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Shaikh H, Bradhurst P, Ma LX, Tan SY, Egger SJ, Vardy JL.
Body weight management in overweight and obese breast cancer survivors.
Cochrane Database of Systematic Reviews 2020, Issue 12. Art. No.: CD012110.
DOI: 10.1002/14651858.CD012110.pub2.

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[Intervention Review]

Body weight management in overweight and obese breast cancer survivors

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Editorial group: Cochrane Breast Cancer Group.
Publication status and date: Edited (no change to conclusions), published in Issue 12, 2020.

Citation: Shaikh H, Bradhurst P, Ma LX, Tan SY, Egger SJ, Vardy JL. Body weight management in overweight and obese breast cancer survivors. *Cochrane Database of Systematic Reviews* 2020, Issue 12. Art. No.: CD012110. DOI: 10.1002/14651858.CD012110.pub2.

ABSTRACT

Background

Studies suggest that overweight and obese breast cancer survivors are at increased risk of cancer recurrence and have higher all-cause mortality. Obesity has an impact on breast cancer survivor's quality of life (QOL) and increases the risk of longer-term morbidities such as type 2 diabetes mellitus and cardiovascular disease. Many cancer guidelines recommend survivors maintain a healthy weight but there is a lack of evidence regarding which weight loss method to recommend.

Objectives

To assess the effects of different body weight loss approaches in breast cancer survivors who are overweight or obese (body mass index (BMI) ≥ 25 kg/m^2).

Search methods

We carried out a search in the Cochrane Breast Cancer Group's (CBCG's) Specialised Register, the Cochrane Central Register of Controlled Trials (CENTRAL, Issue 6), MEDLINE (2012 to June 2019), Embase (2015 to June 2019), the World Health Organisation International Clinical Trials Registry Platform (WHO ICTRP) and Clinicaltrials.gov on 17 June 2019. We also searched Mainland Chinese academic literature databases (CNKI), VIP, Wan Fang Data and SinoMed on 25 June 2019. We screened references in relevant manuscripts.

Selection criteria

We included randomised controlled trials (RCTs), quasi-RCTs and randomised cross-over trials evaluating body weight management for overweight and obese breast cancer survivors (BMI ≥ 25 kg/m^2). The aim of the intervention had to be weight loss.

Data collection and analysis

Two review authors independently performed data extraction and assessed risk of bias for the included studies, and applied the quality of the evidence using the GRADE approach. Dichotomous outcomes were analysed as proportions using the risk ratio (RR) as the measure of effect. Continuous data were analysed as means with the measure of effect being expressed as the mean differences (MDs) between treatment groups in change from baseline values with 95% confidence intervals (CIs), when all studies reported exactly the same outcomes on the same scale. If similar outcomes were reported on different scales the standardised mean difference (SMD) was used as the measure of effect. Quality of life data and relevant biomarkers were extracted where available.

Main results

We included a total of 20 studies (containing 23 intervention-comparisons) and analysed 2028 randomised women. Participants in the experimental groups received weight loss interventions using the core element of dietary changes, either in isolation or in combination with other core elements such as 'diet and exercise', 'diet and psychosocial support' or 'diet, exercise and psychosocial support'. Participants in the controls groups either received usual care, written materials or placebo, or wait-list controls. The duration of interventions ranged from 0.5 months to 24 months. The duration of follow-up ranged from three months to 36 months.

There were no time-to-event data available for overall survival, breast cancer recurrence and disease-free survival. There was a relatively small amount of data available for breast cancer recurrence (281 participants from 4 intervention-comparisons with 14 recurrence events; RR 1.95, 95% CI 0.68 to 5.60; low-quality evidence) and the analysis was likely underpowered.

Overall, we found low-quality evidence that weight loss interventions for overweight and obese breast cancer survivors resulted in a reduction in body weight (MD: -2.25 kg, 95% CI: -3.19 to -1.3 kg; 21 intervention-comparisons; 1751 women), body mass index (BMI) (MD: -1.08 kg/m^2, 95% CI: -1.61 to -0.56 kg/m^2; 17 intervention-comparisons; 1353 women), and waist circumference (MD:-1.73 cm, 95% CI: -3.17 to -0.29 cm; 13 intervention-comparisons; 1193 women), and improved overall quality of life (SMD: 0.74; 95% CI: 0.20 to 1.29; 10 intervention-comparisons; 867 women). No increase was seen in adverse events for women in the intervention groups compared to controls (RR 0.94, 95% CI: 0.76 to 1.17; 4 intervention-comparisons; 394 women; high-quality evidence). Subgroup analyses revealed that decreases in body weight, BMI and waist circumference were present in women regardless of their ethnicity and menopausal status.

Multimodal weight loss interventions (which referred to 'diet, exercise and psychosocial support') appeared to result in greater reductions in body weight (MD: -2.88 kg, 95% CI: -3.98 to -1.77 kg; 13 intervention-comparisons; 1526 participants), BMI (MD: -1.44 kg/m^2, 95% CI: -2.16 to -0.72 kg/m^2; 11 studies; 1187 participants) and waist circumference (MD:-1.66 cm, 95% CI: -3.49 to -0.16 cm; 8 intervention-comparisons; 1021 participants) compared to dietary change alone, however the evidence was low quality.

Authors' conclusions

Weight loss interventions, particularly multimodal interventions (incorporating diet, exercise and psychosocial support), in overweight or obese breast cancer survivors appear to result in decreases in body weight, BMI and waist circumference and improvement in overall quality of life. There was no increase in adverse events. There is a lack of data to determine the impact of weight loss interventions on survival or breast cancer recurrence. This review is based on studies with marked heterogeneity regarding weight loss interventions. Due to the methods used in included studies, there was a high risk of bias regarding blinding of participants and assessors.
Further research is required to determine the optimal weight loss intervention and assess the impact of weight loss on survival outcomes. Long-term follow-up in weight loss intervention studies is required to determine if weight changes are sustained beyond the intervention periods.

PLAIN LANGUAGE SUMMARY

Weight loss programmes for overweight and obese breast cancer survivors: what are their benefits and harms, and do they help survivors to live longer?

What is a healthy weight?

Body mass index (BMI) assesses whether people are a healthy weight for their height. A BMI of 18 to 25 shows a healthy weight, a BMI over 25 indicates being overweight, and a BMI over 30 indicates obesity.

