer drive.

**WILL I GET FEEDBACK?**

Yes. We will post a report of the findings on the diabetes.co.uk website.

**ARE THERE ANY RISKS OR POSSIBLE BENEFITS OF TAKING PART?**

We do not believe that there will be any risk to you in completing this research. However, if you do experience any distress or if you have any questions please feel free to contact the researcher. You will also have access to online support from diabetes.co.uk.

**WHO HAS REVIEWED THE RESEARCH?**

This study has been reviewed and approved by the University of Liverpool Research Ethics Committee [Ref: IPHS-2803].

**WHO SHOULD I CONTACT IF I NEED FURTHER INFORMATION OR IF THERE IS A PROBLEM?**

If you would like further information about the study please contact myself Karen Poole [k.poole@liverpool.ac.uk](mailto:k.poole@liverpool.ac.uk) or my supervisor Katy Lobley [klobley@liverpool.ac.uk](mailto:klobley@liverpool.ac.uk) / 0151 794 5081. If you have a concern or query you would like to discuss with someone outside of the research team please contact Matthew Billington, Research Integrity and Governance Officer, University of Liverpool (0151 794 8290/ [ethics@liverpool.ac.uk](mailto:ethics@liverpool.ac.uk)).

**Thank you.**

## 2.2. Participant consent form



## Committee on Research Ethics

### PARTICIPANT CONSENT FORM

#### The role of positive psychological factors in food addiction and diabetes management.

**Researcher(s): Karen Poole, Katy Lobley, Jennifer Unwin.**

Please  
initial box

1. I confirm that I have read and have understood the information sheet dated 21/11/2017 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my rights being affected. In addition, should I not wish to answer any particular question or questions, I am free to decline.
3. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.
4. I understand and agree that once I submit my data it will become anonymised and I will therefore no longer be able to withdraw my data.
5. I agree to take part in the above study.

Participant Name

Date

Signature

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Name of Person taking consent

Date

Signature

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Researcher

Date

Signature

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Principal Investigator:**  
Names/addresses

**Trainee Investigator:**

**Second Supervisor:**

### Appendix 3: Study Questionnaires

#### 3.1. The Yale Food Addiction Scale (Gearhardt, Corbin, & Brownell, 2009).

This survey asks about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:

- Sweets like ice cream, chocolate, doughnuts, cookies, cake, candy, ice cream
- Starches like white bread, rolls, pasta, and rice
- Salty snacks like chips, pretzels, and crackers
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza, and French fries
- Sugary drinks like soda pop

When the following questions ask about "CERTAIN FOODS" please think of ANY food similar to those listed in the food group or ANY OTHER foods you have had a problem with in the past year IN THE PAST 12 MONTHS:	Never	Once a month	2-4 times a month	2-3 times a week	4 or more times a week
1. I find that when I start eating certain foods, I end up eating much more than planned	0	1	2	3	4
2. I find myself continuing to consume certain foods even though I am no longer hungry	0	1	2	3	4
3. I eat to the point where I feel physically ill	0	1	2	3	4
4. Not eating certain types of food or cutting down on certain types of food is something I worry about	0	1	2	3	4
5. I spend a lot of time feeling sluggish or fatigued from overeating	0	1	2	3	4

## Appendix 3.1 continued

6. I find myself constantly eating certain foods throughout the day	0	1	2	3	4
7. I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods even though I have other options available to me at home.	0	1	2	3	4
8. There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
9. There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
10. There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.	0	1	2	3	4

## Appendix 3.1 continued

	0	1	2	3	4
11. There have been times when I avoided professional or social situations because I was not able to consume certain foods there.					
	0	1	2	3	4
12. I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal symptoms caused by cutting down on caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)					
	0	1	2	3	4
13. I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing. (Please do NOT include consumption of caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)					
	0	1	2	3	4
14. I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.					
	0	1	2	3	4
15. My behavior with respect to food and eating causes significant distress.					
	0	1	2	3	4
16. I experience significant problems in my ability to function effectively (daily routine, job/school, social activities, family activities,					

