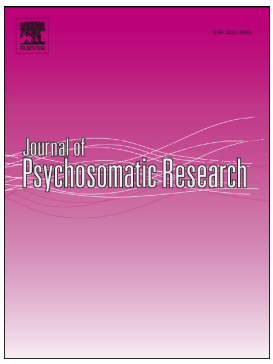

Self-compassion in weight management: A systematic review

Jennifer Brenton-Peters, Nathan Consedine, Anna Boggis, Kate Wallace-Boyd, Rajshri Roy, Anna Serlachius

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Self-compassion in weight management: A systematic review

Jennifer Brenton-Peters[1,*] jbre092@aucklanduni.ac.nz, Nathan Consedine[1] n.consedine@auckland.ac.nz, Anna Boggis[1] abog579@aucklanduni.ac.nz, Kate Wallace-Boyd[1], Rajshri Roy[2] r.roy@auckland.ac.nz, and Anna Serlachius[1] a.serlachius@auckland.ac.nz

[1]Department of Psychological Medicine, University of Auckland, Auckland, New Zealand

[2]Discipline of Nutrition and Dietetics, University of Auckland, New Zealand

[*]**Corresponding author at**: PhD Candidate, PDt, MA, Department of Psychological Medicine, 22-30 Park Avenue, Building 507, Faculty of Health and Medical Sciences, Grafton Campus, University of Auckland, Auckland, 1142, New Zealand.

Abstract

Objective

Self-compassion – the tendency or ability to treat oneself kindly in times of failure or distress – may be a natural fit to support individuals who struggle with weight management. However, while self-compassion shows promise with improving health behaviours, the associations self-compassion has on weight management outcomes are unclear. The objective of this systematic review was three-fold: (1) to evaluate whether self-compassion interventions can increase individual self-compassion in the context of weight management, (2) to investigate if self-compassion interventions can improve weight management outcomes, defined as healthier eating, increased physical activity, or reduced weight and finally, (3) to explore whether these benefits can be sustained over the longer term.

Methods

Following PRISMA guidelines, Scopus, PsycINFO, Medline, PubMed and Embase databases were searched. Studies including a measure of self-compassion and a self-compassion intervention reporting weight management outcomes were included. Studies in populations living with an eating disorder were excluded. The Quality Criteria Checklist from the American Dietetic Association was used to assess study quality. (Prospero Registration number #CRD42019146707).

Results

Of the 9082 records screened, a total of 20 studies met inclusion criteria. Seventeen studies reported significant increases in self-compassion post-intervention. Improvements were also found for eating behaviours (15 of 18), physical activity behaviours (6 of 9), and weight loss (6 of 11). The majority of improvements were maintained at follow-up, except for physical activity behaviours (1 of 7).

Conclusion

Self-compassion interventions tailored to weight management outcomes demonstrate efficacy with increasing self-compassion post-intervention. Methodological weaknesses and questions about the maintenance of any improvements in weight management outcomes limit our ability to make strong conclusions. However, there is promise and clear relevance for including self-compassion interventions to enhance weight management outcomes; directions for improved intervention and study design are given.

Keywords: *eating behaviour, physical activity, self-compassion, weight management*

Introduction

Individual weight management can be defined as intentionally engaging in behaviours (i.e., healthier eating, physical activity) with the goal of weight loss or weight maintenance [1, 2]. The number of individuals attempting to lose weight has increased in tandem with obesity's

prevalence [3]. Yet, despite current weight management efforts, the number of individuals living with obesity is still growing globally [4]. If this trend continues, it is predicted that almost 60% of the world's population will be living with excess weight or obesity by 2030 [5]. Excess body weight may impair physical health with increased risk for chronic diseases including diabetes [6], cardiovascular diseases [6, 7], and cancer [8] as well as impact an individual's mental health, shown through associations with lower quality of life [9, 10] and higher instances of depression [11]. Self-compassion interventions, designed to support individuals in cultivating a kind and accepting relationship with oneself in times of challenge [12, 13], are quickly emerging in a weight management context. Consequently, a systematic review that evaluates the impact of self-compassion on both behaviour (healthier eating and physical activity) and body weight outcomes is warranted.

Traditional weight management recommendations require individuals to initiate and maintain behavioural changes such as dietary restriction and increased physical activity [14]. However, successfully implementing such changes can be complicated by our genetics, biology, socioeconomic status, culture, and stress [15, 16]. In addition, making a healthy food choice is challenging due to interactions with health-disrupting environments, where high fat, high sugar, and ultra-processed foods are readily available and aggressively marketed [16, 17]. Even when individuals manage to lose weight, the amount of weight lost tends to be modest and lost weight is often regained [18, 19]. Therefore, it is not surprising that adherence to weight management interventions can be poor, especially long-term [19].

Weight management can be emotionally challenging. Attempting to lose weight in a health-disrupting environment can contribute to individuals feeling shame, blame [20, 21], vulnerability, distress [10, 22] and even reporting lower health-related quality of life [9]. Self-monitoring of behaviour can support weight management; however, when faced with negative feedback, such as weight gain, self-monitoring

can trigger judgemental and less self-compassionate feelings [21, 23]. Furthermore, individuals living with overweight and obesity report being affected by weight stigma, potentially reducing psychological wellbeing and health outcomes [24]. Weight stigma – a form of negative attitudes and beliefs about those with excess weight [25] –when internalised, can be counterproductive, resulting in individuals engaging in less healthy eating behaviours and increased emotional distress [24, 26]. Thus, interventions to help individuals cope with the emotional ups and downs associated with weight management are urgently required.

Recently, mindfulness has gained popularity in weight management interventions with encouraging results (see Carriere, Khoury [27], Dunn, Haubenreiser [28] for latest reviews). Mindfulness – the ability or tendency to deliberately regulate attention by observing thoughts, feelings, physical sensations and stimuli as they happen, without judgement [29, 30] – may support reduced impulsivity and psychological stress and thus moderate behaviour [31]. In parallel, interventions to enhance self-compassion, defined as treating oneself kindly or with care in times of distress or challenge, also show promise for supporting weight management outcomes [32]. Importantly, while self-compassion includes a component of mindfulness, it differs in that it focuses on providing individuals a way to cope with and relate to negative experiences in a soothing and caring manner [13, 33].

Fostering self-compassion may benefit individual weight management. Self-compassion has shown positive association with weight management self-efficacy and improved emotional response to diet relapses [34]. Furthermore, people with greater self-compassion tend to report reduced body shame [35-37] and lower weight self-stigma [38]. Given the stigma and psychological distress that may characterise weight

management efforts, self-compassion may help individuals overcome the challenges of weight loss efforts (e.g., perceived diet lapse) and cope with what may feel like insurmountable obstacles (i.e., health-disrupting environments).

