Clinical Recommendations

by

Group 3

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The research question for this project,“is intuitive eating considered an evidence-based eating behavior to recommend for achieving weight loss?” and this was chosen after careful research and using keyword filters to be able to find research articles that have studies in this topic. The keywords that were searched are “intuitive eating weight loss, intuitive eating, weight loss, corporate wellness programs intuitive eating and effects of intuitive eating” to be able to find studies to answer the research question. Since we are trying to see the link between intuitive eating and weight loss it is important to focus on all groups. One study conducted on adults 14 and over of both male and female who had BMI between 22 and 38 was included to see the impact intuitive eating can have on all groups. Another study that focuses on ‘Health, not weight loss, focused’ programs on improved health and wellbeing was used rather than the conventional weight loss programs that focus on weight loss. In conventional weight loss programs, the focus is to alter eating behavior to limit the intake of certain food. By focusing on improvement and wellbeing without focusing on weight loss, intuitive eating can be implemented. This study used clinical trial registers and commercial references to conduct randomized controlled trials of adults to be able to compare conventional weight loss programs to ‘Health, not weight loss, focused’ programs. Both studies that focus on adults were used as an inclusion criteria. Any teens younger than 14 of age was used as the exclusion criteria because they are at the developmental stages. We used the UH library database, Google Scholar, and Pubmed.

The Khasteganan et al. (2019) study had a target audience that consisted of mostly women, it compared the influence of health focused programs and conventional weight loss programs on CVD risk factors by conducting a systematic review and meta-analysis. In the study by Keirns and Hawkins (2019), their target audience were adults with obesity, community members and college students of all weight ranges. Their main focus was on observing the relationship between intuitive eating and physical health indicators using the Intuitive Eating Scale - 2. The primary weakness of the Khasteganan et al. (2019) study was selection bias; of the 846 participants studied, only 47 of them were men. Thus creating an environment in which the results derived were women based, weakening the internal validity of the study, and limiting the population to which these results can be applied to. In terms of strengths, the Khasteganan et al. (2019) study effectively showed that weight, body image, and behavioral eating parameters only have a small correlation within the HNWL programs. Proving that there is not enough research to label them as long term evidenced based behaviors to achieve weight loss. In the Keirns and Hawkins (2019) study, the use of hierarchical linear regression limits the external validity of the study. HLR was set up using limited variables, such as IES - 2 scores, health indicators, and BMI. This can affect the study because it is not accounting for all variables that can be affected by intuitive eating. The use of IES - 2 in the Keirns and Hawkins (2019) study also limited the internal validity of the study by presenting reporting bias. IES - 2 is a self reporting instrument and in some cases the participants might not cooperate with truthfully reporting eating behaviors. Strengths within this study are the regression coefficient effectively demonstrating that there was not enough of a significant relationship between intuitive eating, SBP and DBP. The independent variables in this case hold little to no effect.

Across all 10 of the articles we reviewed, multiple were randomized control trials, but there were observational cross-sectional analysis studies, self-administered research questionnaires, qualitative descriptive studies, and linear mixed-effects models were also represented. Most of the articles focused on the women and the female population, but the others recruited obese adults, populations from America, populations outside of America, and bariatric surgery patients. Some of the studies looked at BMI, some of the studies tested blood pressure, hip circumference, stress level, lipid panels, blood glucose, and weight. One randomized controlled trial specifically assessed the measurements of obese adults using calorie restriction and intutive eating to achieve weight loss. Intuitive eating was looked at to achieve weight loss in the majority of the studies; however, the majority of the peer reviewed articles that were researched found that there is not enough scientific evidence to prove that intuitive eating leads to weight loss. Major findings included that intuitive eating positively correlates with long term health benefits such as understanding of what one consumes diet-wise, but no studies showed that intuitive eating is a practice that when implemented directly correlates and results in weight loss. The ultimate purpose of the Khasteganan et al. (2019) study was to compare the influence of health focused programs and conventional weight loss programs on CVD risk factors. In the study by Keirns et al (2019), the main focus was on observing the relationship between intuitive eating and physical health indicators. Both articles came to the conclusion that intuitive eating is still an area of study that needs to be more thoroughly researched.

Research shows that intuitive eating showcased no differences in the fasting glucose levels and systolic blood pressure. In one of the research articles, it tested health, not weight loss versus conventional weight loss. HNWL focuses on health and does not revolve around weight loss; on the other hand, conventional weight loss focuses on weight loss while overlooking the health aspect. The HNWL method focused on encouraging individuals to follow a very healthy and balanced lifestyle instead of promoting weight loss. After extensive research, we recommend that the workplace employees take the HNWL route since there is not enough research about intuitive eating leading to weight loss. Based on the Evidence Analysis Table provided to us, there are five elements to consider when determining the strength of evidence elements. The first element is quality, which for our recommendation, is good since there isn't any bias and it is supported by strong scientific research. The next element is consistency, this part would be graded as "fair", which is supported by evidence from most of the articles obtained since they have extensive proof that intuitive eating is not the best clinical recommendation for our case. Some articles showcased less proof to support our recommendation. For quantity, all of our articles have a decent amount of subjects and studies made upon them and therefore, I would give this section a "good". For the clinical impact, all the articles had important outcomes that supported our clinical recommendation; so, we would grade this part as "good". When considering generalizability, most of the articles researched were limited to mostly women instead of having a broader population of interest; consequently, this element would get a fair grading.

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Appendix

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Khasteganan et al. Systematic Reviews (2019) 8:200
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Systematic Reviews

RESEARCH Open Access

Health, not weight loss, focused programmes versus conventional weight loss programmes for cardiovascular risk factors: a systematic review and meta-analysis

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Abstract

Background: Obesity is a cardiovascular disease risk factor. Conventional weight loss (CWL) programmes focus on weight loss, however 'health, not weight loss, focused' (HNWL) programmes concentrate on improved health and well-being, irrespective of weight loss. What are the differences in CVD risk outcomes between these programmes?

Aim: To conduct a systematic review and meta-analysis to compare the effects of HNWL with CWL programmes on cardiovascular disease risk factors.

Methods: We searched CENTRAL, MEDLINE, EMBASE, PsycINFO, CINAHL, ASSIA, clinical trial registers, commercial websites and reference lists for randomised controlled trials comparing the two programmes (initially searched up to August 2015 and searched updated to 5 April 2019). We used the Mantel-Haneszel fixed-effect model to pool results. Sub-group and sensitivity analyses that accounted for variations in length of follow-up, enhanced programmes and risk of bias dealt with heterogeneity.

Results: Eight randomised controlled trials of 20,242 potential studies were included. Improvements in total cholesterol-HDL ratio (mean difference − 0.21 mmol/L, 95% confidence interval [− 3.91, 3.50]) and weight loss (− 0.28 kg [− 2.00, 1.44]) favoured HNWL compared to CWL programmes in the long term (53–104 week follow-up), whereas improvements in systolic (− 1.14 mmHg, [− 5.84, 3.56]) and diastolic (− 0.15 mmHg, [− 3.64, 3.34]) blood pressure favoured CWL programmes. These differences did not reach statistical significance. Statistically significant improvements in body satisfaction (− 4.30 [− 8.32, − 0.28]) and restrained eating behaviour (− 4.30 [− 6.77, − 1.83]) favoured HNWL over CWL programmes.

Conclusions: We found no long-term significant differences in improved CVD risk factors; however, body satisfaction and restrained eating behaviour improved more with HNWL compared to CWL programmes. Yet firm conclusions cannot be drawn from small studies with high losses to follow-up and data sometimes arising from a single small study.

Systematic review registration: PROSPERO CRD42015019505

Keywords: Obesity, Weight loss, Systematic review, Meta-analysis, Non-diet, Intuitive eating, Cardiovascular disease, Well-being, Disordered eating behaviour

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Background

Cardiovascular disease (CVD) is the leading cause of death across the globe [1]. In more than 90% of cases worldwide, the risk of a first myocardial infarction is related to nine independent, potentially modifiable, risk factors: an abnormal blood lipid profile, smoking, hypertension, diabetes mellitus, abdominal obesity, diet, alcohol, physical activity and psychosocial factors such as depression [2].

The effect of modifying these risk factors is clearer for some behaviours than for others. For example, there is substantial evidence that smoking cessation [3] treatment to reduce blood pressure; treatment to reduce blood lipids and adequately control diabetes [4]; adopting a Mediterranean diet [5, 6]; and increasing levels of physical fitness [7] reduce cardiovascular mortality. A body mass index (BMI) above 25 kg/m^2 is associated with a 23% increased risk of developing CVD [1]; however, limited success at achieving long-term weight loss, together with repeated attempts to lose weight followed by weight gain, limit the potential benefits of weight loss. It has been suggested that such weight cycling is physically harmful but the evidence surrounding this is conflicting [8–11].

The National Institute for Health and Clinical Excellence recommend that interventions for obese individuals comprise components that address diet and physical activity and incorporate behavioural change techniques. It recommends that individuals reach and maintain a realistic target weight loss of 5–10% of their original weight through a weekly weight loss of 0.5 kg to 1 kg [12]. Although many overweight people are able to lose weight in this way, several meta-analyses of randomised controlled trials (RCTs) show a large proportion of these people are unable to maintain this weight loss [13–15] and may regain more weight than they lose [16].

Lack of a sustained change in weight and, hence, a lack of a reduction in long-term chronic disease risk may be due to an emphasis on food restriction, leading to hunger and feelings of deprivation or preoccupation with food [17–19], which may in turn trigger overconsumption. This overconsumption may lead to weight gain accompanied by feelings of low self-esteem, depression and guilt, which trigger further overconsumption. Further attempts are made to restrict eating and a cycle of dieting and bingeing, weight loss and weight gain are perpetuated, with little long-term gain in CVD risk reduction [20–23].

Interventions have been developed to focus on the health gains of dietary change, physical activity and psychosocial well-being in those who are overweight or obese, rather than on weight loss. RCTs have shown that these 'health, not weight loss, focused' (HNWL) programmes may have a greater effect on reducing cardiovascular risk factors, such as improving blood lipid profile and blood pressure and reducing depression, compared with conventional weight loss (CWL) programmes [24, 25]. Two narrative review papers have been published on these RCTs [26, 27], one systematic review containing results from trials with various study designs [28] and one systematic review of RCTs and quasi-controlled trials [29]. These have reported favourable outcomes of HNWL programmes; however, they lack quantifiable pooled estimates of HNWL approaches in comparison to CWL programmes at specific times of follow-up. To date, no meta-analysis has been conducted on RCTs specifically comparing HNWL-focused programmes with CWL programmes on long-term outcomes and, as such, no clinical recommendation for or against the effectiveness of HNWL compared to conventional care can be made. This meta-analysis of RCTs provides quantifiable pooled estimates of HNWL approaches in comparison to CWL programmes on cardiovascular risk outcomes to inform clinical practice and future research.

Aim

To conduct a systematic review and meta-analysis to compare the effects of HNWL programmes with those of CWL programmes on CVD risk factors in adults with a BMI greater than 25 kg/m^2.

Methods

Study inclusion criteria

Only RCTs or cluster RCTs which compared HNWL programmes with CWL programmes in overweight or obese adults were included.

HNWL programmes were defined as any programme promoting an increase in physical activity and healthy eating without a primary focus on weight loss. The focus was instead to improve physical and mental health through addressing a variety of aspects including lifestyle, emotional, social and spiritual factors. CWL programmes were defined as any diet, exercise or behavioural programme, or a combination of these, focusing primarily on achieving a weight loss target of between 0.5 kg/week and 1 kg/week, with regular weight monitoring and a conscious effort to reduce dietary energy intake.

Outcome measures

Outcome measures were based on six of the nine main risk factors for myocardial infarction described previously [2]. Trials included at least one of these outcome measures to be eligible. The six risk factors chosen were those most typically measured as part of weight management interventions and excluded the assessment of changes in the prevalence of smoking and diabetes. Alcohol intake was not assessed as no studies reported on this. Included studies had a minimum follow-up period of two months after the end of treatment.

Primary outcomes

These were the following physiological markers of cardiovascular risk: blood lipids; blood pressure and body weight. In trials using more than one measure for any outcome, the measure with the strictest criteria was preferred (e.g. measured over self-reported weight).

Secondary outcomes

These were those risk factors that mediated the primary outcomes, but that were also known independent cardiovascular risk factors. They included diet, physical activity, and psychosocial well-being, each of which was measured in a variety of ways. Measures of the same dimension were pooled together and included only those studies that measured these outcomes with validated tools.