Breast cancer and weight

People with a BMI over 25 are more likely to develop a recurrence of their breast cancer. Obesity can also affect people's quality of life (well-being) and can lead to serious and life-threatening conditions, including type 2 diabetes, coronary heart disease and stroke. After successful treatment for breast cancer, people with a BMI over 25 are advised to lose weight.

Losing weight

The most common method for losing weight is to reduce the number of calories eaten and to increase physical activity. A healthy, reduced-calorie diet and regular exercise may be combined with psychosocial support. Some weight loss programmes include all three elements.

Why we did this Cochrane Review

We wanted to identify which weight-loss programmes work best to help overweight and obese breast cancer survivors to lose weight; and whether the programmes had advantages or unwanted effects.

What did we do?

We searched for studies that assessed weight loss programmes in survivors of early-stage breast cancer who had a BMI over 25 and no evidence that their cancer had returned. We looked for randomised controlled studies, in which the programmes people received were decided at random. This type of study usually gives the most reliable evidence about the effects of a programme.

We wanted to know how weight loss programmes affected:
-how long people lived;
-whether their breast cancer returned;
-the length of time before the cancer returned;
-how many people died;
-body weight;
-measurements of waist size;
-people's quality of life (well-being); or
-had any unwanted effects.

Search date: we included evidence published up to June 2019.

What we found

We found 20 relevant studies in 2028 women. The studies compared participation in a weight-loss programme to not participating in one but receiving usual care, a placebo (dummy) treatment, a different type of weight-loss programme, written information, or being on a waiting list instead. All the programmes included dietary changes; some combined these with exercise or psychosocial support, or both.

Most studies were conducted in the USA. The weight loss programmes lasted from two weeks to two years; the people participating were followed for three months to 36 months after starting their programme.

None of the studies reported results for: how long people lived; or the length of time before their cancer returned, or how many people died. Few studies reported about the effect of weight loss programmes on the return of breast cancer.

What are the results of our review?

Compared with those not participating in a weight loss programme, breast cancer survivors with a BMI over 25 who take part in one may:
-lose more body weight;
-have greater reductions in their waist size and BMI; and
-improve their well-being.

Taking part in a weight loss programme did not cause more unwanted effects.

Programmes combining diet with exercise or psychosocial support, or both, seemed to reduce body weight and waist size more than programmes based on dietary changes alone.

Our confidence in these results

Our confidence in these results is generally low. We identified limitations in the ways that some of the studies were designed and conducted, and the people taking part and those assessing them knew who received which treatments, which could have affected the study results.

Conclusions

Weight loss programmes may help overweight and obese breast cancer survivors to lose weight, reduce their BMI and waist size, and may improve their quality of life, without increasing unwanted effects. We did not find evidence about whether they could help people live longer, or delay the return of breast cancer.

We need more studies to find out which weight loss programmes work best to help breast cancer survivors lose weight, and whether this helps them to live longer.

Summary of findings 1. All weight loss interventions for overweight and obese breast cancer survivors

All weight loss interventions compared to comparator groups for overweight and obese breast cancer survivors

Patient or population: overweight and obese breast cancer survivors
Setting: various settings (individual or group-based, in-person or remote, exercise centre or external location)
Intervention: all weight loss interventions (diet, diet & exercise, diet & psychosocial, diet & exercise & psychosocial)
Comparison: control programs (usual care, wait-list, written materials, placebo or active control)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (treatment-comparisons)	Quality of the evidence (GRADE)	Comments
	Risk with control programs	Risk with all weight loss interventions				
Overall survival	-	-	-	-	-	No trials reported this outcome as time-to-event data.
Breast cancer recurrence	Study population		RR 1.95 (0.68 to 5.60)	281 (4)	⊕⊕⊖⊖ LOW [1]	
	32 per 1,000	62 per 1,000 (22 to 178)				
Change in body weight	The mean body weight loss[4] was 1.01 kg	MD 2.25 kg lower (3.19 lower to 1.30 lower)	-	1751 (21)	⊕⊕⊖⊖ LOW [2 3]	Heterogeneity: P < 0.00001, I^2 = 69%
Change in BMI	The mean BMI reduction[4] was 0.42 kg/m^2	MD 1.08 kg/m^2 lower (1.61 lower to 0.56 lower)		1353 (17)	⊕⊕⊖⊖ LOW [2 3]	Heterogeneity: P < 0.0001, I^2 = 84%
Change in waist circumference	The mean waist circumference[4] reduction was -0.28 cm (i.e. 0.28 cm increase)	MD 1.73 cm lower (3.17 lower to 0.29 lower)	-	1193 (13)	⊕⊕⊖⊖ LOW [2 3]	Heterogeneity: P < 0.0001, I^2 = 73%
Disease-free survival	-	-	-	-	-	No trials reported this outcome.
Adverse events	Study population		RR 0.94 (0.76 to 1.17)	394 (4)	⊕⊕⊕⊕ HIGH	
	471 per 1,000	443 per 1,000 (358 to 551)				

Change in quality of life - overall scales	-	SMD 0.74 higher (0.20 higher to 1.29 higher)	-	867 (10)	⊕⊕⊖⊖ LOW [2 3]	Heterogeneity: P < 0.00001, I^2 = 89%; An SMD of 0.74 is a moderate sized effect according to Cohen's interpretation of effect sizes.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).
CI: Confidence interval; **MD:** mean difference; **RR:** Risk ratio.

GRADE Working Group grades of evidence

High quality: further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: we are very uncertain about the estimate.

[1]Quality of evidence downgraded two levels for 'imprecision' because 95% CI for risk ratio estimate suggests that the intervention might reduce the risk of progression by up to 32% or increase the risk of progression by up to 460% and risk ratio estimate is based on only 14 events in 281 patients.
[2]Quality of evidence downgraded one level for 'risk of bias' because >20% attrition of randomised participants for measurement of this outcome at follow-up and because most studies were unblinded for participants, personnel and assessment of patient-reported outcomes.
[3]Quality of evidence downgraded one level for 'inconsistency' because I-squared statistic suggests substantial heterogeneity.
[4]Calculated as inverse variance weighted average of control group measurements.