## Appendix 3.1 continued

IN THE PAST 12 MONTHS:	NO
	0
17. My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.	0
18. My food consumption has caused significant physical problems or made a physical problem worse.	0
19. I kept consuming the same types of food or the same amount of food even though I was having emotional and/or physical problems.	0
20. Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions or increased pleasure.	0
21. I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.	0
22. I want to cut down or stop eating certain kinds of food.	0
23. I have tried to cut down or stop eating certain kinds of food.	0
24. I have been successful at cutting down or not eating these kinds of food	0

### Appendix 3.2. The Emotional Eating Scale (Arnow, Kenardy, & Agras, 1995)

We all respond to different emotions in different ways. Some types of feelings lead people to experience an urge to eat. Please indicate the extent to which the following feelings lead you to feel an urge to eat by ticking the appropriate box.

	No desire to eat	A small desire to eat	A moderate desire to eat	A strong urge to eat	An overwhelming urge to eat
Resentful					
Discouraged					
Shaky					
Worn out					
Inadequate					
Excited					
Rebellious					
Blue					
Jittery					
Sad					
Uneasy					
Irritated					
Jealous					
Worried					
Frustrated					
Lonely					
Furious					
On edge					
Confused					
Nervous					
Angry					
Guilty					
Bored					
Helpless					
Upset					

Appendix 3.3. The Adult Hope Scale (Snyder et al., 1991).

*Directions:* Read each item carefully. Using the scale shown below, please select the number that best describes YOU and put that number in the blank provided.

1. = Definitely False; 2. = Mostly False; 3. = Somewhat False; 4. = Slightly False;  
5. = Slightly True; 6. = Somewhat True; 7. = Mostly True; 8. = Definitely True

- \_\_\_ 1. I can think of many ways to get out of a jam.
- \_\_\_ 2. I energetically pursue my goals.
- \_\_\_ 3. I feel tired most of the time.
- \_\_\_ 4. There are lots of ways around any problem.
- \_\_\_ 5. I am easily downed in an argument.
- \_\_\_ 6. I can think of many ways to get the things in life that are important to me.
- \_\_\_ 7. I worry about my health.
- \_\_\_ 8. Even when others get discouraged, I know I can find a way to solve the problem.
- \_\_\_ 9. My past experiences have prepared me well for my future.
- \_\_\_ 10. I've been pretty successful in life.
- \_\_\_ 11. I usually find myself worrying about something.
- \_\_\_ 12. I meet the goals that I set for myself.

## Appendix 3.4. Self-Compassion Scale (Neff, 2003)

**HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES**

**Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale:**

**Almost Never      1      2      3      4      5      Almost Always**

1. I'm disapproving and judgmental about my own flaws and inadequacies.
2. When I'm feeling down I tend to obsess and fixate on everything that's wrong.
3. When things are going badly for me, I see the difficulties as part of life that everyone goes through.
4. When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world.
5. I try to be loving towards myself when I'm feeling emotional pain.
6. When I fail at something important to me I become consumed by feelings of inadequacy.
7. When I'm down and out, I remind myself that there are lots of other people in the world feeling like I am.
8. When times are really difficult, I tend to be tough on myself.
9. When something upsets me I try to keep my emotions in balance.
10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.
11. I'm intolerant and impatient towards those aspects of my personality I don't like.
12. When I'm going through a very hard time, I give myself the caring and tenderness I need.
13. When I'm feeling down, I tend to feel like most other people are probably happier than I am.
14. When something painful happens I try to take a balanced view of the situation.
15. I try to see my failings as part of the human condition.
16. When I see aspects of myself that I don't like, I get down on myself.

## Appendix 3.4 continued

17. When I fail at something important to me I try to keep things in perspective.
18. When I'm really struggling, I tend to feel like other people must be having an easier time of it.
19. I'm kind to myself when I'm experiencing suffering.
20. When something upsets me I get carried away with my feelings.
21. I can be a bit cold-hearted towards myself when I'm experiencing suffering.
22. When I'm feeling down I try to approach my feelings with curiosity and openness.
23. I'm tolerant of my own flaws and inadequacies.
24. When something painful happens I tend to blow the incident out of proportion.
25. When I fail at something that's important to me, I tend to feel alone in my failure.
26. I try to be understanding and patient towards those aspects of my personality I don't like.