Search methods for identification of studies

The following databases were searched: Cochrane Central Register of Controlled Trials 1960 to 3 March 2019, ASSIA (Proquest, 1987 to 5 April 2019), MEDLINE (Ovid, 1946 to 3 August 2015; ebsco, 3 August 2015 to 5 April 2019), PsycINFO (Ovid, 1967 to Aug 2015; ebsco, Aug 2015 to 5 April 2019), CINAHL (Ovid, 1981 to Aug 2015; ebsco, Aug 2015 to 5 April 2019) and EMBASE (Ovid, 1974 to Aug 2015)

The search strategies included MeSH terms and keywords combined with 'OR' to for each PICO category of population, intervention, comparator and outcome; the categories were combined with AND. The first search strategy was developed for Medline in Ovid and adapted for use with the other databases using their unique subject heading indexes. Terms or limiters were applied for study type depending on functionality of each database (see Additional file 1 for full search strategies for each database).

Any relevant ongoing or unpublished trials were identified through searching trial registers: ClinicalTrials.gov (https://www.clinicaltrials.gov/); WHO International Clinical Trials Registry Platform Search Portal (http://apps.who.int/trialsearch/); National Institute for Health Research search portal (https://discover.dc.nihr.ac.uk/portal/home) and National Research Register Archive (portal.nihr.ac.uk/Pages/NRRArchive.aspx), accessed via (https://bepartofresearch.nihr.ac.uk/); UK Clinical Trials Gateway - Current Controlled Trials (http://www.isrctn.com/) and University Hospital Medical Information Network Clinical Trials Registry (www.umin.ac.jp/ctr/);

The reference list of included studies, background articles and the narrative review articles described above were hand searched to identify any additional relevant studies.

Commercial and non-profit organisation websites were also searched for additional relevant information: HAES UK (http://www.healthateverysize.org.uk/), Association for Size Diversity and Health (https://www.sizediversityandhealth.org/), National Association to Advance Fat Acceptance (NAAFA) (http://www.naafaonline.com/dev2/) and the resource list for the HAES curriculum (http://haescurriculum.files.wordpress.com/2013/07/haes-curriculum-resource-list.pdf). The authors of relevant papers where trials were ongoing or data were missing were contacted.

Selection of studies

NK and DL checked the titles and abstracts of studies generated by the search. Full-text copies of papers reporting selected trials were obtained. NK and DL independently reviewed the trials, either accepting or rejecting them in accordance with the eligibility criteria. Any disagreement regarding study inclusion was resolved through discussion with a third author (GF). Where a number of reports of the same study were come across, the reports were allocated to a single study ID and the data was used only once.

Data extraction and management

For each trial, NK extracted the data and one other author checked data extraction. A data collection form was used to record details of the study methods, participant characteristics and outcomes.

Assessment of risk of bias in included studies

Risk of bias was assessed using the guidelines from the Cochrane Handbook for Systematic Reviews of Interventions [30]. Random sequence generation, allocation concealment and incomplete outcome data were graded as having a high, low or unclear risk of bias by NK, and this grading was checked by one other author for each study. The 'risk of bias' judgements were summarised across different studies for use in sensitivity analysis.

Measures of treatment effect

Many of the outcomes (e.g. blood lipids, blood pressure, weight) were continuous data and analysed as mean differences with 95% confidence intervals, in order to compare the change in outcome between the intervention and control arms. Data presented as a scale was entered with a consistent direction of effect. Some of the outcomes used ordinal scales (e.g. measures of psychosocial well-being, levels of physical activity). Where possible (i.e. with scales of five or more ordinal categories), these were treated as continuous data. If there was variation in the scales used to measure the same outcome, these outcomes were analysed using standardised mean differences and 95% confidence intervals (e.g. for body dissatisfaction and self-esteem).

Where a study did not report standard deviation (SD), it was calculated from the standard error of the mean (SEM) information provided in the studies. SD can be obtained from the SEM by multiplying by the square root of the sample size: $SD = SEM \times \sqrt{n}$. The SEMs were also used to calculate the SD for mean differences using formulas.

Dealing with missing data

Investigators or study sponsors were contacted to verify key study characteristics and obtain missing numerical outcome data where possible. Where this was not possible and the missing data were thought to introduce serious bias, the impact of including such studies on interpretation of the results using sensitivity analyses was explored.

Assessment of heterogeneity

Inconsistencies across study results were identified and analysed using forest plots. The overlapping confidence intervals were observed and the I^2 statistic was used to measure heterogeneity among trials in each analysis. Significant heterogeneity was defined as a P value of less than 0.05 for the Chi^2 statistic (Q). Heterogeneity was described as a percentage using the I^2 statistic ($I^2 = [(Q - \text{degrees of freedom})/Q] \times 100\%$). Where there was significant heterogeneity, the pooled estimate for this analysis was provided and heterogeneity was investigated as described below. If I^2 remained over 75%, use of a random-effects model was planned but this was unnecessary as sub-analysis dealt with heterogeneity adequately.

Subgroup analysis

The Mantel-Haneszel fixed-effect model was used for pooling results; where significant heterogeneity was found, sub-group analysis was carried out. Subgroup analyses were used to take into account different lengths of follow-up and enhanced programmes. Enhanced interventions potentially included additional elements that might influence any findings (e.g. one HNWL programme promoted calorie restriction for the first 2 weeks).

Sensitivity analysis

Sensitivity analyses were conducted on studies with a high risk of bias due to greater attrition rates and omission of information relating to intention to treat (ITT) analysis. These allowed us to identify and review the influence of the studies with a high risk of bias.

Assessment of reporting biases

Assessment of the risk of selective outcome reporting was planned across the studies using a funnel plot, if sufficient studies were available. However, with fewer than 10 articles in the review, Sterne et al. [31] advise that a funnel plot for an asymmetry analysis should not be used. This is because the outcomes are usually too low to distinguish chance from genuine asymmetry.

Results

Search results

In total, 20,242 potentially relevant studies were identified from searches of bibliographic databases. A further eight studies were found from websites relating to the HNWL programme. Another 31 studies were selected from the reference lists of studies that we had already identified as relevant. Of the total 20,242 studies, 3,026 studies were duplicated and removed.

Of the total 17,216 remaining studies, 17,106 studies were considered irrelevant and excluded by title and abstract. Our screening resulted in 110 papers with a Cohen's kappa of 0.74. Two authors independently assessed the 110 studies according to the eligibility criteria. Ninety-eight articles were excluded at this stage. In 10 articles, the intervention did not have a control group and in 15 the control was not CWL. In 49 articles, the intervention did not follow the HNWL philosophy because it promoted an energy-restricted diet. Twelve studies were excluded because there was no randomisation reported; nine studies were excluded because participants with a BMI under 25 kg/m^2 were not excluded, two studies excluded because they were protocols in their recruitment phases and one study was excluded because the duration was less than 2 months. Finally, nine articles were excluded because they were duplicates. Our full-text review resulted in 12 articles identified with a kappa of 0.87. We addressed any disagreements directly through discussion involving the two raters and settled these by collaborative review.

Of these twelve articles, some articles reported on the same studies (Table 1). Therefore, eight distinct studies were included in the final review (Fig. 1).

Characteristics of included studies

Participants, sample sizes and settings

Participant numbers in the eight studies ranged from 24 [39] to 219 [36]. A total of 846 participants were included in our review, 799 women and 47 men. In seven of the eight studies, the participants were exclusively women [23, 25, 33, 38–40, 41] and the remaining study [32] recruited men and women. The high proportion of women-only studies may be because the HNWL ethos has been borne out of a feminist philosophy and targets women in particular [41]. The mean age of participants

Table 1 Characteristics of included studies

Included studies	Location	Age (years) Mean (SD)	BMI (kg/ m^2) Mean (SD)	Men (n)	Women (n)	Methods	Participants	Intervention	Attrition
Ash et al., 2006 [32]	Brisbane, Australia	48 (13)	34 (5.5)	47	129	Randomisation: number table. Allocation concealment unclear. Weekly follow- up for 8 weeks, monthly for 6 months, final 12 month follow-up.	Inclusions: BMI > 27 Exclusions: Co-morbidities, non-English speakers, Cognitively impaired.	HNWL (Fat Booters Incorporated (FBI)): $n = 57$ CWL (individualised Dietetic Treatment (IDT)) : $n = 65$ Control group (Information Booklet only (BO): $n = 54$ Delivered by dietitians and nutrition experts	ITT analysis use of generalised estimating equations. Attrition(at 12 months): FBI: 54% CWL : 32% BO: 63%
Bacon et al., 2005 (Bacon et al., 2002)[25]	California, USA	40.7	36.3	0	78	Randomisation: stratified by BMI, eating behaviour and physical activity level. Allocation concealment not recorded. 12, 24, 42 and 104 weeks follow-up.	Inclusions: Dietary restraint>15 BMI > 30 Age 35-40 Exclusions: Co-morbidities Smokers Not Caucasian	HNWL (HAES): $n = 39$ Delivered by counsellors and those with doctorates CWL (LEARN): $n = 39$ Delivered by dietitians	No ITT analysis Attrition (at 24 months): HAES: 8% LEARN: 42%
Crerand et al., 2007 [33] (Wadden et al., 2004) [34]	Philadelphia, USA,	44.2	35.9	0	123	Randomisation and allocation concealment unclear. Weekly group session for 20 weeks, biweekly weeks 20-40. Week 65 follow-up	Inclusion: BMI 30-43 kg/m2 Exclusion: Co-morbidities lost > 5 kg or used weight loss medications in past 6 months	HNWL (non-dieting approach (ND)): $n = 39$ CWL (balanced-deficit diet (BDD)) : $n = 43$ MR (meal replacement plan): $n = 41$ Delivered by qualified clinical psychologist and registered dietitian	ITT analysis, last observation carried forward with assumed weight gain and sensitivity analysis Attrition (at week 65): ND: 74% BDD: 60% MR: 68%
(Keller, 1999) [35] Goodrick et al, 1998 [36]		40	33	0	219	Randomisation and allocation concealment unclear. 24 weeks of weekly treatment followed by 26 biweekly meetings for 12 months	Inclusion: Female Age 25–50 14 to 41kgs overweight Exclusions: Registered with a weight loss programme Co-morbidities Smoker	HNWL (Non-diet treatment (NDT)): $n = 78$ CWL (dieting treatment (DT)): $n = 79$ Waitlist control (WLC): $n = 62$ Delivered by instructors, a registered dietitian and a qualified psychotherapist specialised in eating disorders.	ITT analysis was carried out with baseline values carried forward and sensitivity analysis Attrition (at 18 months): NDT: 21% DT: 18% WLC: 6 % (6 months)
Mensinger et al., 2009 [37] (Mensinger, Calogero, and Tylka, 2016) [38]	Pennsylvania, USA	39.6	38	0	80	Computer generated randomisation. Allocation concealment using sealed opaque envelopes labelled with the sequential randomisation numbers. 6 and 24 month follow-up	Inclusion: Women aged 30–45 BMI 30–45 Physically inactive Pre-menopausal Exclusion: current smokers, did not speak fluent	HNWL (HUGS) $n = 40$ CWL (LEARN) $n = 40$ Delivered by trained group facilitator	ITT with SPSS MIXED and restricted maximum likelihood Attrition (24 months): (HUGS): 53% (LEARN): 48%

Table 1 Characteristics of included studies *(Continued)*

Included studies	Location	Age (years) Mean (SD)	BMI (kg/ m^2) Mean (SD)	Men (*n*)	Women (*n*)	Methods	Participants	Intervention	Attrition
							English Co-morbidities		
Rapoport, Clark and Wardle, 2000 [23]	London, UK	47.5	35.3	0	84	Randomisation and allocation concealment unclear. 10 sessions. 6 and 12 month follow-up.	Inclusion: age18–65 BMI > 28 approved by their GP for treatment Exclusion: involved with any other weight management programme Co-morbidities	HNWL (Modified cognitive-behavioural treatment) $n = 37$ CWL (cognitive behavioural treatment) $n = 38$ Delivered by Clinical psychologist, exercise specialist, dietitian, health psychologist trained in CBT methods.	No ITT analysis was reported Attrition (at 12 months f-up): Modified cognitive-behavioural treatment: 16% Cognitive behavioural treatment: 16%
Sbrocco et al., 1999 [39]	Maryland, USA	41.3	32.6	0	24	Randomisation and allocation concealment unclear. 13 weekly sessions post treatment 3, 6 and 12 months follow up	Inclusion: Healthy (GP verified) Exclusion: Lost >4.5 kg in previous month or > 9 kg previous 6 month Smoker	HNWL (behavioural choice treatment (BCT)): $n = 12$ CWL (Traditional Behaviour Treatment (TBT)) : $n = 12$ Delivered by : Clinical social worker/psychologist, or a psychology graduate	No ITT analysis Attrition(at 12 months f-up): BCT: 8% TBT: 0%
Tanco, Linden and Earle, 1999 [40]	Vancouver, Canada, British Columbia	Age > 19	39.6	0	62	Randomisation and allocation concealment unclear 12 weeks treatment with 6 months follow up	Inclusion: women > 19 BMI > 30 kg/ m^2 3 weight cycles over at least 10 years Exclusion: Co-morbidity which would disallow increased physical activity.	HNWL (Cognitive treatment (CT)): $n = 21$ CWL (Standard behavioural weight management program (BT)): $n = 21$ Wait-list control group: $n = 20$ Delivered by psychology graduates	No ITT analysis Attrition (at 6 month f-up): CT: 57% BT: 43% Wait-list control group: 60%