Summary of findings 2. Weight loss interventions involving diet, exercise and psychosocial support for overweight and obese breast cancer survivors

Weight loss interventions involving all three diet, exercise and psychosocial support for overweight and obese breast cancer survivors

Patient or population: overweight and obese breast cancer survivors
Setting: various settings (individual or group-based, in-person or remote, exercise centre or external location)
Intervention: weight loss interventions involving the following components: diet, exercise and psychosocial support
Comparison: control programs (usual care, wait-list, written materials or placebo)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (treatment-comparisons)	Quality of the evidence (GRADE)	Comments
	Risk with control programs	Risk with All weight loss interventions				

Overall survival	-	-	-	-	-	No trials reported this outcome as time-to-event data.
Breast cancer recurrence	-	-	-	-	-	Subroup analyses not performed for this outcome (insufficient number of studies per subgroup).
Change in body weight	The mean body weight loss[3] was 0.97 kg	MD 2.88 kg lower (3.98 lower to 1.77 lower)	-	1526 (13)	⊕⊕⊖⊖ LOW [1 2]	Heterogeneity: P < 0.0001, I^2 = 69%.
Change in BMI	The mean BMI reduction[3] was 0.41 kg/m^2	MD 1.44 kg/m^2 lower (2.16 lower to 0.72 lower)		1187 (11)	⊕⊕⊖⊖ LOW [1 2]	Heterogeneity: P < 0.0001, I^2 = 89%.
Change in waist circumference	The mean waist circumference[3] reduction was -0.33 cm (.i.e. 0.33 cm increase)	MD 1.66 cm lower (3.49 lower to 0.16 lower)	-	1021 (8)	⊕⊕⊖⊖ LOW [1 2]	Heterogeneity: P < 0.0001, I^2 = 79%.
Disease-free survival - not reported	-	-	-	-	-	No trials reported this outcome.
Adverse events	-	-	-	-	-	Subroup analyses not performed for this outcome (insufficient number of studies per subgroup).
Change in quality of life - overall scales	-	-	-	-	-	Subroup analyses not performed for this outcome (insufficient number of studies per subgroup).

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).
CI: Confidence interval; **RR:** Risk ratio; **OR:** Odds ratio;

GRADE Working Group grades of evidence

High quality: further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: we are very uncertain about the estimate.

[1]Quality of evidence downgraded one level for 'risk of bias' because > 20% attrition of randomised participants for measurement of this outcome at follow-up and because most studies were unblinded for participants, personnel and assessment of patient-reported outcomes.
[2]Quality of evidence downgraded one level for 'inconsistency' because I^2 statistic suggests substantial heterogeneity.
[3]Calculated as inverse variance weighted average of control group measurements.

BACKGROUND

Description of the condition

Breast cancer is the second most common cancer worldwide, with >2 million new cases diagnosed in 2018 (Bray 2018). With early diagnosis, and an increase in the use of neoadjuvant and adjuvant chemotherapy, hormonal therapy and immunotherapy, survival rates have continued to improve (IARC of WHO 2012). The five-year survival rate for breast cancer is now 90% in North America (Siegal 2019), and 87% in England (Office for National Statistics 2013). In light of the rapid increase in the number of breast cancer survivors, there is a new emphasis on the need for appropriate survivorship care (Yu 2014).

In its broadest definition, a person becomes a cancer survivor when they are diagnosed with cancer, and remain a survivor for the rest of their life (Centers for Disease Control and Prevention 2011). Approximately 50% of breast cancer survivors worldwide are classified as overweight or obese (57% to 66% in the USA (Coups 2005; Morimoto 2002; Imayama 2013), 55% in Switzerland (Eichholzer 2012) and 42% in Mexico (Ortiz-Mendoza 2014)). Many breast cancer survivors gain more body weight after primary neoadjuvant or adjuvant treatment (Arce-Salinas 2014; Kann 2014; Kim 2013; Vance 2011; Vagenas 2015) and hormonal therapy (Lorizio 2012).

Being overweight or obese is defined as having an abnormal or excessive amount of total body fat, that may affect health status (WHO 2015). It is usually measured by Body Mass Index (BMI (kg/m^2)), with overweight BMI classified as ranging from 25 to 29.9 kg/m^2, obesity as a BMI of 30 kg/m^2 and above, and morbid obesity as a BMI of 40 kg/m^2 and above (WHO 1997).

Body fat is composed mostly of adipocytes and other cells including preadipocytes, fibroblasts, vascular endothelial cells and a variety of immune cells. It can store energy, and cushion and insulate the body. It has been recognised as a major endocrine organ (Ferlay 2015; Kershaw 2004) as it produces hormones such as leptin, oestrogen, and the cytokine tumour necrosis factor alpha (TNF-α), which stimulates insulin secretion leading to insulin resistance (Rock 2013; Su H 2013). Research has demonstrated that breast cancer survivors that achieve a weight loss of < 5% of their initial weight have higher levels of oestrogen and leptin, and lower levels of adiponectin than those who achieve a weight loss of ≥ 5% of their initial weight (Rock 2013).

Studies suggest that women who are overweight or obese are at an increased risk of cancer recurrence, and higher all-cause mortality (Dignam 2003; Demark-Wahnefried 2018a; Ewertz 2011). Obesity has been found to increase the risk of total mortality by 17%, and 18% for breast cancer-specific mortality, for every 5 kg/m^2 increment before their cancer diagnosis (Chan 2014). In addition, morbid obesity may be a prognostic factor for diabetes and cardiovascular disease (Vance 2011). Obesity also has a significant impact on a woman's quality of life (QOL) and ability to function in relation to everyday activities (Imayama 2013). Hence, many cancer guidelines recommend survivors maintain a healthy weight (Ligibel 2014; World Cancer Research Fund 2019).

Description of the intervention

A number of interventions have been adopted into clinical practice for breast cancer survivors who are morbidly obese, to reduce body weight and maintain it within a healthy weight range (BMI of 18.5 to 24.9 kg/m^2). These include: physical activity programmes (Thomas 2013), dietary changes (Pierce 2009), medication (Goodwin 2011) and bariatric surgery (Philip 2015). The weight loss approach selected needs to be matched to an individual patient's needs, comorbidities, and risk profile. The most common first-line strategy used for weight loss is comprehensive lifestyle modification. The basic components are to facilitate energy deficiency through increased physical activity and reduced calorie intake, generally with the goal of losing 3% to 5% of initial body weight for at least six months.

Individually-tailored physical activity programmes generally consist of a combination of resistance or weight load (strength training) with aerobic exercises (such as walking, jogging, running, cycling, swimming, dancing etc.). Recommendations are to undertake at least 150 minutes per week of activity of moderate intensity (Cormie 2018; Rock 2012; Subirats Bayego 2012; U.S. Department of Health and Human Services 2008).