While self-compassion interventions vary, several main self-compassion therapies have emerged with supporting RCT evidence [39]. For instance, Mindful Self-compassion (MSC) encourages embracing one's own suffering, with self-kindness, common humanity, and mindful awareness [33] and Compassion Focused Therapy (CFT) is thought to help people develop the capacity to tolerate emotions and build inner compassion [40]. Self-compassion interventions may be delivered formally (e.g., an 8-week MSC course or through structured practices such as love and kindness meditation or writing a letter to oneself from the perspective of a kind and compassionate friend) or informally (e.g., using self-compassionate affirmations such as *this is tough, everyone struggles sometimes, may I be kind to myself in this moment*) [41]. Formal and informal self-compassion practices can easily be added to complement broader behaviour change interventions. For example, 'third-wave' cognitive behavioural therapy interventions include practices and techniques such as mindfulness and self-acceptance to improve psychological functioning (e.g., Acceptance and Commitment Therapy [42]).

There is research linking self-compassion specifically to improved health behaviours (see Biber and Ellis [43], Sirois, Kitner [44] for recent reviews). More specific to the weight management literature, self-compassion has shown efficacy in treating those living with eating disorders [45, 46] and demonstrated promise for improving nutrition habits, body image and body weight [32]. Theoretically and practically, self-compassion offers a way to support those struggling with weight management overcome challenges, thus improving weight management outcomes and supporting maintenance over the longer term. However, the associations self-compassion has on individuals' weight management

outcomes, especially over the longer-term, remain unclear. A systematic review of the literature is required to clarify the potential efficacy of self-compassion to improve weight management outcomes to inform practice and direct future research endeavours.

Objectives

This systematic review builds on earlier work [32] that suggests incorporating self-compassion interventions may be beneficial for body image, body weight, and eating behaviour for those engaging in weight management. This review is novel as it provides an update for a rapidly growing area of research and expands the scope of weight management to include eating behaviour, physical activity, and body weight. Body weight is typically the most common outcome of weight management interventions. However, incorporating both behaviour (healthy eating and physical activity) or body weight as outcomes is critical. Weight management is multifactorial; significant weight loss may not occur [34]. However, engaging in healthier eating behaviours and increased physical activity can still improve health outcomes and may slow weight gain and support weight maintenance. Furthermore, physical activity has not been included in previous reviews on self-compassion and weight management outcomes [32]. Physical activity is frequently included in weight management guidelines as a complement to healthier eating to increase energy expenditure and support weight maintenance over the longer term [14, 47]. Thus, to comprehensively evaluate the ability of self-compassion to support weight management outcomes both over the short and long term, it was essential to include physical activity in the current review.

In line with this agenda, the objectives of this review were to evaluate the evidence assessing whether self-compassion interventions tailored to weight management can: 1) increase participant reported self-compassion, 2) improve weight management outcomes, defined as

healthier eating, increased physical activity, and reduced weight, and 3) consider the state of evidence regarding whether benefits can be sustained over the longer-term defined as at least 6-months [47]. The current review will finish with an overview of research gaps and recommendations for future studies.

Methods

Following the new 2020 PRISMA guidelines [48], a protocol for this systematic review was published in Prospero (#CRD42019146707). Our initial search was completed in August 2019 (J.B-P & AB), and it was updated in 2021, with the last search conducted in February 2021 (J.B-P & K.W-B). Self-compassion interventions were defined as interventions designed to support individuals in cultivating a kind and accepting relationship with oneself, especially in challenging times [13, 35]. Participant self-compassion was measured by using a self-compassion scale such as the Self-Compassion Scale [49] or a self-compassion subscale (e.g., Compassionate Engagement and Action Scale [50]). Weight management was operationalised by measuring outcomes, including eating and physical activity behaviours and weight (i.e., weight loss, BMI).

Eligibility criteria

We included studies that i) were published in English in peer-reviewed journals, ii) included a measure of participant reported self-compassion pre and post-intervention, iii) provided an outcome measure of weight management (eating behaviour or physical activity or weight/Body Mass Index), and vi) included a self-compassion-specific intervention (i.e., an intervention designed to increase participant self-compassion) or self-compassion as part of a broader intervention (i.e., self-compassion combined with other components such as mindfulness,

yoga, and/or healthy eating). All study designs testing a self-compassion intervention were included (e.g., experimental, non-controlled trials, randomised controlled trials). Articles were excluded if the above criteria were not met (e.g., weight management outcomes not reported) and no restrictions were placed on study settings (e.g., community, clinical, online). Study protocols, conference abstracts, reviews and commentaries were also excluded from this review. Lastly, this review also excluded studies that targeted self-compassion interventions in populations living with eating disorders (e.g., Binge Eating Disorder, Bulimia Nervosa, Anorexia Nervosa). This was due to the fact self-compassion has already shown effectiveness in supporting outcomes for those living with eating disorders. Although some level of disordered eating is common in people living with overweight and obesity, those diagnosed with clinical eating disorders may be more receptive to the effects of self-compassion interventions due to higher levels of shame and guilt [45, 46].

Search strategy

Studies were identified by searching PsycINFO, Scopus, Medline OVID, Embase and Pubmed. We used the search terms: self-compassion or selfcompassion and weight or weight-loss or obes* or overweight or eat* or behav* or diet or food or nutrition or exercise or activ*. Study eligibility was assessed independently by J.B-P and AB (2019) or J.B-P and K.W-B (2021) using the eligibility criteria and search terms. Relevant studies were exported to Endnote v.9, then to Rayyan, a web and mobile app for systematic reviews [51] and duplicates were removed. Study titles and abstracts were then reviewed, and the most relevant studies were selected for full-text review. Discussions between the reviewers and AS resolved disagreements with study selection. A secondary manual search of the reference lists of included articles was also performed to ensure no studies were missed.

Data extraction

Information was extracted from each of the selected studies based on i) study design (e.g., randomisation), ii) population (e.g., target population, intervention setting), iii) intervention components (e.g., self-compassion practices/activities), iv) self-compassion outcome (i.e., the effect of the intervention on participant self-compassion ratings), v) weight management outcomes (including eating behaviour, physical activity and body weight) and vi) follow-up (e.g., length of time post-intervention).

Risk of bias and quality assessment

Due to the focus on diet and nutrition for this review, the Quality Criteria Checklist from the American Dietetic Association [52] was used independently by two reviewers (J.B-P & AB in 2019, J.B-P & K. W B in 2021) to appraise included studies critically. This checklist allowed for the quality of studies to be grouped into three groups: positive (+), neutral (Ø) and negative (-). Discussions between the reviewers and AS resolved any disagreements. Studies were also ranked according to study design with guidelines used by The Academy of Nutrition and Dietetics (e.g., Randomised control trials were ranked as A, and non-controlled trials were ranked as D) [52]. The strength of the overall evidence in this review was evaluated based on criteria and definitions for grading the strength of evidence from The Academy of Nutrition and Dietetics [52].