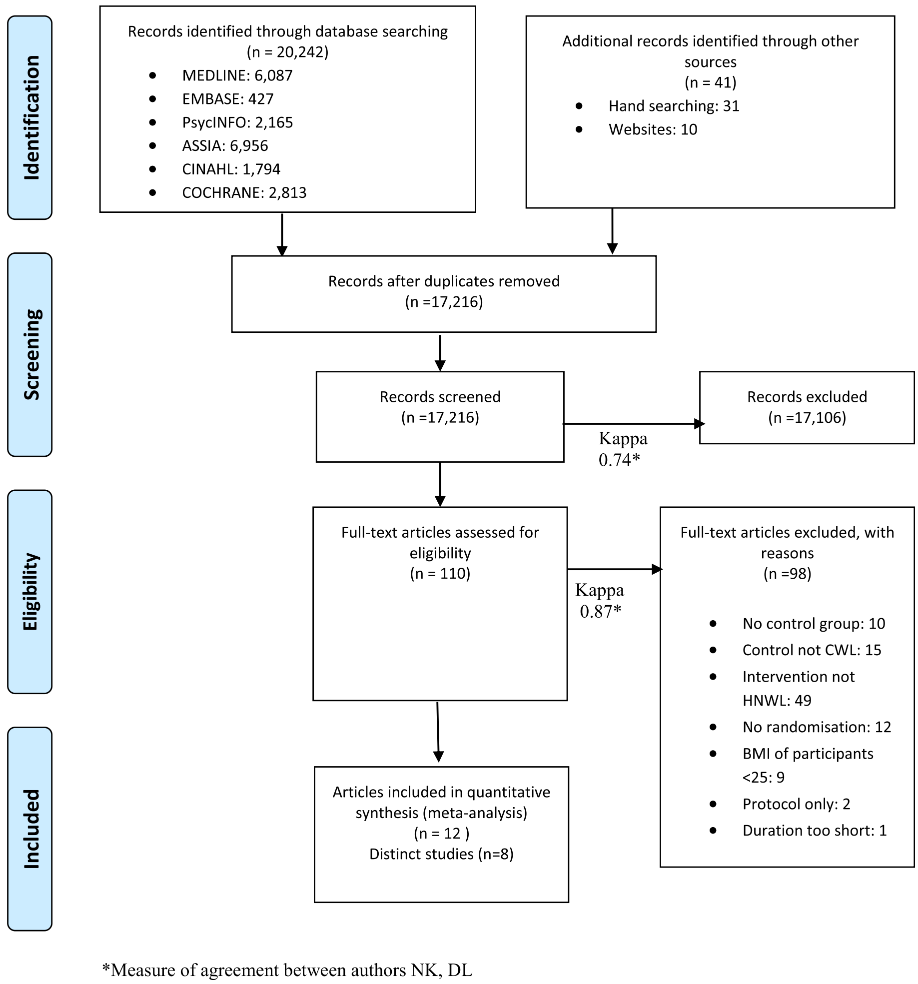


Fig. 1 PRISMA flowchart

across studies was 43 ± 8.92 years, although one study failed to provide age data [40]. The mean body mass index (BMI) across study participants was 35 ± 5.4 kg/m^2. Five of the studies were conducted in the USA [25, 33, 36, 37, 39], one in Australia [32], one in the UK [23] and one in Canada [40].

The trials were undertaken in a range of outpatient settings, including general practitioner's (GP) surgeries [23], a hospital [32], community centres and health centres [23]. The trials were advertised locally.

Interventions were delivered by qualified individuals including registered dietitians [23, 25, 32, 33, 36], trained facilitators [37], counsellors with doctorates in nutritional physiology [25], psychotherapists with a background in eating disorders [36], psychologists [23, 33, 39, 40], a clinical social worker [39]. These individuals were also responsible for gathering participant data, providing group support, dietetic assistance and follow-up sessions across the eight studies.

Interventions

Included studies focused on two comparison groups (HNWL and CWL). Four of the studies also incorporated a third group; two were waitlist controls [36, 40], one was a 'no intervention' control group [32] and one was a meal replacement group [33]. The characteristics of participants were checked across all groups to verify randomisation, but only extracted and used data from the HNWL and CWL programmes.

HNWL programmes Duration

The length of the sessions ranged from 1 [36] to 2 h [23, 40]. Weekly sessions continued for 8 weeks in some programmes [32] and up to 78 weeks in others. Follow up was 24 weeks in some studies [40] and as much as 104 weeks in others [25, 37]. We addressed the differences in outcomes this would have led to, by reporting the results as four phases of follow-up: the period between 8 and 12 weeks, from 20 to 26 weeks, from 40 to 52 weeks and the period between 65 and 104 weeks.

Aims

The primary aims of the intervention groups included improved health and well-being [25, 36, 37] and positive lifestyle change [32]. Participants in Rapoport, Clark and Wardle's [23] study had a primary aim of weight management, rather than weight loss, through permanent lifestyle change, no goals to restrict energy intake were set.

Approach to weight and eating

The dietary changes recommended in Rapoport, Clark and Wardle's [23] study were based on the Health Education Authority's (HEA) 'Balance of Good Health' plate model. Participants were not given precise goals relating to energy intake, and they were permitted to eat foods that they previously avoided in reasonable amounts.

Participants were advised to expect a slower reduction of weight over a longer timescale, than in the CWL programmes, in order to achieve a long-lasting result. In Crerand et al.'s [33] study, a group of registered dietitians gave six lectures on the subject of healthy eating whilst avoiding prescribed restrictions on energy intake. At week six, the participants in the study were encouraged to adopt a new eating plan without dieting. The plan included several instructions: participants would eat at least every 4 h in order to avoid physical hunger pangs, they would consume foods that they enjoyed without restrictions, they would select foods based on their nutritional value, and they would not monitor their weight throughout the process.

Participants were encouraged to respond to internal cues of physical hunger and satisfaction. They were taught principles of intuitive eating in order to reject the diet mentality, recognise their hunger and respect when they felt full [23, 25, 37, 39, 40]. All studies addressed issues of body acceptance, eating behaviour avoiding diet cycles, healthy eating, enjoyable physical activity, rejecting social pressure and accessing social support. In doing so, they aimed to improve self-awareness, self-confidence and self-esteem [25, 32, 36, 37, 39].

Participants were asked not to specifically reduce their calorie consumption or monitor their weight [25, 33, 39, 40].

Physical activity

All the HNWL groups were advised to undertake an enjoyable type of physical activity with no specific exercise regimen enforced. Exercise recommendations were generally less formal in the HNWL programme than the CWL programmes, although in some studies the programmes followed a similar pattern of exercise in both the HNWL and CWL groups [36, 39]. In Rapoport, Clark and Wardle [23], exercise routines were designed and tailored to the needs of study participants.

Behaviour change techniques

Ash et al.'s [32] study group focused on self-improvement, self-sufficiency and prevention of relapse through the application of cognitive therapy. It followed a patient-centred approach that promoted and included a booklet centred on cognitive behaviour therapy principles relating to nutrition. Bacon et al. [25] encouraged acceptance of body shape and focused on how to live a fulfilling life at any weight. Crerand et al. [33] educated participants on obesity, its causes and effects on self-esteem, body image and quality of life. Participants were given selections from *Self-Esteem Comes in All Sizes,* a book containing methods to increase self-esteem, body image and life satisfaction. The first stage of the intervention in Goodrick et al.'s [36] study entailed a psychotherapeutic treatment based on the modern ideal of female body shape. It focused on identifying problems with self-esteem and body image before promoting healthy eating habits and exercise. Rapoport, Clark and Wardle [23] employed behavioural and cognitive techniques with elements of other approaches, including psycho-educational methods and feminist discourse. Rapoport, Clark and Wardle [23] promoted lifestyle changes through self-awareness and autonomy, asking participants to keep journals throughout the process. Sbrocco et al.'s [39] approach was based on Behavioural Choice Treatment (BCT), discussing how food choice, exercise and eating behaviour play a crucial role in suppressing hunger, losing weight and improving health. General rather than individual support was given. Tanco, Linden and Earle's [40] study considered all ancillary issues that might contribute to weight gain, e.g. sexual abuse. Through discussion, participants considered the role of personal experiences in weight management. Social pressures were also discussed and participants were asked to engage in sessions by sharing personal views, feelings and experiences.

Each of the following behaviour change techniques [42] were used in all nine of the HNWL interventions: goals and planning (number 1), feedback and monitoring (number 2), social support (number 3), shaping knowledge (number 4), natural consequences (number 5), repetition and substitution (number 8), identity (number 13) and self-belief (number 15).

CWL programmes Duration

As with the HNWL interventions, most participants in the CWL programmes attended a weekly group session [25, 33, 36–40] that ranged from 1 [36] to 2 h in duration [23, 40]. The durations of the CWL programmes were matched to the corresponding HNWL programmes.

Aims

Despite minor variations in their approaches, all groups followed the CWL philosophy in practice with the primary objective to achieve weight loss. Participants assigned to the CWL group were given an initial nutritional assessment and given a bespoke diet plan that aimed to achieve weight loss of 0.5–1 kg a week. The CWL programmes aimed to achieve this through self-control, physical activity and weight monitoring.

Approach to weight and eating

Several CWL groups followed the LEARN programme, which promotes dieting as fundamental to weight control [25, 33, 36, 37]. The programme's primary goal is weight loss through gradual and sustainable lifestyle changes based on increased physical activity and decreased energy intake [23]. To achieve this, LEARN promotes positive eating behaviour, good nutrition, social support, exercise, decreased fat intake, monitoring of weight and addressing self-esteem and its relationship to weight loss and weight gain. It relies upon methods of self-monitoring, stimulus control, social support, problem-solving, goal setting and relapse prevention [25, 33, 36, 37].

Nutritional education was promoted through methods of reducing the intake of fatty foods, increasing the consumption of complex carbohydrates and eating a wide variety of foods [23, 25, 33, 36, 37]. Participants were taught to restrict their fat intake to 40 g a day and to keep food diaries [39]. Bacon et al. [25] instructed individuals to follow a diet where 30% of their daily energy intake came from fats, 15% from proteins and the remaining energy from carbohydrates. In Crerand et al. [33], relapses were avoided through monitoring food consumption and increasing physical activity levels, undertaking a paced eating speed and using social support systems. Through these tools, participants learned to restrict their energy and fat consumption, keep food diaries and monitor their weight. The CWL group in Rapoport, Clark and Wardle's [23] study were encouraged to make healthy eating choices and select food options that were low in fat, low in sugar, high in fibre and low in salt. Further to this, they were provided with sample menus, strategies for regularising eating habits, managing overeating, modifying recipes, reading food labels, coping with eating out and strategies for maintaining weight loss.

The key difference between HNWL and CWL was that CWL prescribed a specific daily energy restriction and meal plans to follow and promoted weight monitoring. All of the CWL groups followed a weight loss plan to achieve weight loss of at least 0.5–1 kg per week. This was achieved by restricting calorie intake to 1,200 kcal/day [23, 39] or to 1200–1,500 kcal a day [40]. Exact kilocalories per day prescription was not specified in Ash et al. [32], although the programme was designed to achieve weight loss of 0.5–1 kg/week. The remaining studies did not report the exact amount of energy restriction imposed on participants [25, 33, 36, 37], but as reported by Crerand et al. [33], all of these studies followed the LEARN programme and therefore restricted calorie intake by a self-imposed diet within a range between 1,200 and 1,500 kcal a day.

Behaviour change techniques

Crerand et al.'s [33] group was educated on the relationship between self-esteem and weight and discussed the emphasis in the media on thinness. Rapoport, Clark and Wardle [23] used cognitive and behavioural approaches to teach healthy weight loss. The topics in these sessions included self-monitoring, identifying personal triggers, using social support systems, focusing on goals and positive reinforcement.

Sbrocco et al. [39] asked participants to pinpoint the true causes behind overeating and to identify alternative methods of coping with stress. Weight management was approached through behavioural techniques. Tanco, Linden and Earle [40] used psycho-educational methods focused on the specific effects of weight loss and gain. These studies used Behaviour change techniques (BCT) from the BCT taxonomy [42]. with respect to goals and planning (number 1), feedback and monitoring (number 2), social support (number 3), shaping knowledge (number 4), natural consequences (number 5), repetition and substitution (number 8), rewards and threats (number 10) and self-belief (number 15). Many of these BCTs were features of both the HNWL and CWL programmes, although number 13 (identity) and number 10 (rewards and threats) were solely features of the HNWL [40] and CWL [23] programmes, respectively.