Weight loss diets have been designed to provide a balanced diet with low energy intake of 1200 to 1500 kilocalories per day (kcal/d) for women and 1500 to 1800 kcal/d for men (Jensen 2014) (or 1000 to 1600 kcal/d for a low-calorie diet (Commonwealth of Australia 2013)) for the management of overweight and obesity in adults. This can be achieved through a low-fat, high-fibre diet. A very-low-calorie diet (< 800 kcal/d) may be appropriate if supervised in a medical setting. Behavioural, psychological and/or social interventions are often used in conjunction with exercise and dietary interventions.

Physical activity and weight loss dietary programmes are usually administered in medical clinics, at home or in gyms. They can be conducted face-to-face, by telephone or through web sites (Rogers 2008).

Pharmacotherapy can be used either as an adjunct to comprehensive lifestyle modification, or in isolation for cancer survivors who cannot participate in lifestyle programmes due, for example, to comorbidities limiting their physical activity. Medications such as sibutramine and orlistat are most commonly used to achieve or maintain weight reduction in those with a BMI of 30 or above, or BMI of 27 or above in the presence of obesity-related comorbidities (e.g. diabetes, cardiovascular diseases) (Jensen 2014). Sibutramine has been associated with an increased risk of elevated blood pressure and tachycardia (fast heart rate), while orlistat can lead to gastrointestinal side effects, deficiency of fat-soluble vitamins (e.g. vitamins A, D, E and K), and interactions with other medications, e.g. warfarin (National Health and Medical Research Council 2013).

Bariatric surgery may be considered for individuals with a BMI of at least 40, or a BMI of 35 or above with high-risk comorbidities (Jensen 2014) who have not responded to behavioural treatments, with or without pharmacotherapy. Bariatric surgery includes a variety of procedures where the aim is to achieve weight loss by reducing the size of the stomach using a gastric band, or removing a portion of the stomach (sleeve gastrectomy or biliopancreatic diversion with duodenal switch), or by resecting and re-routing

the small stomach pouch (gastric bypass surgery) to the small intestine. Bariatric surgical interventions should be performed only in highly-selected patients and in specialist centres by experienced surgeons. Patients need to be fully informed about the potential risks and side effects. Adverse effects include misplacement of the band, erosion of the gastric wall, port complications, anastomotic leak, wound complications, haemorrhage, pulmonary embolism, deep vein thrombosis, deficiency of nutrients or malnutrition, elevated parathyroid hormone, ventral hernia and, occasionally, death (Jensen 2014).

In this Cochrane Review, we will include randomised controlled clinical trials (RCTs), in which the participants are randomly allocated to one or other of the different treatments under study. We will evaluate several types of comparator interventions such as placebo medications and supportive treatments (e.g. vitamins), as well as evidence-based positive controlled interventions (e.g. increased physical activity and diet modification regimens).

How the intervention might work

Obesity after a breast cancer diagnosis is known to be a poor prognostic risk factor, particularly for postmenopausal women (Chan 2014). This may be due to changes in energy metabolism secondary to the side effects of chemotherapy treatment (Gadea 2013). There is likely to be higher than normal oestrogen conversion and secretion in excess body fat tissue and less sex hormone binding globulin in the circulation (Siiteri 1987), which will increase stimulation to breast tissue. Elevation of inflammatory cytokines such as TNF-α, interleukin-6 (IL-6) and adipokines such as leptin (Khandekar 2011) in adipose tissue can activate cancer cells by activating oncogenic transcription in breast tissue, and a fall in adiponectin decreases the inhibition of proliferation and metastasis of breast tumour cells. Finally, high insulin levels and insulin resistance (Oh 2011) may exacerbate the loco-regional metabolic microenvironment leading to an imbalance in homeostasis, with a depletion of oxygen, and energy dysfunction in localised breast lesions, which are considered to be an ideal microenvironment for tumour recurrence.

Under normal circumstances, obesity occurs when energy expenditure is less than the energy intake over a period of time (Davoodi 2013). However morbidly obese breast cancer survivors are often characterised by fat gain and loss of lean tissue (Vance 2011). The loss of muscle mass in the setting of increased body fat is known as sarcopenic obesity. This is a multifactorial condition. In addition to the metabolic and neuroendocrine alterations that may be induced by chemotherapy and genetics, other lifestyle-dependent factors such as inactivity are likely to be important risk determinants (Davoodi 2013). Other causes such as psycho-social and environmental factors may also play a role in the excess accumulation of adipose tissue (Deusinger 2012; Mastorakos 2010; Nahas 2012; Waxler-Morrison 1991).

Physical activity promotes blood circulation and oxygen concentration, and reduces the concentration of plasma cytokines and inflammatory factors (nuclear factor kappa B (NF-κB), IL-6, C-reactive protein (CRP)), insulin-like growth factor (IGF); (Imayama 2013; Jones 2013), leptin (Iantorno 2014), and hormones (insulin and oestrogens) (Borer 2014; Rock 2004). Exercise can also improve body composition (Guinan 2013). Studies of dietary modification suggest that exercise has positive effects on loss of excess body weight and weight loss maintenance for breast cancer survivors (Carpenter 2012; Reeves 2014). These effects may be helpful in improving the local breast microenvironment. In addition, management of body weight may have preventative effects on secondary events associated with breast cancer such as type 2 diabetes, cardiovascular disease, dyslipidaemia and other comorbidities (Jensen 2014; Patnaik 2011). Loss of body weight can also have a positive impact on psychosocial well being (Demark-Wahnefried 2012b; Dignam 2003; Imayama 2013).

Over-the-counter medications for obesity in the non-cancer population may reduce excess body weight by decreasing macronutrient absorption (orlistat) and suppressing appetite (sibutramine) (National Health and Medical Research Council 2013). Bariatric surgery results in weight loss through limiting food intake or diminishing the area available for digestion and absorption in the gastrointestinal tract (Bordalo 2011). However, there is a lack of evidence for use of these weight loss methods in breast cancer survivors.

Why it is important to do this review

Changes in body weight associated with cancer treatment have been noted for decades (Dixon 1978). Studies indicate that body weight changes can occur in either direction, with weight gain or loss (Vagenas 2015). This heterogeneity may be associated with complex factors in breast cancer survivors, including: genetic predisposition (Slattery 2015), socio-demographic factors (Sedjo 2014; Thompson 2014), menopausal status (Irwin 2007), hormone receptor status (Ewertz 2012), clinical presentation (tumour size, histological grade and degree of differentiation, lymph node metastasis) and treatment modality.