## Appendix 3.5. Depression Anxiety and Stress Scale -21 (Henry &amp; Crawford, 2005)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

*The rating scale is as follows:*

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix 3.6. Satisfaction with Life Scale (Pavot & Diener, 1993).

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

\_\_\_\_\_ In most ways my life is close to my ideal.

\_\_\_\_\_ The conditions of my life are excellent.

\_\_\_\_\_ I am satisfied with my life.

\_\_\_\_\_ So far I have gotten the important things I want in life.

\_\_\_\_\_ If I could live my life over, I would change almost nothing.

**Appendix 4: Score Guides**

## Appendix 4.1. DASS – 21 Severity Ratings (Henry &amp; Crawford, 2005).

	Depression	Anxiety	Stress
Normal	0-4	0-3	0-7
Mild	5-6	4-5	8-9
Moderate	7-10	6-7	10-12
Severe	11-13	8-9	13-16
Extremely Severe	14+	10+	17+

Satisfaction with Life Scale Score Guide (Diener, 2006).

30 – 35 Very high score; highly satisfied

25- 29 High score

20 – 24 Average score

15 – 19 Slightly below average in life satisfaction

10 – 14 Dissatisfied

5 – 9 Extremely Dissatisfied

## Appendix 5: Ethical Approval



Health and Life Sciences Research Ethics Committee (Psychology, Health and Society)

21 February 2018

Dear Dr Lobley

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: 2803

Project Title: The role of positive psychological factors in food addiction and diabetes management.

Principal Investigator/Supervisor: Dr Katy Lobley

Co-Investigator(s): Dr Karen Poole, Dr Jen Unwin

Lead Student Investigator: Dr Karen Poole

Department: School of Psychology (including DClinPsych)

Approval Date: 21/02/2018

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 via the Research Integrity and Ethics Team ([ethics@liverpool.ac.uk](mailto:ethics@liverpool.ac.uk)) within 24 hours of their occurrence.

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 research, 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 using the research ethics system.

Appendix 5 continued

It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Health and Life Sciences Research Ethics Committee (Psychology, Health and Society)

iphsrec@liverpool.ac.uk

0151 795 5420

### **Appendix - Approved Documents**

(Relevant only to amendments involving changes to the study documentation)

The final document set reviewed and approved by the committee is listed below:

#### **Document Type File Name Date Version**

Questionnaire 8.3 response to reviewer

Questionnaire SWLS\_English 17/11/2017 1

Questionnaire dass-21 17/11/2017 1

Questionnaire hopescale 17/11/2017 1

Questionnaire Self\_Compassion\_Scale\_for\_researchers 17/11/2017 1

Questionnaire yale\_food\_addiction\_scale 17/11/2017 1

Questionnaire Emotional Eating Scale 17/11/2017 1

Participant Information Sheet PPI V1 21/11/2017 1

Participant Consent Form University consent form V1 KP 21/11/2017 1

Evidence Of Peer Review Poole Karen\_Formal Approval\_21.11.17 21/11/2017 1

Participant Information Sheet Debrief - master copy 09/02/2018 2

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## Appendix 6. Additional Results

Table 5. Direct effects for each independent model: YFAS to outcome variables and EES to outcome variables.

	Outcome variables	R <sup>2</sup>	Direct effects
YFAS	BMI	.02	.07
	ANX	.21**	.14**
	DEP	.24**	.46**
	STRESS	.23**	.49**
	SWL	.05	-.23**
EES	BMI	.00	.01
	ANX	.13**	.36**
	DEP	.15**	.39**
	STRESS	.14**	.37**
	SWL	.03	.16*

Table 6. Proximal predictors – main model

Proximal predictors	Outcome variables	Direct effects	
SCS	BMI	.07	
	ANX	-.33**	
	DEP	-.35**	
	STRESS	-.40**	
	SWL	.14 (.054)	
HOPE	BMI	-.06	
	ANX	-.16	
	DEP	-.31**	
	STRESS	-.16*	
	SWL	.47**	
YFAS	SCS	.28*	
	HOPE	-.27**	
EES	SCS	-.24**	
	HOPE	-.04	

Appendix 6 continued.