Physical Activity

All of the CWL groups across the nine included studies encouraged their participants to increase their level of physical activity. Participants in Rapoport, Clark and Wardle [23] were advised to exercise for 30 min, three times per week. In Crerand et al. [33], physical activity included walking, or other aerobic activity, for 150 min per week. At the end of week 20, this was increased to 180 minutes per week. Participants in Sbrocco et al. [39] and Tanco, Linden and Earle's [40] studies exercised five times a week during the treatment and reduced this frequency to three times a week over the follow-up period. No formal exercise groups or routines were offered and participants kept track of their physical activity via a daily exercise log [39].

Enhanced programmes

There were several studies where either the HNWL programme or the CWL programme contained enhanced elements that could potentially result in greater differences in weight and heterogeneity when pooling the results. In Crerand et al. [33], the HNWL participants received an intervention in three phases. The first phase was implemented across the first six weeks and focused on weaning subjects from their existing diets; the second phase, occurring between week six and week 20, had subjects adopt a specific eating plan with a goal of eating at least every 4 h to prevent hunger and where no food groups were restricted; the final phase focused on improvement of body image and self-esteem through therapy sessions held between weeks 20 and 40.

In Sbrocco et al. [39], the HNWL participants were prescribed 1800 kcal/day (7534 kJ) for the first 2 weeks of the study. Therefore, initially, HNWL had an energy restriction which was likely to lead to significant weight loss in this group.

As described above, although these programmes were enhanced in HNWL, beyond the standard interventions, each was enhanced in different ways and it was not appropriate to combine them.

In another study, there was an enhanced aspect to the CWL intervention. After 8 weeks of treatment, participants in the HNWL programme demonstrated marked improvement in their psychological well-being, and individuals in the CWL were provided with a further 4 weeks of treatment as a consequence. They studied the principles taught in the HNWL sessions. In order to ensure both groups received the same contact, the participants in the HNWL programme were also offered 4 further weeks of sessions where they reviewed the topics that were previously covered in the HNWL condition [40]. This may have potentially led to a smaller difference between the intervention and control groups, particularly in respect to outcome measure of psychological well-being, so this needs to be born in mind in interpreting the results.

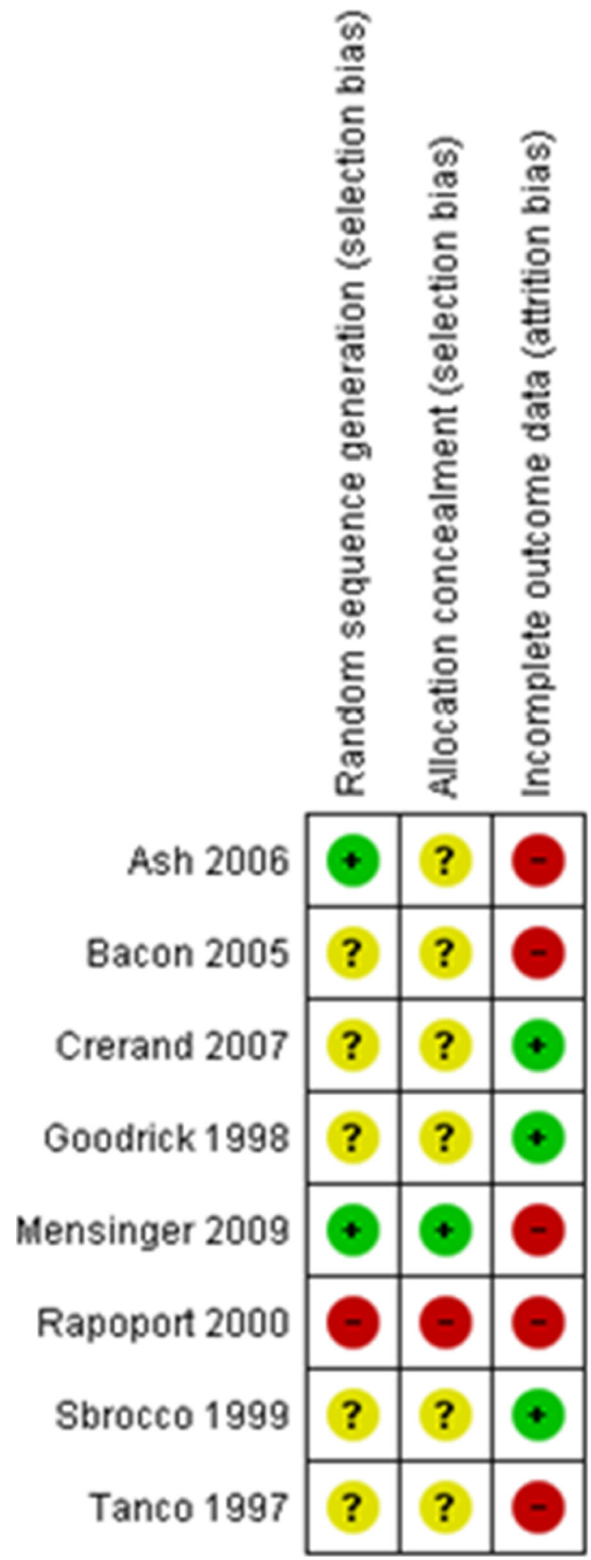


Fig. 2 Risk of bias summary: results of the assessment of each risk of bias item for each included study

Risk of bias in included studies

Information concerning risk of bias for each study can be found in Fig. 2, and summarised below. This includes information on the likelihood of selection bias (including randomisation and allocation concealment) and attrition bias. Each study is classified on each bias as presenting a low risk, a high risk or an unclear risk of bias.

Allocation (selection bias) A large section of studies neglected to report the method used to generate random allocation sequences or information concerning allocation concealment—neither of these were reported in five of the eight studies [25, 33, 36, 39, 40]. Two studies used methods of randomisation with a low risk of bias. Ash et al. [32] used a table populated with random numbers to generate the randomisation sequence. Mensinger et al. [37, 38] used a computer-generated randomisation programme that was devised by a statistician to assign interventions to participants. One study [23] was found to have a less robust method of randomisation that forced alternate allocation of interventions: in the first cohort of participants, treatments were allocated by the toss of a coin. In subsequent cohorts, allocation was alternated to ensure that every form of treatment was represented at specified times of the day.

The method of allocation concealment was only reported in one study Mensinger et al. [37, 38] and was found to have a low risk of bias. Mensinger et al. [37, 38] instructed an assistant to place folded index cards containing group assignment information into sealed, opaque envelopes. These were labelled with the sequential numbers from the randomisation scheme before they were given to participants in the study.

Incomplete outcome data (attrition bias) There were concerns relating to attrition bias across all of the studies. Most studies were found to present a high risk of bias due to high attrition rates (up to 74%). Intention to treat (ITT) analysis was carried out in some studies using modelling techniques or data carried forward with sensitivity analysis, such that ITT analyses were compared to the results from associated completer case analyses and similar results were found [36]. In Sbrocco et al. [39] a low attrition rate (i.e. less than 15%) was reported.

Data synthesis

Findings were stratified according to the length of the follow-up period. The results pooled revealed high levels of heterogeneity because the studies had varied lengths of follow-up treatment stages. This was addressed by reporting the results as four phases of follow-up treatment based on the timing of data collection in the included studies. These became Period 1, 8-19 weeks; Period 2, 20-39 weeks; Period 3, 40-51 weeks; and Period 4, 52-104 weeks.

All data reported in all studies was captured by these time periods and no data was missed out.

Effects of interventions

In this report, the meaning of being 'in favour of' is that the change reported is clinically better in the 'favoured' programme than in the comparator. Results of all outcomes and presentation of meta-analysis for all data is available as supplementary material online (Additional file 2). For reasons of space, within this paper, only the long-term effects of the more commonly used clinical measures are presented here.

Primary outcomes

Each of the eight studies provided data on weight. Only three studies, reported in four papers [23, 25, 37, 38], reported data on blood lipids and blood pressure.

Total cholesterol-HDL ratio

The total cholesterol-HDL ratio increased in participants in both intervention groups. However, the increase was less in the CWL programmes. The mean difference [95% CI] in the change in total cholesterol-HDL ratio was slightly in favour of the CWL programme by magnitude of (− 0.16, [− 4.51, 4.18]) at weeks 8 to 19, − 0.28 [− 3.68, 3.12] at weeks 20 to 39, and − 0.12 [− 4.30, 4.06] at weeks 40 to 52 (see Additional file 2). It slightly favoured the HNWL programmes during the longer follow-up period between weeks 53 and104 (− 0.21 [− 3.91, 3.50]). This data was based on just 2 low-moderate quality studies (Fig. 3).

Blood pressure

The mean difference in change in systolic and diastolic blood pressure [95% CI] across participants was in favour of the CWL programmes compared to those on the HNWL programmes at all stages of the follow-up. Those in the CWL programmes had between a 1–3 mmHg and 0–1 mmHg lower systolic and diastolic blood pressure respectively, than those in the HNWL programmes at all time points. This data was based on just 2 low-moderate quality studies, and confidence intervals were wide (Figs. 4 and 5). The meta-analysis for diastolic blood pressure contained heterogeneity of 53%

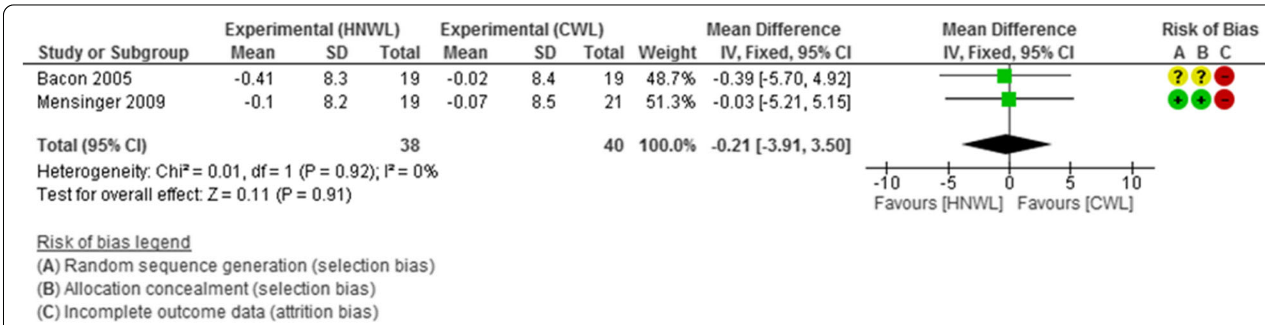


Fig. 3 Meta-analysis of total cholesterol-HDL at 53–104 weeks

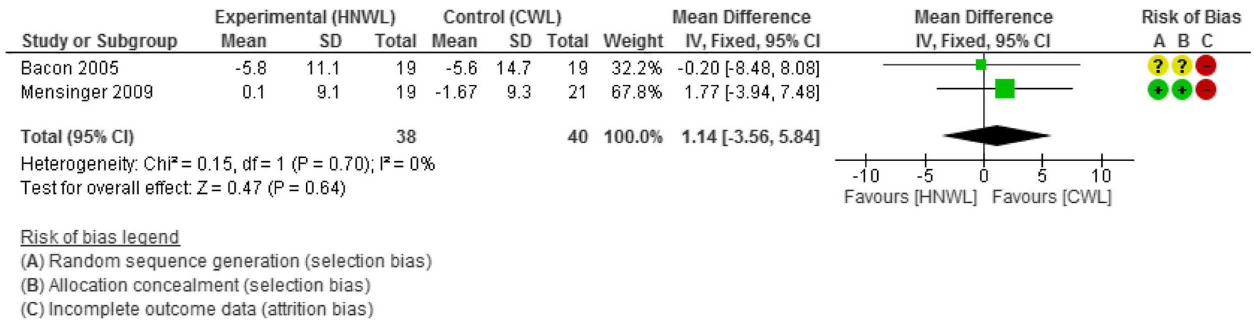


Fig. 4 Meta-analysis systolic BP change at 53–104 weeks

($p = 0.14$) (Fig. 5), but this was considered moderate and below our a priori protocol for random effects modelling.

Weight

The weight loss data was analysed in three ways: firstly, weight loss results from all studies pooled, secondly, a sensitivity analysis excluding data from groups using enhanced programmes, and thirdly, a sensitivity analysis excluding studies found to have a high risk of bias.

All studies The mean weight loss [95% CI] across participants was greater in the CWL programmes compared to the HNWL programmes, at the end of treatment (− 1.43 kg, 95% CI [− 2.48 to − 0.38] at 8 to 19 weeks), and during the follow-up periods weeks 20 to 39 (− 2.89 kg, [− 4.05 to − 1.72] and 40 to 52 (− 0.05 kg, [− 1.38 to 1.27] (see Additional file 2). At the latest follow-up (weeks 53 to 104), improvements in weight were in favour of the HNWL programmes (− 0.28 kg, [− 2.00 to 1.44]) this contained significant heterogeneity ($I^2 = 89\%$) which was dealt with by firstly a sub-analysis excluding data from groups using enhanced programmes (Fig. 6).