Cancer survivors gain weight mainly through sedentary and inactive lifestyles, with a peak in the third year, when followed for six years, after diagnosis (Makari-Judson 2014; Vagenas 2015). Studies suggest that body weight loss of more than 5% is feasible for obese or overweight breast cancer survivors (Davoodi 2013; Vitolins 2014). However, many studies have been observational in design (Makari-Judson 2014), with a paucity of high-quality evidence from clinical interventions to guide effective body weight management for cancer survivors. Consequently, body weight reduction is frequently not addressed in overweight breast cancer survivors (Chan 2014). There is a need to synthesise the evidence in terms of which modality to recommend, at what intensity, and for which group of participants. In this review, we aim to assess the benefits, risks and efficacy of different body weight loss approaches in overweight breast cancer survivors in order to guide survivors, clinicians, and policy makers associated with survivorship care.

OBJECTIVES

To assess the effects of different body weight loss approaches in breast cancer survivors who are overweight or obese (body mass index (BMI) ≥ 25 kg/m^2).

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials (RCTs), quasi-RCTs and randomised cross-over trials that evaluated body weight loss for overweight and obese breast cancer survivors. No restrictions were

based on the language of the publication. We translated studies published in other languages into English.

Types of participants

This review included overweight or obese breast cancer survivors diagnosed with early stage breast cancer with no evidence of a recurrence of their cancer. Participants could have had surgery and/or be receiving or have received adjuvant chemotherapy and/or radiotherapy, adjuvant hormonal treatment and/or targeted therapies such as trastuzumab for women with HER2+ status. Whilst the protocol stated that ductal carcinoma in situ (DCIS) was excluded, many studies included some patients with DCIS. We included cohorts that had < 10% of participants with DCIS. No restrictions were placed on participants' residence, race or ethnicity, occupation, gender, religion, education, socio-economic status (SES), or time from diagnosis.

Types of interventions

The experimental interventions could involve the following.

- Physical activity that included exercise as well as other activities involving body movements done as part of playing, working, active transportation, household chores and recreational activities (WHO 1997). This could include physical activity programmes alone, or in combination with various other treatments. There were no limitations on the setting, duration and delivery of the physical activity programme, but the aim of the intervention had to be weight loss.
- Dietary interventions that adhered to a foundation diet, with the goal of losing 3% to 5% of body weight (Jensen 2014). Categories included a low-calorie diet (< 1200 kcal/d) and very-low-calorie diet (< 800 kcal/d), based on participants' needs and risk factors. There were no restrictions on dietary type.
- Drugs aimed primarily at reducing obesity such as: orlistat; sibutramine; L-carnitine, or other drugs such as metformin used for secondary event prevention.
- Social, psychological, and behavioural interventions aimed at improving the social environment, and cognitive and behavioural factors in relation to weight loss.
- Bariatric surgery, which may include a variety of surgical procedures including gastric banding, removal of a portion of the stomach, or gastric bypass surgery.
- Multifactorial interventions with a combination of the following regimens: physical activity ± diet intervention ± obesity drug ± bariatric surgery ± social, psychological, and behavioural interventions.

The control interventions of comparisons included: placebo, no treatment or waiting list, supportive treatments such as vitamins or minerals, or both, conventional treatments or active control interventions to prevent the recurrence of cancer.

We grouped the comparisons by interventions and controls in the pooling.

We included studies with co-interventions if they were applied in exactly the same way to both the control and intervention group.

Types of outcome measures

Primary outcomes

- Overall survival: generally defined in RCTs as time elapsed between randomisation (or study enrolment or intervention initiation) to date of death from any cause.
- Breast cancer recurrence: generally defined in RCTs as time elapsed between randomisation (or study enrolment or intervention initiation) and event, with event defined as disease recurrence.

Secondary outcomes

- Change in body weight (from baseline weight).
- Change in body mass index (BMI).
- Change in skinfold thickness.
- Change in waist circumference.
- Disease-free survival:generally defined in RCTs as time elapsed between randomisation (or study enrolment or intervention initiation) and event, with event defined as disease recurrence or death from any cause.
- Adverse events such as exacerbation of symptoms (pain, fatigue, nausea, dyspnoea), falls and bone fractures.
- Change in quality of life (QOL) and patient-reported outcomes, as defined by the perceived quality of an individual's daily life. This included emotional, social and physical, domains. We included data from self-administered structured questionnaires including participants' self-reported socio-demographic (race/ethnicity) and medical characteristics (menopausal status) and QOL.
- Changes in concentration of oestradiol, androgen, insulin, insulin-like growth factor (IGF), fasting glucose and lipids profile.
- Changes in adipokine concentrations: plasma leptin, adiponectin.
- Changes in inflammatory marker concentrations: IL-6, TNF-α, CRP.

'Change in BMI' was not listed as an outcome in the protocol, but was added after it became apparent that many studies were reporting this outcome. 'Crude death rates' were incorrectly listed as a secondary outcome in the protocol. However, this has been removed from the list above as 'crude death rates' are group summary statistics corresponding to the outcome of death (or time to death) which is already listed as a primary outcome.

Main outcomes for 'Summary of findings' tables

According to the protocol the following outcomes were to be included in the 'Summary of findings' table(s).

- Overall survival.
- Breast cancer recurrence.
- Adverse events.
- Change in body weight.
- Disease-free survival.
- Mortality.
- Change in skinfold thickness.
- Change in waist circumference.

However due to no trials reporting time-to-event data for overall survival and no trials reporting disease-free survival

or skinfold thickness, the following outcomes were included comparing all weight loss interventions (diet, exercise and/or psychosocial) versus comparators (usual care, written materials, wait-list, placebo or active control).

- Overall survival
- Breast cancer recurrence
- Change in body weight
- Change in BMI
- Change in waist circumference
- Disease-free survival
- Adverse events
- Change in quality of life (overall scales).

Search methods for identification of studies

Electronic searches

We searched the following databases to obtain relevant studies. No language restrictions were applied to the search.