Results

The search protocol yielded a total of 9082 records (last search, February 2nd, 2021). An initial screening of records titles and abstracts resulted in the removal of 1185 duplicates. In total, 7839 records were considered by reviewers as ineligible for review as they did not meet inclusion criteria. Our final review includes 18 records reporting on a total of 20 studies (see figure 1).

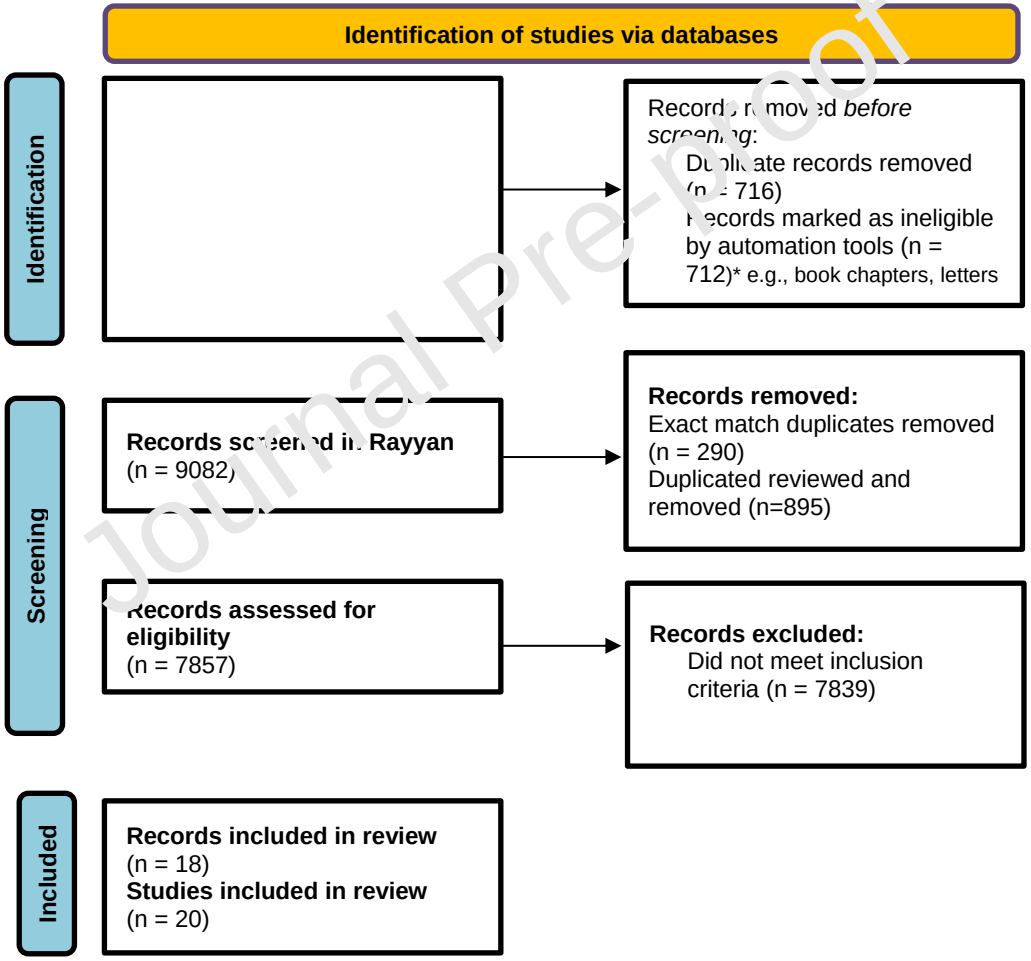

Figure 1. PRISMA flowchart of the literature search and article selection.

Study design and characteristics

The final sample of studies included eight studies that were deemed 'pilot' [53-59]. Ten studies were non-controlled trials [53-55, 58, 60-64], four were non-randomised controlled trials [63, 65-67], two studies were laboratory-based experimental studies [56, 68], and four were randomised controlled trials (RCT) [59, 65, 68-70]. Two studies did not include a control group that was not exposed to a self-compassion condition (e.g., mindful self-compassion diaries compared to loving kindness meditation) [56, 65]. See Table 1 for a list of control/comparator groups. The studies took place in a variety of settings including: the workplace [55], community [58, 67], primary care [62, 69], high school [59], 100% online [70], universities [54, 56, 65, 68], and immersive yoga retreats [53, 57, 60, 61, 63, 66]. Majority of the participants were female; seventeen studies had either 100% female participants [53, 62, 66, 68, 69] or over 50% female participants [54, 55, 57, 58, 60, 61, 63, 67, 70]. Furthermore, eleven studies reported predominantly Caucasian populations [53, 55-57, 59-61, 63, 66]. See Table 1 and Supplemental Table S1 for full study details.

Five studies utilised self-compassion-specific interventions tailored to weight management outcomes, including two laboratory-based experimental studies [53, 65] two RCTs [62, 67] and one non-randomised controlled study [62]. The remaining fifteen studies included self-compassion as part of broader weight management interventions, for example, including other elements such as yoga, Emotional Freedom Techniques, more in-depth mindfulness and/or nutrition and physical activity goal-setting and self-monitoring [50-52, 54-61, 63, 64, 66]. The

delivery of the self-compassion intervention components was diverse (e.g., online, immersive yoga-based retreats, self-compassion scripting, journaling and meditations). The main self-compassion intervention delivery and components are briefly detailed in Table 2.

A meta-analysis was not deemed appropriate for this review due to the high heterogeneity among studies. Specifically, variations in study design (e.g., non-controlled studies, laboratory-based experimental studies and RCTs), combined with additional differences in outcome reporting and timing of follow-up measurement as well as diversity in the delivery and dose (e.g., intervention length, self-compassion practices used) of interventions created major interpretative issues.

Participant self-compassion post-intervention and at follow-up

Seventeen of the twenty studies, including four RCTs [56, 62, 66, 67], reported significant improvements in participant self-compassion post-intervention with varying effect sizes (see Table 1). Larger effect sizes were found in the yoga-based interventions (Cohen's *d* =0.08-1.2 [53, 60]) and a workplace-based intervention (Cohen's *d*= 0.58 [55]). Smaller effect sizes were reported in a laboratory- based study (sR^2= 0.10) and a study facilitated 100% online during the COVID-19 lockdown (n^2=0.089) [68, 70]. Notably, five of the seven randomised and non-randomised controlled studies demonstrated significant increases in participant self-compassion with small to medium effects compared to a control group [65, 67-70]. See Table 1. Of the three studies reporting non-significant self-compassion post-intervention, one showed a non-significant increase (n=5) [54], and two yoga-based studies demonstrated significant increases in self-compassion at follow-up (3-months [53], 2-months [57]). Increases in participant self-compassion were maintained or increased in all thirteen studies reporting a follow-up measure on participant self-compassion, see Table 1.