Excluding enhanced programmes Considering only the unenhanced programmes at weeks 8 to 19 there was a greater mean weight loss in the CWL programmes compared to the HNWL programmes (3.09 kg, [1.03, 5.15]. Results were similar for the 20–39 week follow-up period (− 0.69 kg, [− 2.10, 0.72] (see Additional file 2), and at 53 to 104 weeks (− 1.17 kg, [− 4.24, 1.89] (Fig. 6)). The mean weight loss between weeks 40-52 was slightly in favour of the HNWL programme (− 0.16 kg, [− 2.30, 1.99].

Excluding studies with high risk of bias Excluding studies with a high risk of bias at 8–19 weeks and 20–39, the mean weight loss was greater in the CWL than in the HNWL programmes (− 3.09 kg, [− 5.15, − 1.03] and − 6.21 kg [4.42, − 8], respectively). By 40–52 week follow-up, this difference was smaller (− 0.18 kg, [− 1.86, 1.50] (see Additional file 2). By the 53–104 week follow-up, the mean weight loss favoured the HNWL programmes by − 1.3 kg [− 3.14, 0.54] (Fig. 7). However, this data included two enhanced studies so there was high heterogeneity ($I^2 = 92$). This was dealt with by separating out the enhanced programmes, as per previous sub-analysis, this left us depending on the study of one unenhanced programme [36] (Fig. 7) which showed at 53–104 week follow-up a − 0.29 kg [− 4.19, 3.61] in favour of HNWL.

Secondary outcomes

Dietary intake, physical activity and alcohol intake

Data were available on physical activity levels [23, 25, 32, 36, 38, 39], fruit and vegetable intake, intuitive eating behaviour, [37] eating patterns and nutrient intake [23, 39].

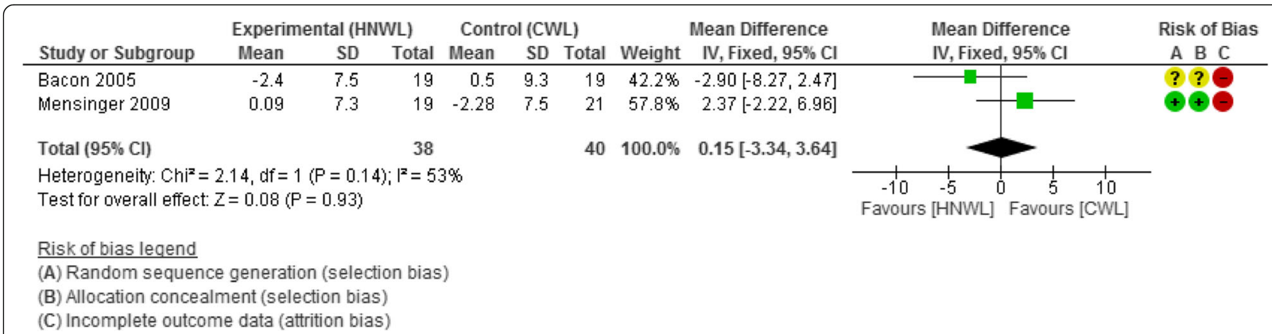


Fig. 5 Meta-analysis of diastolic BP change at 53–104 weeks

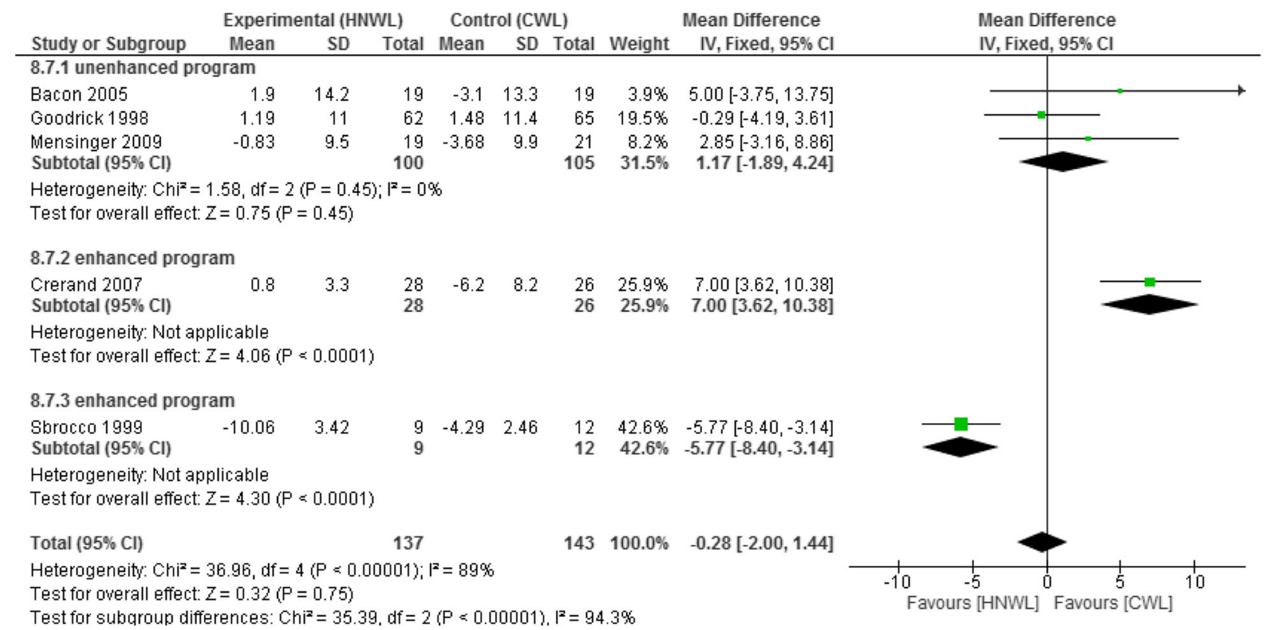


Fig. 6 Meta-analysis of weight change at 53–104 weeks

Dietary intake

Mensinger et al. [37, 38] reported an increase in participants' intake of fruit and vegetables. The mean increase was 0.32 portions higher in the HNWL programme (mean (sd); 0.98 (0.82)) compared to those on the CWL programme (0.66 (0.84)). Energy intake in Rapoport, Clark and Wardle's [23] study showed a reduction over time in both programmes, with very little difference between them at 52 weeks (− 466Kcal/d (HNWL) and − 462 kcal/d (CWL)). There was a greater reduction in percentage energy from fat (5.2 g vs 3.4 g) and increase in the percentage energy from protein (2.2% vs 1.8%) and carbohydrate (3.4 g vs 1.4 g) in the CWL, compared to the HNWL, programmes. The amount of fibre consumed increased in the CWL programmes (1.3 g) and was reduced in HNWL (− 2.7 g). The intake of sucrose was reduced in both programmes, although the HNWL group saw a greater reduction (− 14.3 g vs − 12.6 g).

Physical activity

Energy expenditure levels were measured, and this was done in three different ways: Bacon et al. [24] reported daily energy expenditure (kcal/day) and reported exercise in kcal/kg per day, and Rapoport, Clark and Wardle [23] reported MET (metabolic equivalents) hours per week. All of these results were converted to daily energy expenditure in kilocalories per day. Participants on the HNWL programmes had greater energy expenditure at all stages compared to the CWL programmes (MD − 81 kcal/day 95%CI [− 173, 336] 8–19 weeks; − 94 kcal/day [− 17, 171] 20–39 weeks; − 224 kcal/day [− 20, 469] 40–52 weeks; − 9.00 kcal/day [− 80, 98] 53–104 weeks although this latter time relied on one study's data).

Four further studies reported physical activity [37], regular exercising [40], frequency and duration of exercise sessions across the treatment and follow-up period

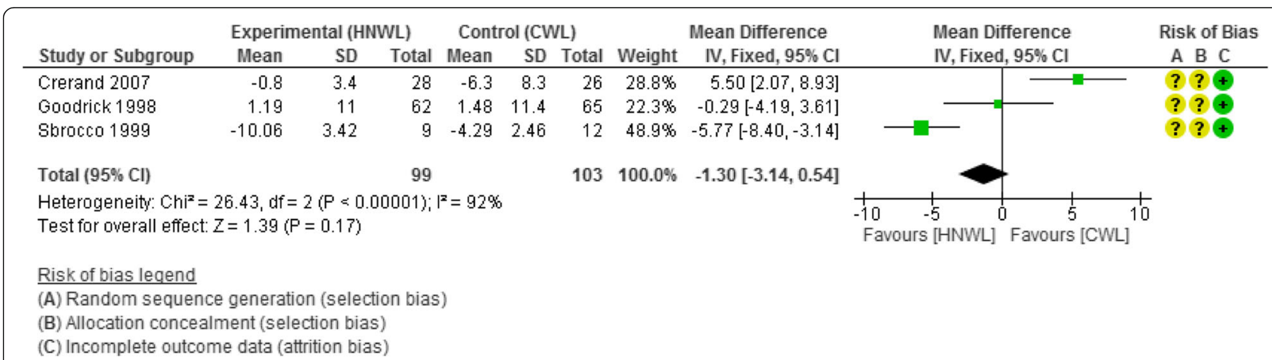


Fig. 7 Meta-analysis of the results weight at 53–104 weeks (excluding studies with high bias)

[39], and the ratio of physical activity in comparison to baseline [32]. The results of Ash et al.'s [32] study showed some differences between the number of participants who were physically active. The likelihood of the participants remaining active in the CWL group compared to the HNWL was decreased at 3 months, but there was no difference at the 6 and 12-month periods. Sbrocco et al. [39] reported an increase of physical activity in the treatment stage of both programmes, but the CWL programme showed a greater change. This continued throughout all follow-up stages after treatment in either programme. In the CWL programme, subjects were more likely to have reduced their physical activity during the longer follow-up period. Tanco, Linden and Earle's [40] study showed that following treatment, there were more regular exercisers in the HNWL programme than in the CWL programme. However, the proportion did not differ greatly between the two treatment groups. The proportion of participants who exercised regularly in the HNWL programme increased over the course of treatment but this was less so in the CWL programme. In fact, during the same period, there was a decrease in the proportion of individuals in the CWL programme who reported exercising regularly. Mensinger et al. [37, 38] reported an increase of physical activity in the HNWL programme only.

Psychosocial wellbeing

Data were available on restrained eating behaviour [23, 25, 33, 39] and pathological eating behaviours' including binge eating and loss of control [23, 33, 36]. Data were also available on self-efficacy, self-esteem [23, 25, 32, 33, 37, 39], body dissatisfaction [23, 25, 39, 40] and body image [23, 25, 33], depression [23, 25, 33, 39, 40], psychological well-being and quality of life [37].

Self-esteem

This was measured using two scales across studies: the first was the state self-esteem scale (SSES), which gives a score between 54 and 83, with a high score indicating better self-esteem [39]; the second scale used was the Rosenberg self-esteem scale, where scores range between 10 and 40; with higher scores indicating higher self-esteem [23, 25]. The standardized mean difference in improvements in participants' self-esteem was in favour of CWL programmes over HNWL programmes by 0.03 between weeks 8 and 19. It favoured the HNWL programmes by a standardized mean difference of 0.02 between weeks 20 and 39 and 0.17 at weeks 40 and 52. Low-moderate quality of evidence showed greater improvement in self-esteem on the HNWL programme during the longer follow-up period from weeks 53 to 104 (0.51 [− 0.29, 1.30] (Fig. 8)). This meta-analysis contained heterogeneity of 67% ($p = 0.08$) (Fig. 8), but this was considered moderate and below our a priori protocol threshold of 75% for random effects modelling.

Body image avoidance

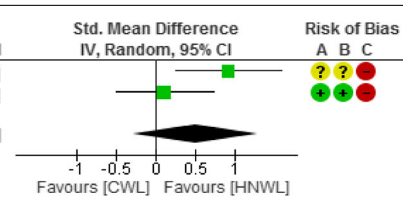
This showed greater improvement on the HNWL programmes than CWL programmes at all stages of the treatment and the follow-up periods. The magnitude of the difference at weeks 8 to 19, showed a reduction in the HNWL programme by 3.7 points on the body-image avoidance questionnaire (BIAQ). This scale ranges from 1 to 74, and a greater score indicates a higher occurrence of body image avoidance. On average, overweight women score approximately 32 points. During the 20–39 week period, the HNWL programme showed a decrease by 4.8 points on the BIAQ. A 53–104 week follow-up the reduction in BIAQ favoured the HNWL programme by − 3.2 [− 8.34, 1.94] points, but this relied on data from just one study.