1. The Cochrane Breast Cancer Group's (CBCG's) Specialised Register on 25 June 2019. Details of the search strategies used by the Group for the identification of studies and the procedure used to code references are outlined in the Group's module (http://www.mrw.interscience.wiley.com/cochrane/clabout/articles/BREASTCA/frame.html). Trials with the key words 'breast cancer survivor', 'survivorship', 'breast cancer', 'obesity', 'overweight', 'body weight management', 'weight loss', 'weight reduction', 'body mass index', 'lifestyle intervention', 'lifestyle activity', 'exercise', 'diet', 'bariatric surgery', 'obesity medication', 'behavior', 'drug therapy' and 'cognitive therapy' were extracted and considered for inclusion in the review.
2. Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, 2019, Issue 6. See Appendix 1.
3. MEDLINE (2012 to 17 June 2019) (via OvidSP). See Appendix 2.
4. Embase (2015 to 17 June 2019) (via OvidSP). See Appendix 3.
5. The WHO International Clinical Trials Registry Platform (ICTRP) search portal (http://apps.who.int/trialsearch/Default.aspx) for all prospectively registered and ongoing trials on 17 June 2019. See Appendix 4.
6. Clinicaltrials.gov (http://clinicaltrials.gov/) on 17 June 2019. See Appendix 5.
7. Mainland Chinese academic literature databases using keywords in Chinese: CNKI (via http://www.cnki.net/) (1979 to 25 June 2019); VIP (http://edu.cqvip.com/) (1989 to 25 June 2019); Wan Fang Data (http://www.wanfangdata.com.cn/) (1980 to 25 June 2019); SinoMed (http://www.sinomed.ac.cn/zh/) (1978 to 25 June 2019).

Searching other resources

Bibliographic searching

We attempted to identify further studies from reference lists of identified relevant trials or reviews. A copy of the full article for each reference reporting a potentially-eligible trial was obtained. Where this was not possible, we attempted to contact authors to obtain additional information.

We handsearched the retrieved articles and bibliographies in order to identify other potentially-eligible studies and unpublished data.

Data collection and analysis

Selection of studies

Two review authors (HS and PB) independently screened the titles and abstracts. HS and PB obtained full-text copies of the relevant articles and included the eligible studies in accordance with the inclusion criteria. During this process any disagreements were resolved by consensus and by the involvement of other review authors (SYT and JV). We recorded excluded trials in the 'Characteristics of excluded studies' table.

Data extraction and management

Data were collected in accordance with the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011) based on the inclusion criteria.

Data were extracted from eligible studies using a data extraction form designed and pilot-tested by the review authors. We collected the following information: study design, participants, setting, interventions, outcomes, follow-up, and any other items relevant to this review. Where studies had multiple publications, the main trial report was used as the primary reference and additional details supplemented from all papers. Two review authors (HS and PB) independently extracted the data, and any uncertainties were discussed with other authors (SYT and JV). We contacted study authors if required.

Assessment of risk of bias in included studies

Two review authors (HS and PB) assessed the risk of bias in the included studies using Cochrane's 'Risk of bias' assessment tool. Relevant items included: sequence generation; allocation concealment; blinding of participants and personnel; blinding of outcome assessors; completeness of outcome data; selective outcome reporting; and other potential sources of bias. Two review authors (HS and PB) assessed these 'Risk of bias' domains independently, with any disagreements resolved by consensus or by discussion with other review authors (SYT and JV). All judgments were described in the 'Risk of bias' tables and classified as 'low risk', 'high risk', and 'unclear risk'. The results were incorporated into the interpretation of review findings by means of sensitivity analyses.

Measures of treatment effect

For time-to-event outcomes, the hazard ratio (HR) is the most appropriate measure of effect. However, no time-to-event data were available for extraction.

Dichotomous outcomes were analysed as proportions using the risk ratio (RR) as the measure of effect. Pooled RRs and 95% confidence intervals (CIs) were obtained through Mantel-Haenszel random-effects analysis.

Continuous data (including change in body weight, waist circumference, BMI, levels of hormones, cytokines and adipokines, and metabolic effects) were analysed as means with the measure of effect being the mean difference (MD) between treatment groups in change from baseline values, when all studies reported outcomes on the same scale. If similar outcomes were reported on different scales (for example, change in QOL) the standardised

mean difference (SMD) was used as the measure of effect. Pooled MDs and SMDs and 95% CIs were obtained through inverse variance random-effects analysis.

Unit of analysis issues

Intervention-comparisons were the unit of analysis in this review and corresponded to pairwise comparisons of intervention and control groups. Individual studies assessing more than one intervention group or more than one control group (or both) contributed more than one intervention-comparison to the review. Consequently, there were more intervention-comparisons in this review than there were studies.

One study contained three intervention groups (Djuric 2002a;Djuric 2002b;Djuric 2002c) for comparison against a single control group, and another study contained two intervention groups (Demark-Wahnefried 2014a;Demark-Wahnefried 2014b) for comparison against a single control group. This was taken into account when treatment effect statistics were calculated by reducing the number of participants in the control groups proportional to the number of intervention-comparisons. These methods for correcting for multiple intervention and/or control groups were suggested in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

Cross-over trial designs were eligible for inclusion, but only data collected from the first stage were used in meta-analysis.

Dealing with missing data

If the results of an RCT were published but information on an outcome of interest had not been reported, an attempt was made to contact the trial authors for the missing information (a number of studies provided additional results sufficient for extraction).

With regards to missing outcome data from individual participants, we chose not to impute best/worst case values because this method may not be informative for the most plausible scenarios, particularly for continuous outcomes with no limits to their potential values (Deeks 2019). Moreover, missing outcome data from individual participants probably had a limited impact on effect estimates in this review because attrition was similar in the intervention and control groups (Table 1).

Assessment of heterogeneity

Heterogeneity between trial results was assessed using the Chi^2 test statistic and the I^2 statistic. The Chi^2 test statistic assesses the amount of variation in a set of trials. Small P values for the Chi^2 test statistic suggest that there is more heterogeneity present than would be expected by chance. Chi^2 is not a particularly sensitive test: a cut-off of P value less than 0.10 is often used to indicate significance, but lack of statistical significance does not mean there is no heterogeneity. I^2 is the proportion of variation that is due to heterogeneity rather than chance. In conjunction with the Chi^2 test, we used the I^2 statistic to assess heterogeneity using the rule of thumb guide outlined in the *Cochrane Handbook* (Higgins 2011) (i.e. an I^2 between 0% to 40% might not be important; between 30% to 60% may represent moderate heterogeneity; between 50% to 90% may represent substantial heterogeneity; and between 75% to 100% considerable heterogeneity).