Table 7. Associations between predictor variables and outcome variables for zero-order correlations, direct only model, direct effects in the main model, SC model and Hope model.

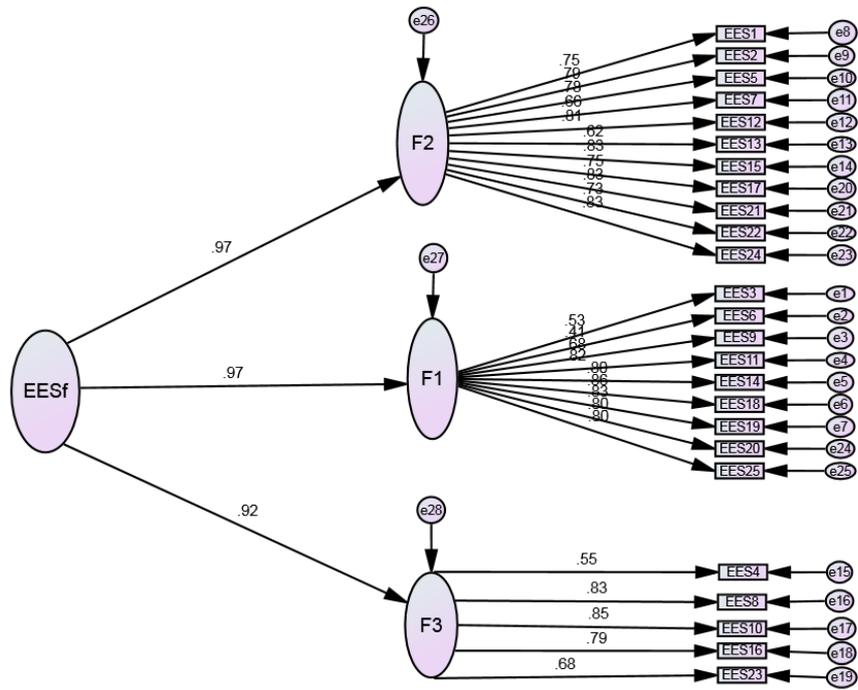
Predictor	Outcome	Rs	Direct Only	Direct Main	Direct SC	Direct Hope
YFAS	BMI	-.22*	.17*	.17	.18*	.16
	Anxiety	.49***	.38**	.24**	.26**	.28**
	Depression	.56***	.40**	.20**	.24**	.25**
	Stress	.51***	.39**	.23**	.25**	.29**
	SWL	.37**	-.19*(check)	-.025	-.07	-.04
EES	BMI		-.06	-.05	-.06	-.06
	Anxiety		.19*	.11	.09	.18**
	Depression		.20**	.10	.07	-.17**
	Stress		.19*	.09	.08	.18**
	SWL		-.07	-.02	-.03	-.05