Depression

The Beck Depression Inventory (BDI) was used to measure depression; scores can range from 0 to 64 points. Greater scores reflect higher levels of depression on the BDI and a score of 12 is often used as an indication of clinical depression. Feelings of depression were reduced in both programmes over time, but there was less reduction in the HNWL programme, and therefore change in depression favoured the CWL programmes at all stages of the study by a greater reduction in score (mean

	Experimental (HNWL)			Experimental (CWL)				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Bacon 2005	3.7	4	19	-1	5.8	19	48.7%	0.92 [0.25, 1.60]
Mensinger 2009	1.91	3.2	19	1.55	3.3	21	51.3%	0.11 [-0.51, 0.73]
Total (95% CI)			**38**			**40**	**100.0%**	**0.51 [-0.29, 1.30]**

Heterogeneity: Tau² = 0.22; Chi² = 3.05, df = 1 (P = 0.08); I² = 67%
Test for overall effect: Z = 1.24 (P = 0.21)



Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Incomplete outcome data (attrition bias)

Fig. 8 Meta-analysis of the results self-esteem at 53–104 weeks difference – 0.83, 95% confidence interval [– 3.24, 1.57] at 8–19 weeks, – 0.26 [– 2.44 to 2.76] at 20–39 weeks, – 0.86 [– 3.47, 1.74] at 40–52 weeks and – 0.10 [– 5.19, 4.99] at 53–104 weeks), but this relied on data from just one study (see Additional file 2). Similar results were found when the enhanced programmes were removed from the analysis.

Binge eating

There was only one study containing data on binge eating from weeks 8 to 19 and weeks 40 to 52 and one study with results from weeks 53 to 104. These studies both reported changes in binge behaviour between weeks 20 and 39. At all stages, both groups showed a mean reduction in binge eating of between 5 and 14 on a scale with possible scores ranging between 0 and 65. A baseline value on the binge eating scale for both groups was 27, which is the threshold value indicative of bulimia nervosa. Participants on the CWL programmes showed a greater mean reduction than those on the HNWL programmes, but the difference between the groups was small (between 0 and 2).

Drive for thinness, bulimia and body dissatisfaction

These were measured using the Eating Disorder Inventory (EDI) [40] and EDI-2 [25, 39] scales and the body satisfaction scale [23].

Drive for thinness

The mean reduction at weeks 8 to 19 (– 1.10 [– 3.15 to 0.96]), weeks 20 to 39 (– 2.13 [– 3.93 to – 0.34]), weeks 42 to 52 (– 2.06 [– 4.02 to – 0.11]) (see Additional file 2) and, relying on data from just one study, weeks 53 to 104 (– 2.60 [– 5.11 to – 0.09]) were greater in the HNWL programme in comparison to the CWL programme. Removing the enhanced programme from the analysis showed a greater reduction in the HNWL programme at all stages in comparison to the CWL programmes.

Bulimia

The Eating Disorder Inventory (EDI) [40] and EDI-2 [25] scales were used to measure bulimia. The level of bulimia was reduced in both programmes, but the reduction was slightly greater in the CWL programme between weeks 8 to 19 (– 0.59 [– 1.73, 0.56]) (baseline values in both groups were 5) and at weeks 20 to 39 (– 0.04 [– 1.17, 1.09] (see Additional file 2). A reduction was reported across both programmes, but it was slightly greater in the HNWL programmes (– 0.07 [– 1.22 to 1.08] at weeks 40 to 52 and – 1.00 [– 2.95, 0.95] at weeks 53 to 104 and relied on one study's data.

Body dissatisfaction

The baseline value in the studies that assessed body dissatisfaction using EDI was 22.2. One study assessed body satisfaction using BSS and baseline scores were 11. The standardised mean difference in change in body dissatisfaction favoured the HNWL programmes over the CWL programmes between weeks 8 and 19 (– 0.02 [– 0.33 to 0.29]), weeks 20 and 39 (– 0.22 [– 0.53 to 0.10]), weeks 40 and 52 (– 0.08 [– 0.42 to 0.26]), weeks 53 and104, (– 4.30 [– 8.32 to – 0.28]) but this was based on one study only. Sensitivity analysis removing enhanced programmes showed a similar pattern (available on request).

Hunger, disinhibition and restrained eating

These were measured using the three-factor eating questionnaire (TFEQ) [43]. This is a 51-item scale with each item scoring 0 or 1. Hunger has 14 items, disinhibition has 16 items and cognitive restraint has 21 items [23]. The minimum score for factors I-II-III is therefore 0-0-0 and the maximum possible score 21-16-14.

Hunger

Only two studies [23, 25] reported changes in hunger levels, showing a reduction in both programmes at all stages. The reduction was greater on the CWL programme at weeks 8 to 19 (– 0.56 [– 1.90 to 0.58]). On the HWNL programme, it was greater at weeks 20 to 39 (– 0.89 [– 2.23 to 0.45]) and weeks 40 to 52 (– 1.17 [– 2.48 to 0.13]) (see Additional file 2). Only one study [25] reported data from weeks 53 to 104 (– 1.20 [– 3.46 to 1.06]) which showed a greater reduction in hunger in the HNWL programme compared to CWL. The difference between the levels of reduction in hunger across the two programmes showed less than a 1.2 point variation on a scale of 0 to 14.

Disinhibition

Two studies reported disinhibition [23, 25], showing a reduction across both groups at all stages. The reduction was greater on the CWL programmes between weeks 8 to 19 by – 0.89 [– 2.16 to 0.37] and weeks 20 to 39 by – 0.20 [– 1.54 to 1.13]; it was greater on the HNWL programme from weeks 40 to 52 – 0.92 [– 2.28, 0.44] (available on request) and weeks 53 to 104 by – 2.30 [– 4.34 to – 0.26] but this relied on data from one study only [25]. The difference in disinhibition between the programmes therefore ranged between 0 and 2.3 on a scale of 0 to 16.

Restrained eating

There was a reduction in restrained eating behaviour in the HNWL programmes and an increase in the CWL programmes at all stages of the study. During this period, the reduction was of a magnitude between 5 and 12 on the restrained eating scale (0–21) and the difference between the programmes was between 3 and 9. Removing the enhanced study from the analysis showed that there was a greater reduction in the HNWL programme at all stages (available on request).

Discussion

Summary of main results

Primary outcomes

In the long-term follow-up period between weeks 53 and 104, changes to weight loss and total cholesterol-HDL ratio favoured the HNWL over the CWL programmes. The changes in blood pressure levels favoured the CWL programme. However, the differences between programmes for all of these primary outcomes were neither statistically significant nor of a mean magnitude which is of clinical consequence.

Secondary outcomes

Energy expenditure was slightly higher on the HNWL programme at all stages. Energy intake was reduced in both programmes with negligible differences between them. In the long-term, improvements to self-esteem and body image favoured the HNWL programme. The differences between programmes were minute. Feelings of depression and episodes of binge eating demonstrated a mean reduction in both programmes and favoured the CWL programme at all stages, but the differences were negligible. The HNWL programme showed greater reduction in disordered eating behaviours compared to the CWL programmes and in the drive for thinness and body dissatisfaction at all stages. The reduction in the bulimia subscale was greater in the HNWL programme in the longer term. In the long-term, the HNWL group showed a slightly greater reduction in the hunger factor and the disinhibition factor of the TFEQ. The HNWL group also showed a reduction at all stages in restrained eating behaviour.

Quality and applicability of evidence

Many of the outcomes showed little real difference between the programme types, these were neither statistically significant nor clinically important. This may be because many of the components and behaviour change techniques are similar across the interventions. However, universally, CWL programmes promote weight loss through dietary restriction and weight monitoring while HNWL programmes do not; it may be this that accounts for the improvements in HNWL seen, particularly in restrained eating behaviour and body dissatisfaction, with a mean improvement in the longer term of 22% for restrained eating behaviour and 20% for body dissatisfaction. It is possible that the HNWL interventions were less true to their philosophy because of the research process. The HNWL philosophy, states that the participants should not focus on weight loss and record weight change. However, individuals are weighed at the beginning and end of the programme for gathering research data. This may have been a positive factor for achieving weight loss in the HNWL programmes in these studies, which might not have otherwise been found in a non-research setting.

There were no included studies that contained all outcomes of interest. Many of the studies had more women participants and seven of the eight studies were exclusively women; this limits the applicability of their results on a mixed population. Studies with a long follow-up period of more than 2 years were not available. RCTs showed that the HNWL programme was more successful than CWL in the long-term but as this was up to 2 years of follow-up more studies that specifically compare the two programmes over a longer period of time are needed before results can be certain.

The risk of bias in some of the included trials was high, with six of the eight studies not identifying how random allocation sequences and concealment were administered. Furthermore, many studies showed a high risk of attrition bias. Considering only those studies with a lower risk of bias and removing those studies with enhanced elements reduced the sample size of studies and in some cases the results from a single study were relied on. However, these sensitivity and sub-analyses made little difference to the direction of the findings and the interpretation of them.

Strengths and limitations with respect to other studies

There is no existing meta-analysis of RCTs conducted in this area, of the two systematic reviews published to date, one combined results from a variety of study designs [28] and the other included a variety of control groups [29].

Schaefer's [28] study examined the effects of intuitive eating. It included 24 articles on 20 different studies and nine were randomised controlled trials. Only two of these studies were included in our research [25, 40] because the others did not use CWL as a control group. The studies showed improvements in eating habits, lifestyle and body image and improved psychological health. Several improvements were sustained throughout the follow-up periods for as long as 2 years. One prospective cohort study [44] followed participants for 3 years and found that participants maintained increased physical activity and self-esteem and a decrease in restrained eating. In one RCT [45], 14 participants maintained intuitive eating habits after 10 years. However, the lack of a conventional weight loss control group in these studies limits the confidence we can put in the results as a potential alternative to conventional care.

Similarly, Clifford et al.'s [29] systematic review included studies which were both quasi-experimental and randomised designs where the control was not conventional weight loss. Therefore only four of the studies included in the Clifford review [23, 25, 36, 40] matched our strict inclusion criteria of precise definitions for conventional weight loss controls and HNWL interventions (which did not have weight loss targets). Our broader search terms and more recent search of the databases led to inclusion of additional trials, providing us with more up to date and comprehensive results.

Clifford et al. showed statistically significant improvements in disordered eating behaviour, depression and self-esteem. They found no significant weight gain or raised blood pressure, blood glucose or cholesterol caused by these interventions. In two of the studies, biochemical measures were improved. However, because of the broad inclusion criteria, these results could not be pooled in a meta-analysis and the effects at different time-points are unclear.

We found that biochemical and weight parameters were better with CWL programmes in the short term, but in the long term there were no significant differences, so only in the long term were our results consistent with Clifford et al. Clifford et al. found significant improvements in depression, we only found long-term significant improvements, beyond that of conventional programmes, in restrained eating behaviour and body satisfaction; these effects were small and relied on data from a single study. We recommend large non-inferiority trials are needed between HNWL and CWL programmes to confirm these conclusions.

Conclusions

The effects of HNWL programmes compared to CWL programmes show no long term, significant differences in blood lipids, hypertension and weight loss. This is consistent with previous systematic reviews. However, losses to follow up in some studies were high and the estimates resulting from meta-analyses were often imprecise. HNWL programmes were slightly better at long-term improvement in disordered eating behaviour and body satisfaction, but results were often drawn from a single study. Therefore large, long-term, high-quality randomised controlled trials are now needed to confirm our findings before firm clinical recommendations can be made regarding the comparative non-inferiority or superiority of these programmes.

Additional files

Additional file 1: Search strategies. (DOCX 31 kb)

Additional file 2: Additional Meta-analysis. (DOCX 975 kb)

Abbreviations

BMI: Body mass index; CI: Confidence interval; CWL: Conventional weight loss; HAES: Health at every size; HNWL: Health, not weight loss, focused; IE: Intuitive eating; MD: Mean difference; RCT: Randomised control trials; RR: Relative risk

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Not applicable

Authors' contributions

NK and DL selected the studies. NK extracted the data and assessed risk of bias. Data extraction and risk of bias assessment was checked by a second author (all authors contributed to this). All author contributed to writing the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analysed during this study are included in this published article and its supplementary information files.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Competing interests

DL has received vouchers from Slimming World for conducting a previous trial. NK has found the HNWL approach personally helpful to her health. The other authors declare that they have no competing interests.

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Intuitive eating, objective weight status and physical indicators of health

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Summary

Introduction

Intuitive eating (IE) has emerged as a weight-neutral approach to health promotion for those with overweight/obesity. This weight-neutral paradigm has some support, although research thus far has often neglected to control for potential confounds (i.e. objective weight status and demographics) and foundational studies are lacking. The objective of the current study was to observe the unique association of IE with physical health indicators in a sample of adults, independent of objective weight status.

Methods

Participants were 248 adults (32 ± 14 years old, 73% female, 64% White) of all weight categories (18.2–55.3 kg m^{-2}), with an average body mass index (BMI) of 30 ± 8 kg m^{-2}. IE was measured with the Intuitive Eating Scale-2 (IES-2). BMI was objectively measured in-lab. Health indicators included blood pressure (BP) and fasting glucose.