Assessment of reporting biases

In addition to assessing each intervention-comparison individually for 'selective reporting' using Cochrane's 'Risk of bias' assessment tool (see Assessment of risk of bias in included studies above), publication bias and/or small-study effects were assessed for outcomes with more than 10 or more intervention-comparisons. Egger's statistical test was used to formally assess the degree of asymmetry (Egger 1997).

Data synthesis

For binary outcomes, RevMan 5.3 was used to estimate pooled RRs and 95%CIs using the random-effects Mantel-Haenszel method. For continuous data, RevMan 5.3 was used to estimate pooled MDs or SMDs and 95%CIs using inverse variance random-effects analysis. No time to event data were available for pooling.

Subgroup analysis and investigation of heterogeneity

For outcomes with more than 10 or more intervention-comparisons, four subgroup analyses were performed to determine whether the results differed by the following.

- Intervention type versus control type:
  - diet versus usual care, wait-list, written materials or placebo;
  - diet + exercise versus usual care, wait-list, written materials or placebo;
  - diet + exercise + psychosocial versus usual care, wait-list, written materials or placebo;
  - diet + psychosocial versus active control (diet + psychosocial);
  - diet + exercise versus active control (diet + exercise).
- Ethnicity:
  - > 95% African descent;
  - > 95% White/Caucasian;
  - mixed (≤ 95% of any one ethnic group); or
  - unspecified.
- Menopausal status:
  - 100% postmenopausal women;
  - mix of pre- and post-menopausal women; or
  - unspecified.
- Duration of follow-up (months):
  - ≤ 6 months;
  - > 6 months;
  - ≤ 12 months;
  - > 12 months.

Possible subgroup differences were assessed using Chi^2 tests. Of the above four subgroup analyses, subgroup analyses of intervention type, ethnicity and menopausal status were 'a priori' subgroup analyses pre-specified in the review protocol while the subgroup analysis on duration of follow-up was 'post hoc'.

A number of other subgroup analyses pre-specified in the review protocol were not performed because data relating to the subgroup characteristic were insufficient or participants characteristics relating to the subgroups varied substantially within studies (making subgroup analysis vulnerable to ecological bias).

Sensitivity analysis

To assess the sensitivity of our primary results to our choice of analytical method, we repeated Analysis 1.2, Analysis 1.3 and Analysis 1.4 (the outcomes with the most intervention-comparisons) but using fixed-effect rather than random-effects methods.

Summary of findings and assessment of the certainty of the evidence

We used the standard GRADE system to rate the quality of evidence relating to the estimated treatment effects on breast cancer recurrence, change in body weight, change in BMI, change in waist circumference, adverse events and change in quality of life (overall scales). GRADE criteria for assessing quality of evidence included 'study design', 'risk of bias', 'inconsistency', 'indirectness', 'imprecision', 'suspected publication bias' and 'other considerations' (Schünemann 2011). Assessments of these criteria and corresponding justifications are provided in two 'Summary of findings' tables largely created using GRADEproGDT. GRADE assessments were performed separately for selected subgroups related to effect estimate heterogeneity (or 'inconsistency' as labelled in the GRADE assessment criteria).

We used GRADEproGDT software (GRADEproGDT) to produce 'Summary of findings' tables to illustrate the main outcomes and grade the quality of the evidence.

Four grades of evidence were used, as recommended by the GRADE Working Group, as follows.

- High quality: further research is very unlikely to change our confidence in the estimate of effect.
- Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
- Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- Very low quality: we are very uncertain about the estimate.

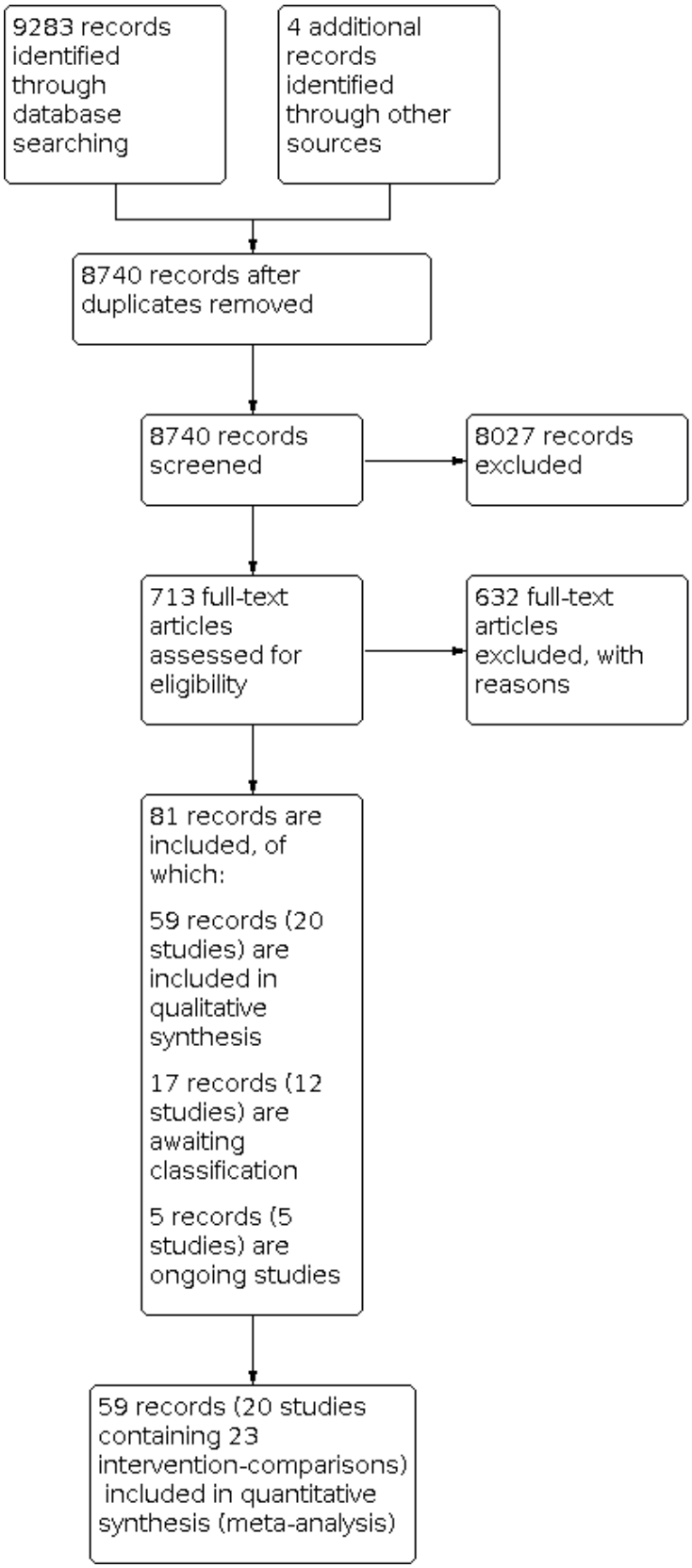
RESULTS

Description of studies

Results of the search

See Figure 1 .