Table 8. Indirect effects for each model

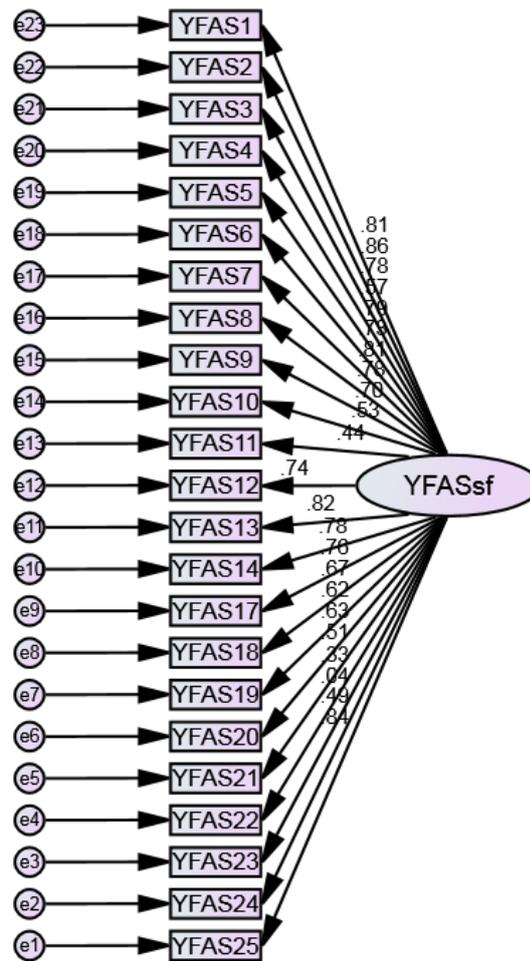
Predictor	Outcome	Indirect Main Model	Indirect SC	Indirect Hope
YFAS	BMI	-.003	-.01	.01
	Anxiety	.14**	.12*	.09**
	Depression	.18**	.15*	.14**
	Stress	.16**	.14*	.10**
	SWL	.17**	-.12*	-.15**
EES	BMI	-.01	-.01	.01
	Anxiety	.08**	.10**	.01
	Depression	.09*	.13**	.02
	Stress	.10**	.12**	.01
	SWL	-.05	-.10**	.02

**Appendix 7:** Factor Models illustrating factor loadings. Models used to compute factor scores.

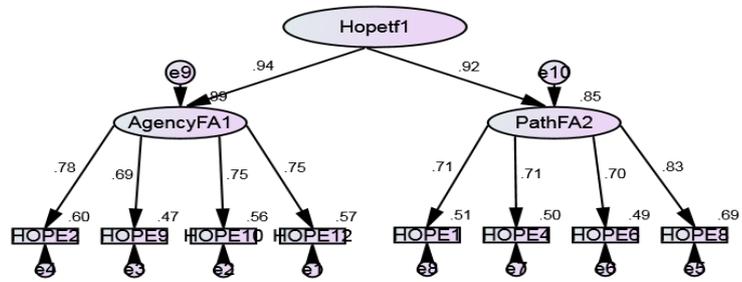
Appendix 7.1. Factor loadings for EES



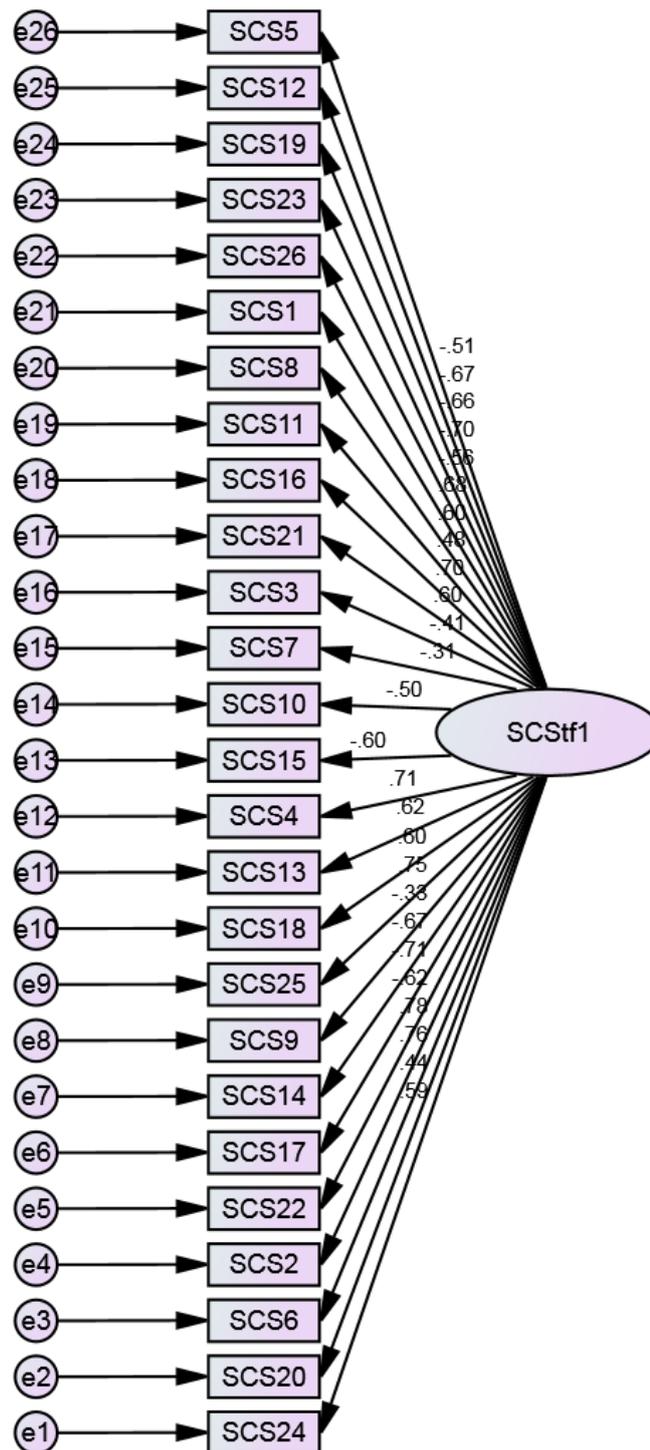
## Appendix 7.2. Factor loadings for YFAS