Results

A series of hierarchical linear regressions revealed no significant associations between IE and systolic BP ($\beta = -0.076$, $P = 0.256$), diastolic BP (DBP; $\beta = -0.122$, $P = 0.073$) or fasting glucose ($\beta = 0.047$, $P = 0.500$) after controlling for BMI. All effects sizes were small or below ($f^2 = 0.00$ to -0.04). Sensitivity analyses revealed significantly lower DBP in high intuitive eaters versus low when analysed with a *t*-test, $t(111.651) = 3.602$, $P < 0.001$, Levene corrected; however, after controlling for relevant covariates (i.e. BMI and demographics), analysis of covariance revealed no difference in DBP between groups, $F(1, 116) = 0.330$, $P = 0.567$. No significant differences in systolic BP or fasting glucose were observed between low and high intuitive eaters before or after considering covariates.

Conclusions

In sum, this study investigated associations between IE and common indicators of physical health after controlling for objective weight status. Findings revealed no unique relationship between IE and physical health, and any IE–physical health relationships that were observed were accounted for BMI and/or demographic factors.

Keywords: Blood pressure, eating behaviours, glucose, weight control

Introduction

Current treatment approaches for obesity most often consist of behavioural weight loss (BWL) interventions, typically characterized by lifestyle intervention focused on decreasing calorie intake and increasing physical activity.[1] Although the current obesity treatment approach often leads to initial losses of weight, approximately 46% of lost weight is regained.[2] The general consensus is that weight loss maintenance from BWL treatments is poor, and individuals typically regain most, if not all, of the weight that they lose.[3], [4], [5], [6] Further, although the primary target of BWL interventions is physical health, the treatment can affect many other aspects of individuals' lives. A review of the literature revealed that dietary restraint – a tendency to consciously restrict food intake that is often promoted in BWL calorie reduction plans – is associated with negative psychosocial factors such as excessive body and shape concerns, problematic food-related attitudes and behaviours and impairments in general psychological functioning in some individuals.[7]

As a response to these weaknesses in current obesity treatments, new paradigms that are less focused on weight are being considered,[8], [9] particularly in light of evidence suggesting that improvements in physiological markers of health (e.g. blood pressure [BP] and cholesterol) can be found independent of weight loss.[10], [11], [12], [13] One such approach that has received substantial attention in research, clinical and popular culture domains is intuitive eating (IE).[11], [14] As first defined by Tribole and Resch,[15] IE is an adaptive approach to eating that is based on trusting the body to guide eating decisions rather than adhering to external rules of dietary restraint. It is currently conceptualized as four separate domains, which together refer to eating based on physiological need, choosing foods that provide optimal fuel and removing the restrictions of when and what to eat that are common in traditional diets.[16]

Intuitive eating shares some similarities with traditional non-diet programmes, such as Health at Every Size (HAES).[17] The HAES philosophy includes a weight-neutral approach to health that 'promotes feeling good about oneself; *eating well in a natural, relaxed way*; and being comfortably active' (p. 13, emphasis added).[17] As seen, HAES does include IE-like principles (see italics), but it also captures acceptance of the self and body and aspects of physical activity. IE may also be compared with emerging weight loss paradigms, including acceptance-based treatment (ABT) for weight loss.[18] Compared with IE, ABT approaches to weight loss are more closely aligned with traditional BWL treatments.[18] While IE encourages the release of dietary restrictions and acceptance of internal eating regulation, ABT utilizes acceptance to increase adherence to traditional dietary prescriptions and achieve weight loss through skills such as mindfulness and cognitive defusion.[18] Additionally, both HAES and ABT are larger treatment programmes, while IE is a specific construct. Although there are a variety of interventions/treatment programmes utilizing the weight-neutral/non-diet approach present in the literature, all of these approaches are similar in that they include a focus on eating based on internal cues rather than dietary prescriptions, which is the construct objectively defined as IE.[11], [15], [18]

Intuitive eating has been positively associated with a broad range of psychological and behavioural factors.[7], [19], [20], [21] Specifically, IE has been found to have a positive relationship with general psychological well-being, body image and self-esteem, and pleasure from eating. Additionally, IE has displayed a negative relationship with preoccupation with food and disordered eating. Despite these psychological benefits, it may be premature to promote IE as a health-promoting alternative to dieting if there are limited benefits to physical health.

Unfortunately, the research on IE and physical health indicators is less developed. To begin, IE is consistently negatively associated with body mass index (BMI) in cross-sectional studies,[20], [22], [23], [24], [25], [26], [27] and weight-neutral interventions are often associated with either a maintenance of or a decrease in weight.[10], [13], [28], [29], [30], [31], [32] Fewer studies include biomarkers other than BMI or weight, and available results are mixed. For example, Hawks and colleagues found that individuals high in IE displayed lower BMI, higher high-density lipoprotein (HDL) cholesterol, lower triglycerides and lower cardiovascular risk than individuals low in IE in a cross-sectional study.[22] Other investigations in this area have been conducted to evaluate non-dieting interventions. Recent reviews of these studies have suggested that these interventions may positively impact BP and blood lipids.[12], [33], [34] Specific findings across the literature include improvements in the levels of total cholesterol,[10], [13], [31], [32] HDL cholesterol,[28] LDL cholesterol,[10], [13], [31], [32] triglycerides,[13] systolic BP (SBP)[10], [13], [30], [32], [35] and diastolic BP (DBP).[28], [30], [32], [35] However, there is also at least one published study that did not observe an effect for each one of these variables,[10], [13], [28], [31], [32], [36], [37] and none of these studies considered the impact of BMI on the IE–physical health relationships.

Taken together, the aforementioned findings suggest that IE and the weight-neutral paradigm may contribute to both psychological and physical benefits. However, several gaps and methodological limitations are present in the current literature (e.g. non-representative samples, inconsistent study designs and a lack of foundational research) that limit conclusions about the physical health benefits of IE and whether they are independent of weight status. Thus, the objective of the current study was to observe the unique baseline association of IE with physical health indicators in a sample of adults, independent of weight status. The primary study aims were (a) to determine whether IE is associated with better overall physical health (as measured using BP and glucose measurements) and (b) to evaluate whether these relationships remain after adjusting for BMI. Due to lack of consilience in the extant literature, we made no a priori hypotheses.

Method

Overview

Data used in the current analyses came from compiling baseline data from multiple studies that included the Intuitive Eating Scale (IES-2), measured BMI, BP and fasting glucose measurements. Baseline data from two larger trials of BWL in adults with obesity – Cognitive and Self-Regulatory Mechanisms of Obesity Study (COSMOS)[18] and Pilot of Weight Reduction in Underserved Populations (POWER-UP) – were used as well as data from community and laboratory conducted studies. Compilation of data from these sources allowed for a diverse sample of individuals from all weight statuses, from underweight to obese.

Participants

Participants included adults with obesity from the community enrolled in a weight loss trial (i.e. COSMOS and POWER-UP), community members of all weight statuses and college students enrolled at a large public university. Inclusion criteria for this study were (a) aged ≥21 years and ≤65 years, (b) speak English fluently, (c) completed the IES-2 and (d) completed BMI, BP and glucose assessments. Exclusion criteria were as follows: (a) individuals out of the stated age range, (b) those who were currently pregnant, (c) history of a neurological disorder and/or (d) non-English speaking. Using G*Power version 3,[38] we estimated that a sample size of at least 156 participants would be needed to have an 80% chance to detect a significant small effect ($f^2 = 0.051$) at the 5% level (one-tailed).

Measures

Intuitive eating (IES-2) The IES-2[16] is a 23-item self-report instrument that measures an individual's tendency to eat based on his or her body's internal cues. Responses to each question range from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) and are averaged to provide the total IE score. Higher scores represent higher levels of IE. The IES-2 has previously displayed good reliability and validity in both women and men.[16] Specifically, Cronbach's coefficient alphas for internal consistency were 0.87 and 0.89 for women and men, respectively. In the current study, the IES-2 total score displayed good reliability as well (women α = 0.84; men α = 0.79).

Health indicators Multiple measures that have been shown to be related to physical health were examined in this study. Specifically, these measures are predictive of negative health outcomes commonly associated with obesity (e.g. hypertension, type 2 diabetes and cardiovascular disease).

Body mass index Body mass index was measured continuously as a function of participants' height and weight. Participants' height (cm) and weight (kg) were measured directly by research personnel using research-grade scales: Tanita scale (TANITA Body Fat Analyzer Model TBF-105 K930599) or seca scale (Model 813).

Blood pressure Systolic blood pressure and DBP (mmHg) were measured with an electronic sphygmomanometer by a research personnel. When multiple readings were available, the average of the first three readings was taken.

Fasting glucose Fasting glucose levels were obtained via clinic blood draw (COSMOS sample) or via fingerstick and a glucometer (for all other participants). All glucose measurements were taken following a fast of at least 8 h.

Demographic factors and covariates Participants completed a questionnaire assessing demographic variables, including gender, age, race and education level. These demographic variables were included as covariates in the data analysis.

Procedure

All data were collected from the baseline visit of the larger, ongoing studies across multiple settings. All participants signed informed consent documents approved by the university's Institutional Review Board and were adequately compensated. IE was measured during the baseline visit via self-report using the IES-2.[16] Demographic factors and covariates (i.e. age, gender, race and education level) were self-reported. BMI and BP were objectively measured by a trained research personnel. Fasting glucose levels were measured via glucometer or clinic blood draw.

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Data analysis

All data were reviewed prior to analysis to assure completion and adequacy based on the assumptions for statistical normality, and tests for homogeneity of variance were conducted (i.e. Levene's). Missing data were imputed via within-person within-scale mean imputation when ≤20% of scale responses were missing. Outliers were retained unless they impacted the normality of the data.

A series of hierarchical linear regression analyses were performed to evaluate whether IES-2 total scores predicted health indicators when adjusting for BMI. A separate analysis was conducted to evaluate IES-2 total scores on each of the outcome variables (i.e. SBP, DBP and fasting glucose). For all analyses, covariates included age, gender, race and education level. All covariates were entered in Step 1, IES-2 total was entered in Step 2 and BMI was entered in Step 3. A partial Bonferroni correction was performed according to SISA guidelines,[39] which revealed a corrected alpha level of 0.028 to account for multiple testing of interrelated outcomes. Therefore, this alpha level (i.e. 0.028) was used as the criteria for statistical significance for all primary outcome variables. Of note, given that study participants came from several settings, stratified analyses were performed to assure that there were no different patterns of results among the treatment-seeking and non-treatment-seeking samples.

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To further probe the relationship between IE and health indicators and pursue a clinical application of IE scores, sensitivity analyses were performed. First, *t*-tests were performed to analyse differences in SBP, DBP and fasting glucose between individuals high and low in IE. Second, analyses of covariance

(ANCOVAS) were performed to analyse these differences after controlling for the previously stated covariates (i.e. BMI, sex, race/ethnicity and education). Based on previous literature,[22] individuals were categorized as high and low IE based on quartile; high IE was defined as a score ≥75th percentile in the sample, and low IE was defined as a score ≤25th percentile in the sample.

Results

Participants

Participants were included in the final sample if they met all eligibility criteria and had complete data for all demographic and IES-2 measures. Three individuals were excluded due to ineligibility (i.e. age >65), and 31 individuals were excluded due to missing demographic or IES-2 values. One individual was excluded only from fasting glucose analysis due to an out-of-range fasting glucose value. The final sample consisted of 248 adults who were 32.2 ± 14.3 years old, 73% female, and 64% White. Because of missing data on outcome variables, the analysed samples for BP and fasting glucose analyses included 243 and 212 participants, respectively. Participants had a mean BMI of 30.4 ± 7.6 kg m^{-2}, and all weight categories were represented (BMI range 18.2–55.3 kg m^{-2}). Mean values for other collected biomarkers (i.e. BP and glucose) were within the normal range on average. At the group level, participants displayed IE scores of 3.3 ± 0.5 on average for the 1–5 scale. Total IE displayed a moderate-to-large effect size in association with BMI ($r = -0.448$). Detailed demographic and descriptive data can be found in Table 1. Stratified analyses confirmed no differences between study samples (i.e. treatment-seeking versus non-treatment-seeking); therefore, all results presented below are from the aggregate sample.

Table 1

Participant characteristics

	Max (N = 248) M (SD) or N (%)
Demographics and history	
Age	32.18 (14.29)
Gender (female)	182 (73.4)
Education level	
Some high school	7 (2.8)
High school	31 (12.5)
Some college	76 (30.6)
Bachelor's degree	70 (28.2)
Graduate or professional degree	64 (25.8)
Race/ethnicity	
African American	13 (5.2)
American Indian/Alaska Native	37 (14.9)
Asian/Pacific Islander	7 (2.8)
Caucasian	159 (64.1)
Hispanic	7 (2.8)
Other	5 (2.0)
Multiple	20 (8.1)
Biomarkers and obesity indicators	
BMI (kg/m^{-2})	30.41 (7.56)
Blood pressure (mmHg)	
SBP	116.06 (13.15)
DBP	74.64 (10.14)
Fasting glucose (mg/dL^{-1})	95.68 (26.83)
Intuitive eating (IES-2)	3.27 (0.51)

BMI, body mass index; DBP, diastolic blood pressure; IES-2, Intuitive Eating Scale-2; SBP, systolic blood pressure; SD, standard deviation.