Weight management outcomes

In total, there were eighteen studies that reported on participant eating behaviours [53, 55-63, 66-70], nine studies reported on physical activity [54, 55, 57, 60, 61, 63, 66, 69], and eleven studies reported body weight as an outcome [53, 55, 58, 60, 62, 65, 67, 69, 70]. There were thirteen different self-reported eating behaviour measures (e.g., mindful eating, emotional eating, healthier eating) and five different self-reported measures of physical activity (e.g., exercise levels, lifestyle questionnaires). Weight was most often collected by researchers or health professionals [55, 58, 62, 65, 67, 69], one study asked participants to send a photo of the number on the scale [70], and three studies relied on participant self-reported weight [53, 60]. See Table 1 and supplemental Table S1 for a list of all measures and reported effect sizes of weight management outcomes.

Self-Compassion and Eating Behaviour

Fifteen studies, including four RCTs [59, 68-70], reported an improvement in at least one targeted eating behaviour, such as increased mindful eating, less emotional eating and/or increased vegetable or fruit intake [53, 55, 57, 59, 60, 62, 63, 68, 69]. The effect sizes were demonstrated in three studies reporting on mindful eating behaviours, with effect sizes ranging from Cohen's *d*= 1.0 -1.5 [53, 55]. One study suggested a non-significant decrease in eating disturbance (n=5, *d*= 1.2) [54]. Improvements persisted in eight of the eleven studies reporting a follow-up (e.g., 2-months, 3-months) [53, 57, 59-63, 67]. See Table 1 and Table S1 for eating behaviour outcomes.

Self-Compassion and Physical Activity

Six of the nine studies, including one RCT [69], that evaluated self-compassion interventions on physical activity suggest greater physical activity engagement (e.g., physical activity frequency, mindful exercise) [54, 55, 57, 60, 61, 63, 66, 69]. Three studies reported large effects on increased physical activity frequency (Cohen's *d* = 0.84 [60]; 1.11 [69]) and mindful exercise (Cohen's d= 1.04 [55]). Seven studies reported a follow-up on physical activity outcomes; however, only one found that physical activity was still significant at the 2-month follow-up [63]. See Table 1 and Table S1 for physical activity outcomes.

Self-Compassion and Weight

In total, eleven studies measured weight/Body Mass Index (BMI) as an outcome, including three RCTs [53, 55, 58, 60, 62, 65, 67, 69, 70]; however, these results were mixed. Six studies reported significantly improved weight outcomes [60, 62, 65, 69, 70], including three RCTs [62, 65, 70]. However, the effect on body weight was relatively small. Only one yoga-based immersive study reported a large effect on body weight (Cohen's *d* =0.99 [60]). The remaining studies reported negligible [67, 69, 70], small [62] or medium effects [65] on body weight. Two non-controlled studies demonstrated improvements in body weight reporting losses of 4% and 1.7% total body weight post-intervention and a further reduction at the 3-month follow-up to 5.8% and 4.3% total body weight [53]. Three of the four studies reporting follow-up at 3-months demonstrated that weight loss was maintained [53, 60, 62]. See Table 1 and Table S1.

Longer-Term Maintenance of weight management outcomes

Improvements in eating behaviour persisted in all studies reporting follow-up at 6-months [64], including one RCT [59]. Only one study, a non-randomised controlled trial, reported a follow-up on eating behaviour at 12-months, with a reduction in eating guilt persisting [67]. No

studies reported a follow-up on physical activity behaviour at 6- or 12-months. One study found weight loss was negligible at 6 and12-months in both the control and intervention groups [67]. At 12-months, Braun and colleagues [60] found self-reported weight loss was significant compared to baseline. It is important to note attrition was high in most studies with follow-ups, which is discussed further in the quality assessment of the studies below. See Table 1 and Table S1 for additional details on weight management outcomes.

Quality Assessment

The full study quality assessment is included in supplementary Tables S2. Five of the included studies were given grade A study design (i.e., RCTs including a randomised laboratory-based study), four studies grade C (i.e., non-randomised controlled studies), and the remaining studies grade D (i.e., non-controlled studies). In terms of the Quality Criteria Checklist and risk of bias, all studies were found to be neutral in study quality and nine studies had a potential conflict of interest. See supplementary Table S2. Overall, the strength of the evidence for eating behaviours and weight/BMI outcomes was Grade II: Fair. However, the strength of the evidence for physical activity is Grade III: Weak/Limited. See supplementary Table S3.

Ensuring treatment fidelity remains an area of concern for research in this area. The fact that self-compassion typically increases following "self-compassion" interventions is useful, but only provides indirect evidence. More promisingly, most studies included manualised interventions [53-55, 57, 59-66, 69, 71] and mentioned facilitator training [53-55, 57, 59-64, 66, 69, 71]. A variety of methods were used to measure the fidelity of intervention delivery including: a facilitator intervention checklist [59], an end-of-day online survey on self-compassion, mood and eating behaviour [70], daily tracking of goals online [58], qualitative interviews [54, 58], number of videos played, visits to website

[71], impact questionnaire to assess continued use of skills and practice [57, 61, 63, 64, 66]. However, consistent methods to check interventions against theory was lacking.

It is important to note sample sizes varied and were relatively small overall (mean *n*=107, 5-974, *SD*=208). Attrition was also high (over 18% [72]). Studies included in this review reported mean attrition rate of 19% post-intervention (3%-47%, *SD*=12.44) and a mean attrition rate of 42% at follow-up (15%-64%, *SD*=15.56). One study used incentives to promote attendance, with a $100 deposit, with 50% returned for attending at least five meetings and 100% returned for attending at least eight sessions [56]. No significant differences between completers and non-completers were reported in most studies. Except Mantzios and colleagues [49], who found that more females dropped out of their self-compassion-specific intervention and Trent and colleagues [63], who found non-completers reported higher stress and negative affect than those who completed the study.

Discussion

This review systematically assessed whether self-compassion interventions tailored to weight management effectively increase participant self-compassion and improve weight management outcomes. The evidence presented in this review is broadly consistent with prior conclusions that interventions including some aspect of self-compassion can increase participant self-compassion and may have beneficial effects on body weight and eating behaviours [32]. Uniquely, this review incorporates analyses of the full scope of weight management outcomes (eating behaviours, physical activity and body weight) and maintenance of these outcomes with limited but promising results.