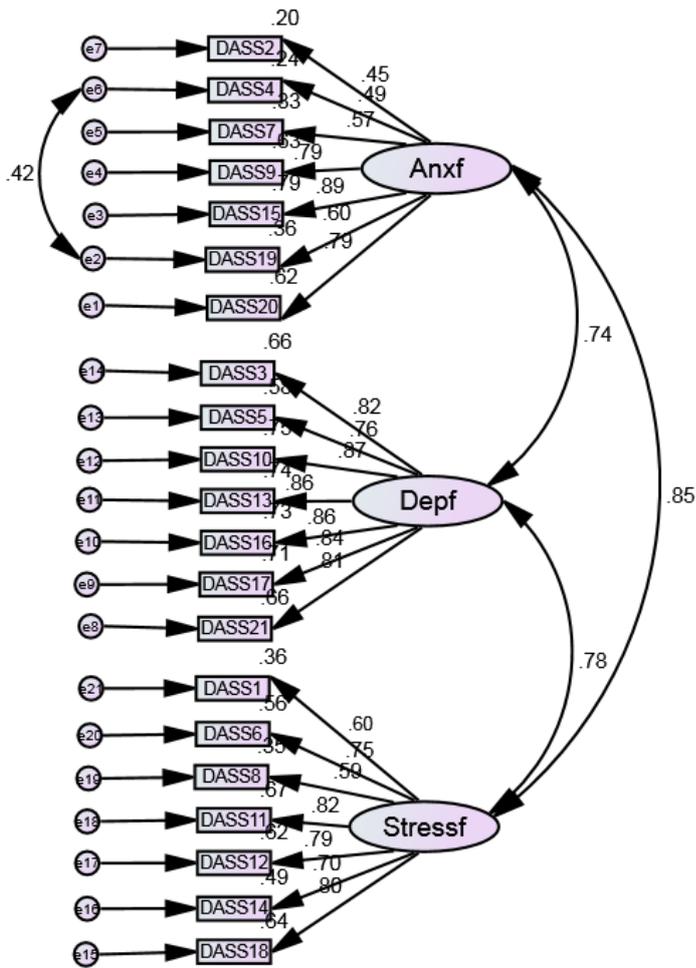
## Appendix 7.3. Factor loadings for Hope



## Appendix 7.4. Factor loadings for Self-compassion



Appendix 7.5. Factor loadings for DASS-21



## Appendix 7.6. Factor loadings for SWL