Primary results

Intuitive eating and health indicators Associations of IES-2 total scores with SBP, DBP and fasting glucose – following the inclusion of covariates and BMI – were examined. Although there was a significant association between IE and DBP in Step 2 ($\beta = -0.191$, $P = 0.003$), IE showed a non-significant relationship with BP levels (SBP $\beta = -0.076$, $P = 0.256$; DBP $\beta = -0.122$, $P = 0.073$) after the inclusion of BMI. IE was not significantly related to levels of fasting glucose ($\beta = 0.047$, $P = 0.500$). In line with these results, effect sizes of IES-2 with health indicators were in the range of small effects or below ($f^2 = 0.00$ to 0.04). A detailed review of these results can be seen in Table 2.

Table 2

Associations between total IE and health indicators

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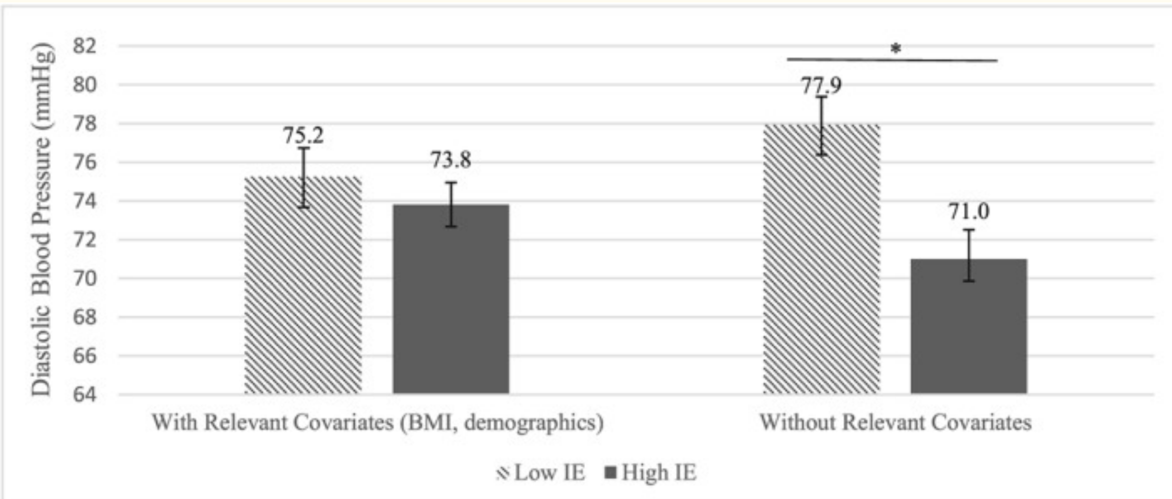
	Systolic blood pressure (n = 243)			**Diastolic blood pressure (n = 243)**			**Fasting glucose (n = 212)**		
Step 1	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF
	0.210	–	15.808*	0.138	–	9.493*	0.242	–	16.527*
	β	P		β	P		β	P	
Age	0.267	<0.001*		0.361	<0.001*		0.474	<0.001*	
Sex	−0.379	<0.001*		−0.101	0.104		0.085	0.168	
Race/ethnicity	−0.060	0.312		−0.002	0.980		0.059	0.348	
Education	−0.108	0.079		−0.104	0.106		−0.109	0.090	
Step 2	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF
	0.217	0.007	2.119	0.168	0.031	8.749*	0.243	0.001	0.298
	β	P		β	P		β	P	
Age	.237	<0.001*		0.297	<0.001*		0.487	<0.001*	
Sex	−0.399	<0.001*		−0.143	0.023*		0.093	0.143	
Race/ethnicity	−0.060	0.317		0.000	0.999		0.061	0.331	
Education	−0.111	0.069		−0.111	0.078		−0.108	0.093	
TOT IE	−0.091	0.147		−0.191	0.003**		0.036	0.585	
Step 3	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF	R^2	ΔR^2	ΔF
	0.218	0.001	0.430	0.198	0.030	8.773*	0.244	0.001	0.269
	β	P		β	P		β	P	
Age	0.216	0.002*		0.201	0.005*		0.468	<0.001*	
Sex	−0.397	<0.001*		−0.132	0.033*		0.094	0.140	
Race/ethnicity	−0.062	0.301		−0.010	0.870		0.057	0.370	
Education	−0.102	0.102		−0.071	0.263		−0.100	0.133	
BMI	0.048	0.512	f^2	0.220	0.003*	f^2	0.041	0.605	f^2
TOT IE	−0.076	0.256	0.00 (no effect)	−0.122	0.073	0.04 (small effect)	0.047	0.500	0.00 (no effect)

*Significant at $P < 0.05$ for omnibus statistics and covariates.

**Significant at $P < 0.028$ for primary outcomes (bolded).

BMI, body mass index; TOT IE, Intuitive Eating Scale-2 total score.

Sensitivity analyses In order to provide clinical information for certain thresholds of IE, additional analyses were performed. As observed by the *t*-test, no differences in SBP between high and low IE were found, $t(109.788) = 0.974$, $P = 0.332$, Levene corrected. This was supported by the ANCOVA, which controlled for the effects of BMI, sex, race/ethnicity and education, $F(1, 116) = 0.015$, $P = 0.902$, partial $\eta^2 = 0.000$. Significant differences in DBP between high IE and low IE were observed, $t(111.651) = 3.602$, $P < 0.001$, Levene corrected. However, after controlling for relevant covariates, the ANCOVA revealed non-significant effects, $F(1, 116) = 0.330$, $P = 0.567$, partial $\eta^2 = 0.003$. These contrasting results are pictured in Figure 1. Lastly, no differences in fasting glucose between high IE and low IE were found by the *t*-test, $t(103) = 1.302$, $P = 0.196$, or the ANCOVA, $F(1, 98) = 2.414$, $P = 0.123$, partial $\eta^2 = 0.024$.



Note: *$p < .05$; IE = Intuitive Eating as measured by Intuitive Eating Scale-2; Error bars represent standard error estimates from the mean.

Figure 1

Differences in diastolic blood pressure between high and low intuitive eaters with and without controlling for relevant covariates

Discussion

The objective of the current study was to observe the unique association of IE with physical health indicators, independent of weight status. Overall, the observed results suggest that IE does not have a unique cross-sectional relationship with specific physical health indicators after adjusting for BMI. Specifically, no unique associations between IE and BP (i.e. SBP or DBP) or fasting glucose were observed. Although the relationship between IE and DBP was significant prior to considering BMI, the relationship did not persist after the inclusion of BMI into the model. This pattern suggests that differences in objective weight status likely explained the observed relationship between IE and DBP.

Further, additional analyses were performed to evaluate differences between high and low intuitive eaters. Once again, no differences in SBP or fasting glucose were observed between individuals displaying low and high levels of IE. Individuals high in IE did display lower levels of DBP, suggesting better resting BP than low intuitive eaters, but this was only the case when covariates were not considered. After controlling for BMI, sex, race/ethnicity and education, there were no differences in DBP between IE groups. In sum, it appears that significant, cross-sectional IE–physical health relationships are only observed when other relevant factors (i.e. BMI and demographics) are not considered – at least for BP and fasting glucose health indicators.

These results are somewhat consistent with previous literature. While there is some evidence for the association of adaptive eating patterns with BP and fasting glucose, there are also multiple studies that have not found support for the IE–physical health relationship.[11, 12, 34, 40] Of note, Hawks and colleagues performed a similar study in which they evaluated associations between IE and health in college women.[22] That study found that IE was negatively correlated with BMI, triglycerides and cardiovascular risk and was positively correlated with HDL cholesterol. Further, significant differences were observed between high and low intuitive eaters on all of these indicators, with individuals high in IE displaying better health. However, Hawks *et al*. did not control for covariates or potential confounds, and they also measured IE with a different self-report instrument than the one used in the present study. Although the current study did not evaluate the same indicators of physical health or the exact same IE scale, a similar pattern of results emerged. When using similar methodology to Hawks *et al*. (e.g. *t*-test), a relationship between IE and health (i.e. DBP) was observed; however, the current study suggests this relationship is explained by the third variable of objective body weight and/or other demographic variables. The strong influence of relevant covariates on observed results is highlighted in Figure 1.

The overarching aim of this study was to increase knowledge of IE's basic and unique cross-sectional relationships with physical health indicators, in order to serve as a foundation for continuing to refine longitudinal IE studies that could justify IE's utility as an alternative/adjunctive obesity treatment. Unfortunately, the results of this study did not support the presence of a cross-sectional IE–physical health relationship that is independent of the effects of BMI. Additionally, the current study contained greater participant diversity in terms of age, race/ethnicity and weight status than many of the previous studies, which allowed for the observation that weight status and demographic characteristics are important potential confounds to consider in the IE–physical health relationship. Recent work has also suggested that BMI may serve as a moderator of IE–physical health associations, such that relationships between IE and body image function differently within individuals of different weight statuses.[21] It is imperative for future studies to continue to work to disentangle the complex relationships between eating behaviours, body weight and health.

Given that some researchers and clinicians have called for a paradigm shift in obesity treatment, in which the IE/weight-neutral approach is utilized over traditional BWL consisting of diet and exercise,[8, 11, 17] the results of this study have a variety of clinical and research implications. We suggest that – in order for IE to be recommended as a viable physical health promotion tool among those with excess adiposity – it should improve other physical health indicators even if it does not lead to a decrease in weight.[34] However, our study did not reveal that higher IE was associated with better health using basic biomarkers commonly associated with negative consequences of obesity. This finding, in conjunction with the absence of consistent support of a unique IE–physical health relationship in previous literature, does not support IE's potential as a stand-alone obesity treatment if the goal is improvement in physical health indicators.

Despite the current findings, there are still multiple ways in which IE might serve as an effective health promotion/weight management technique. First, IE displayed a moderate-large negative correlation with BMI in the present sample, which has previously been found in numerous studies.[12, 34] This suggests that – even if IE does not help to improve physical health status independent of weight loss – having an intuitive approach to eating is associated with having a lower baseline weight. Therefore, IE may be well suited as an obesity prevention technique. Focusing on encouraging young people to attend to their body's physical needs over emotional, social or environmental cues for eating may help to decrease the incidence of obesity development. Future research on the utility of an IE intervention for obesity prevention is warranted. Second, IE may still have psychological benefit for individuals who have experienced psychological or behavioural detriments of dieting in the past (e.g. chronic dieting and disordered eating), particularly because IE is consistently linked to positive psychological indices (e.g. self-esteem).[7, 19] Thus, future research might investigate whether IE could serve as protective pre-treatment to standard obesity treatments, especially for those with risk for eating pathology or history of unhealthy restricting. IE may help these individuals establish healthier relationships with food and foster positive feelings about the self, which may increase the ability to adhere to a healthful eating plan and to be successful at losing and maintaining weight. Lastly, IE may be able to play a role in improving the maintenance of weight loss. Many studies of IE-based interventions have revealed an attenuation of weight gain within populations with overweight/obesity.[12, 34] This finding, along with the previously mentioned psychological and behavioural benefits of IE, supports additional research on the impact of IE for individuals who have successfully improved their health via weight loss and are attempting to establish a sustainable pattern of adaptive eating.

In discussing the implications of these findings on IE utility, various limitations of the current study must be considered. Firstly, there are no validated clinical cut-offs available to separate high and low intuitive eaters. Developing these cut-offs may be a useful next step; however, it is not possible in this study because of the lack of a clinical sample. With the addition of these clinical cut-offs, future research can investigate the psychological and physical consequences of being both high and low in IE. Additionally, based on the cross-sectional study design, conclusions regarding causality or the study variables' relationships over time may not be made. Furthermore, as a self-report instrument, the IES-2 may be prone to some error because of difficulty accurately reporting typical eating behaviours or social desirability. Lastly, this study examined BMI as a covariate or confound in the IE–physical health relationship; future studies may consider alternative ways to conceptualize the role of BMI, such as a potential mediator between IE and physical health outcomes.

In brief summary, this study investigated baseline associations between IE and common indicators of physical health after controlling for objective weight status. Findings revealed no unique relationship between IE and physical health, and any IE–physical health relationships that were observed were accounted for BMI and/or demographic factors. These results display the importance of considering

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relevant contextual factors, such as objective weight status, in research on IE, and they do not support the recent motion for an IE-based approach to obesity treatment if physical health indicators are the intervention targets. However, IE may be beneficial for health promotion in terms of obesity prevention, weight loss pre-treatment to promote or protect psychological health and/or weight loss maintenance. Further, additional research is imperative to disentangle the complex relationships between IE, body weight and physical/mental health.

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Conflict of Interest Statement

The authors declared no conflict of interest.

Notes

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