Self-compassion interventions delivered in a weight management context demonstrate efficacy with increasing participant self-compassion with potentially large effects. However, this review highlights the diversity in the way self-compassion interventions are incorporated into weight management. The majority of the studies reviewed included self-compassion as part of a broader intervention, including many other components, such as goal setting, and yoga. Notably, more negligible effects on self-compassion were found in the limited studies delivered in the laboratory [68] or online [70]. Our review demonstrated that self-compassion components, as part of broader interventions, effectively increased participants' self-compassion post-intervention in most studies and these effects persisted at follow-up. The ability to have diversity in delivery is valuable, as it may be more practical for self-compassion to be included in broader interventions in clinical and community settings. Nevertheless, to make an appropriate evaluation on the independent effect of self-compassion on weight management outcomes, more research utilising manualised self-compassion-specific interventions is required.

The most consistent evidence suggests that self-compassion intervention components may support improvement in individuals' eating behaviours. For example, a large effect was seen for more mindful eating [53, 55, 60] . The link between greater self-compassion and improvements in peoples' eating behaviours is consistent with previous work. For instance, self-compassion is associated with intentions for people to engage in health-promoting behaviour [44, 73] and more mindful eating behaviour [74]. However, mixed results were found regarding *healthier* eating (e.g., more fruits and vegetables) [55, 56, 63]. Nonetheless, regardless of specific food intake, healthier eating behaviours such as reduced emotional eating and more mindful eating are associated with improved weight and health outcomes [27, 31]. Thus, this is a meaningful finding in the context of weight management.

Self-compassion may be more supportive of improved eating behaviours in specific populations. For example, as illustrated in people living with disordered eating [45, 46] and individuals who were restrictive in their eating behaviour [68]. 'Restrictive eating,' defined as engaging in cognitive restraint to limit food intake, may also include people who are living with chronic conditions in which adherence to a specific or restrictive diet is a key component of their self-care regimen (e.g., individuals living with diabetes). The current review found only two studies that examined clinical populations, and none specifically tested self-compassion interventions in populations living with a chronic disease that requires adherence to strict dietary guidelines, such as diabetes. Cross-sectional data suggest positive associations between higher trait self-compassion and health behaviours in patient cohorts, including those living with celiac disease [75] and with diabetes [73, 76], as well as an association with physiological outcomes (e.g., an MSC intervention improved HbA1c in patients with diabetes [77]). Future studies in the area of self-compassion in weight management could consider populations living with chronic diseases where diet and physical activity are an essential aspect of self-care.

The possible link between self-compassion interventions and physical activity as a weight management outcome is currently weak due to limited intervention studies and lack of follow-up. However, a recent review found the relationship between self-compassion and physical activity was significant [78]. Furthermore, the few available studies presented in this review also suggest benefits in physical activity levels. Physical activity may increase individuals self-compassion, a link that has been seen in adolescents [79], although this has yet to be directly tested. Physical activity such as yoga, a component in many of the included studies, is linked to positive mental health outcomes [80]. Therefore, it is difficult to separate if the increase in physical activity is directly connected to self-compassion. Despite this scattered evidence, because

physical activity can increase individual energy expenditure and support weight maintenance, it is a key part of improving and maintaining weight management outcomes. Further work is warranted to investigate self-compassion and physical activity in the context of individual weight management.

The evidence presented in this review suggests that including self-compassion intervention components may improve individual weight outcomes (albeit with varying effect sizes). The effect on weight loss was negligible or small in the majority of studies. However, even modest weight loss can improve health outcomes [14]. Over half of the studies did report statistically significant improvements in BMI [60, 62] including two RCT studies [69, 70]. However, the RCT studies lacked robust control conditions, with one study utilising a waitlist [70] and the other treatment as usual [69]. One non-randomised controlled study utilised a behavioural weight management intervention as a control with negligible change in weight outcomes in both groups [71]. This finding supports the theoretical need for increased self-compassion as a way for individuals to cope with the potential disappointment of slower or smaller weight loss and sustain motivation to continue with weight management behaviours. Therefore, more research is needed to determine if self-compassion interventions offers an improvement in weight management outcomes over and above current behavioural weight management interventions.

Finally, more work is needed to determine if self-compassion interventions can improve weight maintenance. However, the limited results presented in this review are encouraging. One study reported individual weight maintenance at the 12-month mark [60]. This is consistent with another study that was not included in the official review (due to lack of self-compassion measure) that also found a self-compassion intervention supported improved weight outcomes at the 12-month follow-up and had less weight regain than a mindfulness intervention [81].

Another study also reported individuals achieved clinically significant (>5% TBW) weight loss at the 3-month follow-up [53]. These results, while limited, are important as the maintenance of individual weight management is multifactorial and thus immensely challenging. In order to support the health and wellbeing of those struggling with weight management, interventions need to support weight loss *and* be sustainable over the longer term.

Limitations

As with any systematic review, it is possible that some studies may have been missed. A methodological framework [82] was used in an attempt to control for this. However, it is acknowledged that studies may inadvertently include the principles of self-compassion (i.e., self-kindness, inner compassion and/or self-acceptance) without officially labeling it as a self-compassion component/intervention and therefore, it may not have been included in this review (e.g., ACT interventions). In addition, the search terms in this review were limited to self-compassion, general eating behaviour (e.g., diet), general physical activity (e.g., not sport-related activity) and body weight.

Limitations were also evident in the diversity of measurement of weight management outcomes. Although the measure of self-compassion was consistent in most studies (SCS [83] or SCS-SF [84]), the measures of weight management outcomes were varied, with different outcomes (i.e., mindful eating, emotional eating, healthy eating) and different scales/measures (i.e., MEQ, Lifestyle Questionnaires) being employed. Most outcomes were self-reported (except for weight obtained by researchers/health professionals), resulting in possible under- or over-reporting. Although from well-validated scales (e.g., the MEQ), most of the studies relied on self-reports of participants' perceptions of their behaviour (e.g., more mindful eating). In addition, few studies reported on diet quality. Therefore, there is limited evidence presented in this

review on if self-compassion interventions support *healthier* food choices rather than reducing food intake. Furthermore, not all studies included in our review tested interventions with populations living with overweight or obesity [56, 68], and six studies did not report the BMI of their population [57, 59, 61, 63, 66]. Attrition rates (defined as participants who dropped out or did not complete follow-up) are typically high for weight management programs ranging from 10 to 80% [85], and the studies included in this review were no exception (19%).

More broadly, the lack of diversity in both gender and ethnic background also limits the generalizability of the findings. Most studies included in the review were conducted among female populations, clearly limiting the generalizability of findings to female populations. A predominantly female population base appears to be a systematic issue with weight management and mindfulness research [86, 87]. Although it is acknowledged that men may have different eating behaviours and attitudes towards eating behaviour, men also struggle to lose weight [88]. This review includes two studies with a sample population of 49% or more males with encouraging results [65]. BMI and health-related quality of life have shown differences by both gender and ethnicity [89]. Furthermore, perceptions of body weight and weight management can vary by ethnicity [90, 91]. Future self-compassion-based studies in this area should aim to recruit more from male and more diverse ethnic populations to assess possible differences in responsiveness empirically.

Lastly, perhaps because self-compassion in weight management is an emerging area, this review included a large number of pilot studies and non-controlled studies, with considerable variation in intervention delivery. Thus, this review was limited by the diversity of study designs, the small number of controlled trials, and major differences in intervention delivery.

Directions for future research

The literature in the area of self-compassion in weight management is rapidly expanding, from six studies reported in a review in 2018 to 20 studies in the current review over the span of three years [32]. However, despite this growth, the quality of the included studies remains limited. The following five recommendations are suggested to improve the quality of the literature to allow stronger conclusions to be made on the potential efficacy of self-compassion for improving weight management outcomes.

1) Test self-compassion-specific interventions on weight management outcomes (i.e., eating and physical activity behaviour and body weight). Testing manualised self-compassion practices in isolation from other components will allow for more direct examinations of the specific contribution this therapeutic component may have.

2) Improve study quality with rigorous design. More research is needed to contrast self-compassion interventions with robust, meaningful control conditions, for example testing for improvements beyond standard behavioural weight management interventions. More frequent use of validated and objective outcome measures is warranted, as are more systematic reporting of retention and intention to treat analyses, and assessments of interventional fidelity.

3) Report both statistically and clinically significant outcomes. While weight tends to be the most common outcome of weight management interventions, weight loss is typically modest, even with evidence-based programs. Furthermore, assessing both weight and behavioural change can index clinically significant outcomes, such as improved chronic disease management, even if weight loss itself is nonsignificant.

4) Evaluate self-compassion interventions in more diverse populations. Studies on self-compassion and weight management to date have been conducted in largely similar populations, limiting generalizability. More research on self-compassion and weight management in the areas where self-compassion may have a more significant health effect, for instance, in people living with diet-controlled chronic disease and ethnically diverse populations at a higher risk for weight-related health conditions.

5) Incorporate longer follow-up on weight management outcomes (e.g., 3, 6, 12-months+). Maintenance of weight loss (prevention of weight gain) is one of the core challenges of weight management. Self-compassion may offer a way to overcome obstacles and support weight maintenance. However, more evidence is needed to confirm how self-compassion may benefit weight management outcomes over time.

These suggestions for future research will allow for stronger claims about the effectiveness of self-compassion interventions for improving weight management outcomes. Moreover, these recommendations promote homogeneity of research design and intervention delivery to allow for future meta-analyses to be conducted.

Conclusion

A self-compassionate approach to weight management may offer a way to improve weight outcomes for those struggling to manage their weight; however due to variations in study design and diversity in intervention delivery, more rigorous research is needed to make stronger conclusions. To summarise, the evidence presented in this review suggests that including self-compassion as part of weight management interventions has the potential to increase participant self-compassion. Currently, the role of self-compassion as an independent therapeutic component on weight management outcomes remains unclear due to the limited research on self-compassion-specific interventions focused on

weight management outcomes. In addition, most studies thus far have only included short-term outcomes. Therefore, we recommend more rigorous research that utilises self-compassion-specific interventions and measures weight management outcomes to determine if self-compassion can effectively support those struggling with managing weight over the short and longer-term.

Supplementary data
Supplementary material 1
Supplementary material 2
Supplementary material 3

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Conflict of interest statement

No conflict of interest was declared.

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**Indicates inclusion in the systematic review*

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Table 1: ***Participant self-compassion at post intervention and follow-up with weight management outcomes***

Study	*Study Design*	*Population*	*Self-compassion Post-Intervention*	*Self-compassion Follow-up*	*Weight Management Outcome/s*
Adams and Leary [68]	Randomised Experiment **Group 1:** unhealthy preload (donut)/self-compassion condition. **Group 2:** preload/no self-compassion condition. **Group 3:** No preload, no self-compassion control condition	Undergraduate university students N=84 100% female, mean BMI 23.1 SD 3.84	↑* Self-compassionate reaction to diet breaking, sR^2=0.10	NR	**Eating behaviour:** ↓* Amount of chocolate eaten for those high in eating restraint (btw) sR^2=0.09
Braun, Park [60]	NCT	Individuals living with overweight/ Obesity, BMI ≥25, engaging in yoga-based integrative weight loss program (IWL) N=37 Middle aged, primarily females	↑***SCS, Cohen's *d* =- 0.80	**3-months:** ↑***SCS, Cohen's *d* =- 1.07	**Eating behaviour:** ↑** Healthier eating (healthy nutrition habits) Cohen's *d* =- 0.77, maintained at follow-up Cohen's *d* =- 0.92 **Physical activity:** ↑***Physical activity Cohen's *d* =- 0.84, negligible at follow-up Cohen's *d* =- 0.12 **Body weight:** ↓*** Cohen's *d* =0.99, self-reported 12-month follow-up
Braun, Park [53] (Study 1)	NCT	Yoga-experienced women living with overweight/Obesity, BMI ≥25, engaging in a yoga-based IWL program N= 22	↑ NS SCS, Cohen's *d*=-0.50	**3-months:** ↑**SCS, Cohen's *d* =- 1.1	**Eating behaviour:** ↑** Mindful eating Cohen's *d* =- 1.0, maintained at follow-up Cohen's *d* =- 1.8 **Body weight:**

		100% female Mean age 48.2 SD 14.3			4% TBWL 6.8% TBWL, self-reported 3-month follow-up
Braun, Park [53] (Study 2)	NCT	Yoga-naïve women living with overweight/ Obesity, BMI >25, engaging in a yoga-based IWL program N= 21 100% female Mean age 49.4 SD 10.7 years	↑**SCS, Cohen's *d* =- 1.2	**3-months:** ↑**SCS, Cohen's *d* =- 1.0	**Eating behaviour:** ↑** Mindful eating Cohen's *d* =- 1.5, maintained at follow-up Cohen's *d* =- 1.4 **Body weight:** 1.7% TBWL 4.3% TBWL, self-reported at 3-month follow-up
Carter, Gilbert [54]	NCT	Individuals with bigger bodies and high levels of body shame, BMI >30 N=5 80% female Mean age 30.6 SD 6.43 years	↑ NS CEAS- SC *d*= -0.76 (SC Engagement) *d*= -0.46 (SC Action)	**3 months:** NS *d*= -0.40 (SC Engagement) *d*= -0.32 (SC Action)	**Eating behaviour:** ↓ NS Eating disturbances *d* =1.20, NS follow-up *d*= 1.48 **Physical activity:** ↓ NS Physical activity *d* =0.11 follow-up *d*= 0.45
Duarte, Gilbert [67]	NRCT **Group 1**: Compassion-Focused Therapy (CFT)+ commercial weight management program **Group 2:** Parallel group, Commercial weight management program (active control)	Individuals participating in a commercial weight management program N=974 Intervention: 95.6% female, mean age 46.8 SD 12.80, mean BMI 32 SD 6.9 Control: 94.5% female, mean age 47.5 SD 12.8, mean BMI 31 SD 6.4	↑** CEAS- SC subscale, Cohen's *d* =0.37 (btw)	**3-months:** ↑** CEAS- SC subscale, Cohen's *d* = 0.37 (btw) **6-months:** ↑*CEAS- SC subscale, Cohen's *d* = -0.35 (btw) **12-months:** ↑** CEAS- SC subscale, Cohen's *d* = 0.39 (btw)	**Eating behaviour:** NS restrictive eating Cohen's *d* =0.13 ↓** Eating guilt Cohen's *d* = 0.52 (btw), maintained at follow-up 6-months Cohen's *d* = 0.38, 12-months Cohen's *d* = 0.40 (btw) **Body weight:** ↓ NS Body weight Cohen's *d* = 0.04, NS follow-up 6-months Cohen's *d* = -0.05, NS 12-months Cohen's *d* = 0.02 (btw)
Dyer, Borden [61]	NCT	Education professionals, engaging in a yoga-based program N=133 78.8% female	↑***SCS-SF	**2-months:** ↑***SCS-SF	**Eating behaviour:** ↑* Vegetable intake, NS Fruit intake, did not persist at follow-up **Physical activity:** ↑* Physical activity, did not persist at

		Mean age 46.8 years			follow-up
Dyer, Borden [66]	NRCT **Waitlist control**	Education professionals engaging in a yoga-based program N=36 100% female Mean age 47.5 years	↑**SCS-SF (btw)	**2- months:** ↑**SCS-SF (btw)	**Eating behaviour:** NS fruit and vegetable intake, NS at follow-up **Physical activity:** NS physical activity, NS at follow-up
Horan and Taylor [55]	NCT	Workplace (university faculty), individuals living with overweight or obesity N= 24 79% female Mean age 51.8 SD 12.2, mean BMI 26.05 SD 8.24	↑***SCS-SF, Cohen's *d* = 0.99	NR	**Eating behaviour:** ↑** Mindful eating Cohen's *d* = 1.04, ↓* dietary fat intake Cohen's *d* = 0.39 **Physical activity:** NS physical activity level, ↑*** Mindful exercise Cohen's *d* = 1.04 **Body weight:** ↓ NS Body weight
Hussain, Egan [56]	Randomised Experiment **Group 1**: Self-kindness to the mind **Group 2:** Self-kindness to the mind and body	University students N= 90 Mean age, 24.54, Mean BMI 24.32 SD 9.13	↑***State SC, n^2_p= 0.61 (NS btw)	NR	**Eating behaviour:** NS unhealthy food (M&Ms) (NS btw n^2_p= 0.01) NS interaction between the conditions and usual fruit and vegetable intake n^2_p= 0.001 ↑* healthy food intake (grapes) for those classified as low consumers of fruit and vegetables *d*= 0.77 in the self-kindness to the mind compared to the self-kindness to the mind and body
Mantzios and Wilson [65] (Study 2)	RCT **Group 1:** Concrete ('how' they are	University students trying to lose weight, mean BMI 25.55 SD 4.78 N= 136	↑*SCS, n^2_p= 0.07 (↑***SCS n^2_p= 0.48 btw)	NR	**Body weight:** ↓*** (btw) η^2=0.51

	eating – self-compassion) **Group 2:** Abstract ('why' they are eating)	41.6% female Mean Age 21.1 SD 3.64,			
Mantzios and Wilson [65] (Study 3)	**NRCT** **Group 1:** Concrete construal diaries (self-compassion) **Group 2:** Love and kindness meditation (self-compassion)	University students trying to lose weight, mean BMI, 25.79 SD 3.97 N=122 41.8% female Mean age 23.30 SD 5.53,	↑***SCS (NS btw)	NR	**Body weight:** ↓***Body weight (NS btw) Group 1 lost more weight than group 2 at 3-month follow-up (regained less weight)
Palmeira, Cunha [62]	NCT	Individuals living with overweight/ obesity, primary care patients, BMI ≥25 N=60 100% female Mean age 42.55 SD 9.05, Mean BMI 34.09 SD 5.30	↑**SCS, n^2_p = 0.12	**3-months:** Increase in Self-compassion maintained	**Eating behaviour:** ↓*** Emotional eating η_p^2= 0.37, maintained at 3-month follow-up **Body weight:** ↓***Body weight η_p^2= 0.18, maintained at follow-up
Palmeira, Pinto-Gouveia [69]	RCT **Group 1:** Kg-Free, self-compassion component, **Group 2:** Treatment as usual (regular medical and nutritional appointments)	Individuals living with overweight/ obesity, primary care patients, BMI ≥ 25 N=73 100% female Intervention: Mean age 41.97 SD 8.79, BMI 34.82 SD 5.26 Treatment as usual: Mean age 42.73 SD 8.36, mean BMI 33.65 SD 4.83	↑**SCS, Cohen's *d* = 0.81 (NS btw Cohen's *d*= 0.38)	NR	**Eating behaviour:** ↓** Emotional eating Cohen's *d* = 0.67 (↓** btw Cohen's *d* = 0.44) **Physical activity:** ↑***Physical exercise Cohen's d= 1.33, (↑***btw Cohen's *d* = 1.11) **Body weight:** ↓*Body weight Cohen's *d*= 0.12 (↓*btw body weight Cohen's *d*= 0.09)
Rahimi-Ardabili, Vartanian [58]	NCT	University convenience sample open to changing eating habits or losing weight N=15 100% female	↑**SCS, Cohen's *d* = 0.61	NR	**Eating behaviour:** ↓* Energy intake, Cohen's *d* = -0.55 **Body weight:** ↓ NS BMI, Cohen's *d* = -0.03

		Mean age 37.9 years, mean BMI 30.58 SD 3.44			
Schnepper, Reichenberger [70]	RCT **Waitlist control**	Individuals seeking to lose weight or develop healthier eating during lockdown due to COVID-19 pandemic N=65 Intervention: 89.3% female, mean age 27.0 SD 7.52, BMI 22.1 SD 2.97 Waitlist: 79.3% female, mean age 31.0 SD 14.0, mean BMI 23.9 SD 4.44	↑**SCS (↑**SCS, n^2=0.089, btw)	NR	**Eating behaviour:** ↓* Emotional eating (↓* Emotional eating, n^2=0.069 btw) **Body weight:** ↓*BMI (n^2=0.089 btw)
Stapleton, Chatwin [59]	RCT **Waitlist control**	Adolescents wishing to eat healthy, increase physical activity, and improve resilience N= 26 50% female Participants aged 14-15 years	↑** SCS-SF, n^2 = 0.378 (NS btw)	**10-weeks:** Increase maintained (NS btw)	**Eating behaviour:** ↑*** Healthy drink consumption η_p^2= 0.37 (btw), ↑** η^2=0.67 btw maintained at follow-up ↓***unhealthy drink consumption η_p^2= 0.28 btw, ↓* η_p^2=0.41 btw, maintained at follow-up NS ↑ healthy food consumption η_p^2=0.06 btw ↓***unhealthy food consumption η_p^2= 0.28 btw, not maintained at follow-up η_p^2=0.05
Trent, Borden [63]	NRCT **Waitlist control**	Professionals engaging in a yoga-based program N= 121 75.6% female Mean age 41.4	↑**SCS-SF (NS btw)	**2-months:** ↑**SCS-SF, (*btw, r^2=0.19)	**Eating behaviour:** ↑** fruit & ↑* vegetable intake (NS btw), maintained at 2-month follow-up (*btw) **Physical activity:** ↑*** physical activity, ↑** commitment to activity, ↑**attending yoga classes, maintained at follow-up
Trent, Miraglia [57]	NCT	Professionals (Frontline) engaging in yoga-based program	NS ↑ SCS-SF	**2-months:** ↑*SCS-SF	**Eating behaviour:** ↑*** fruit & ↑*** vegetable intake,

		N=64 81.8% female Mean age 42.7			maintained at 2-month follow-up **Physical activity:** ↑***duration of exercise(min/day), not maintained at follow-up
Trent, Borden [63]	NCT	Professionals (Education), engaging in a yoga-based program N=57 95.5% female Mean age 50.5 years	↑***SCS-SF	**2-months:** ↑***SCS-SF	**Eating behaviour:** NS fruit & NS vegetable intake, no change at 2-month follow-up **Physical activity:** NS duration of exercise(min/day), no change at follow-up

Note: Within group effects unless specified. Btw (Between-groups); RCT (randomised controlled trial); NCT (non-controlled trial); NRCT (non-randomised controlled trial); SD (Standard Deviation);*p≤0.05; **p≤0.01; ***p≤0.001; NS (not significant); NR (not reported), btw (between-groups); SCS (Self-compassion scale); SCS-SF (SCS-short form); CEAC (Compassion Engagement and Action Scale); TBWL (Total Body Weight Loss); Effect sizes provided as reported when data available; sR^2 (squared semi-partial correlation coefficient); n^2 (eta squared); n^2_p (partial eta squared); Cohen's *d* (standardised mean difference); *d* (change score effect size); r^2 (coefficient of determination).

Table 2: ***Self-compassion intervention delivery and self-compassion specific components***

Study	**Self-compassion Intervention Delivery**	**Main self-compassion intervention component/s**
Adams and Leary [68]	Experimental, brief script	*'I hope you won't be hard on yourself. Everyone eats unhealthy sometimes...I don't think there is any reason to feel really bad about it.' (*pg.1129)
Braun, Park [60]	Daily for 5-days	*Kripalu yoga-based weight loss program:* Sessions on body image and self-compassion, self-compassion woven into yoga classes (body acceptance)
Braun, Park [53] **(Study 1 & 2)**	10-bi-weekly workshops	*Yogic weight loss with Ayurveda-inspired components:* Sessions on self-compassion, meditations, letter writing, self-compassion as a buffer to self-judgement, self-compassion woven into yoga classes

Study	Self-compassion Intervention Delivery	Main self-compassion intervention component/s
Carter, Gilbert [54]	Twice a week for a 6-week period	*Compassion focused therapy (CFT):* Sessions focused on cultivating compassionate motivations to reduce shame, self-criticism and improve wellbeing
Dyer, Borden [61] & **Dyer, Borden [66]**	Daily for 3-days (immersion)	*RISE:* Modules on compassionate self-awareness, breathing exercises, meditations, self-compassion woven into yoga classes
Horan and Taylor [55]	10-weekly sessions	*Workplace health behaviour change intervention:* Sessions on self-compassion. and health, self-compassion and food choice self-compassion and body image, self-compassion and physical exercise
Hussain, Egan [56]	Experimental, mindful construal diaries	*Mindful construal diaries (MCD):* MCD focused on kindness to one's mind and thoughts '*How do you feel and what passes through your mind now that you are eating this snack?*' or kindness to one's mind and body '*how are you taking care of your emotions and your physiological health now that you are eating this snack*?' (pg. 2)
Mantzios and Wilson [65] **(Study 2)**	Written instructions and 5-weeks of keeping construal diaries	Participants were provided with a pocket-sized diary and asked to spend a few moments observing emotions and thoughts prior to and during meals about 'how' they eat using concrete priming questions such as '*how does your food smell*?', '*How important is it for me and all people to eat healthily*'? and '*How kind are you to yourself now that you eat this meal*?' (pg. 430)
Mantzios and Wilson [65] **(Study 3)**	Meditation group: 3-days of sessions, asked to practice for 5-weeks 3x per day Construal group: Written instructions and 5-weeks of	Meditation group received introductory sessions to mindfulness meditation and loving and kindness meditation Construal group the same as above

Study	Self-compassion Intervention Delivery	Main self-compassion intervention component/s
	keeping construal diaries	
Palmeira, Cunha [62] & **Palmeira, Pinto-Gouveia [69]**	10-weekly sessions	*KgFree:* Self-compassion psychoeducation on eating and emotions, mindful awareness, acceptance and diffusion skills, self-compassion as an antidote for shame and self-criticism, meditations and practices using mindfulness (acceptance-, mindfulness- and compassion-based-intervention)
Rahimi-Ardabili, Vartanian [58]	4-weeks, 1st session in person the remaining information was provided weekly via email with online goal tracking.	*Self-compassion intervention based on Mindful Self-Compassion (MSC):* Informal and formal activities tailored to eating behaviour and dietary change such as meditations and compassionate phrases (e.g., to overcome emotional eating or diet relapse) to support self-selected goals delivered via email
Schnepper, Reichenberger [70]	2-week smartphone app intervention	*Self-compassion intervention based on MSC:* Three different meditations and eight different journaling exercises adapted to improve one's eating behaviour (e.g., being more mindful, less critical)
Stapleton, Chatwin [59]	6-weekly sessions	*Emotional Freedom Techniques:* Self-compassion for body image, resilience and emotional discomfort
Trent, Miraglia [57], Trent, Borden [63] & Trent, Borden [63]	Daily for 5 days (immersion)	*RISE:* Modules on compassionate self-awareness, breathing exercises, meditations, self-compassion woven into yoga classes

Highlights:

- Self-compassion (SC) is a way to cope with the challenges of weight management (WM)
- SC interventions can increase participant SC and may support WM outcomes
- Due to variation in study and intervention design, more rigorous research is needed

- Directions for future research that will allow for stronger claims are provided