Figure 1. Study flow diagram.



We identified 9283 records from a comprehensive literature search conducted on 17 June 2019 (English database search) and 25 June 2019 (Chinese database search) (Figure 1). A further four records were identified through other sources including correspondence with authors and bibliographic searching. We identified and removed 547 duplicates, leaving 8740 records. Of these records, 8027 were excluded by the title and abstract screen, and 713 records were subsequently full-text screened. Of these records, 632 were excluded by the full-text screen, with reasons provided (refer to Characteristics of excluded studies). Of the remaining 81 records, 59 records (corresponding to 20 studies containing 23 intervention-comparisons) were included in the qualitative and quantitative synthesis (refer to Characteristics of included studies), 17 records (corresponding to 12 studies) were awaiting classification (refer to Characteristics of studies awaiting classification) and five records (corresponding to five studies) were ongoing studies (refer to Characteristics of ongoing studies). No studies from the Chinese searches met the inclusion criteria for our review.

Included studies

In total, 20 studies comprising 23 intervention-comparisons were included in this review (refer to Characteristics of included studies table). The principal publications of these 20 studies are: Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Dittus 2018; Djuric 2002a; Ferrante 2017; Ghavami 2017; Goodwin 2014; Greenlee 2013; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Shaw 2007; Sheppard 2016; Stendell-Hollis 2010; Stolley 2017; Swisher 2015; Thomson 2010. There were two intervention-comparisons for the DAMES (Daughters And MothErS Against Breast Cancer) trial (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b), and three intervention-comparisons for the ABC (Weight Loss After Breast Cancer Diet Study) trial (Djuric 2002a; Djuric 2002b; Djuric 2002c). Where applicable, we contacted authors for further data for this review, and received additional data regarding the following intervention-comparisons: Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ferrante 2017; Kwiatkowski 2017.

Of the 23 intervention-comparisons included in this review (Table 1):

- no time-to-event data for pooled hazard ratio (HR) estimation were extractable for 'overall survival', 'disease-free survival' or 'breast cancer recurrence'. One intervention-comparison (Rock 2015) reported the number of deaths in each arm during the 24-month follow-up period. Four intervention-comparisons (Greenlee 2013; Mefferd 2007; Sheppard 2016; Kwiatkowski 2017) reported the number of breast cancer recurrences in each arm during their respective maximum follow-up periods (6, 4, 3 and 36 months, respectively). Hence, we performed a meta-analysis of the 'breast cancer recurrence' outcome, but with risk ratios (RRs) rather than HRs as the measure of effect.
- 21 (91%) were included in meta-analysis for 'change in body weight', 17 (74%) for 'change in BMI' and 13 (57%) for 'change in waist circumference'.
- 10 (43%) were included in meta-analysis for 'change in overall QOL', 10 (43%) for 'change in QOL physical subscales', 6 (26%) for 'change in QOL social subscales', 8 (35%) for 'change in QOL emotional subscales' and 3 (13%) for both 'change in QOL mental health subscales' and 'change in QOL anxiety and depression subscales'
- 6 (26%) were included in each meta-analysis for 'change in insulin', 'change in glucose', 'change in total cholesterol', 'change in high-density lipoprotein (HDL) cholesterol', 'change in low-density lipoprotein (LDL) cholesterol' and 'change in triglycerides', and 3 (13%) for 'change in leptin'.
- 4 (17%) were included in meta-analysis for adverse events.

The 23 intervention-comparisons included in this review can be subdivided according to the types of interventions and controls as follows:

- 3 (13%) compared diet-only interventions to controls consisting of usual care, wait-list, written materials or placebo (Djuric 2002b; Shaw 2007; Stendell-Hollis 2010);
- 3 (13%) compared interventions consisting of both diet and exercise to controls consisting of usual care, wait-list, written materials or placebo (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Greenlee 2013);
- 15 (65%) compared interventions consisting of all three of diet, exercise and psychosocial support to controls consisting of usual care, wait-list, written materials or placebo (Demark-Wahnefried 2012a; Dittus 2018; Djuric 2002a; Djuric 2002c; Ferrante 2017; Ghavami 2017; Goodwin 2014; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Sheppard 2016; Stolley 2017; Swisher 2015);
- 1 (4%) compared an intervention group consisting of both diet and psychosocial support to an active control group also consisting of both diet and psychosocial support (Thomson 2010);
- 1 (4%) compared an intervention group consisting of both diet and exercise to an active control group also consisting of both diet and exercise (Arikawa 2017).

Excluded studies

We excluded 632 reports in the full-text screen and reasons for exclusion were provided for a subset of reports (i.e. 158 reports; refer to the Characteristics of excluded studies table). Common reasons for exclusion included trials where the aim of the intervention was not weight loss, trials with participants who were not overweight or obese (BMI <25 kg/m^2), trials not reporting outcomes relevant to this review (e.g. anthropometric measures), and trials with the wrong study design (e.g. non-randomised trials).

Risk of bias in included studies

Allocation

Random sequence generation

All 23 intervention-comparisons were randomised, as this was an inclusion criteria for this review. Of these, 11 intervention-comparisons provided sufficient details on the method of randomised sequence generation to be judged as having a low risk of bias (Arikawa 2017; Demark-Wahnefried 2012a; Ferrante 2017; Ghavami 2017; Goodwin 2014; Kwiatkowski 2017; Reeves 2016; Rock 2015; Shaw 2007; Stendell-Hollis 2010; Stolley 2017) (Figure 2). The remaining 12 intervention-comparisons did not provide sufficient details on sequence generation and were therefore judged to have an unclear risk of bias (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b;

Djuric 2002c; Greenlee 2013; Mefferd 2007; Scott 2013; Sheppard 2016; Swisher 2015; Thomson 2010).

Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

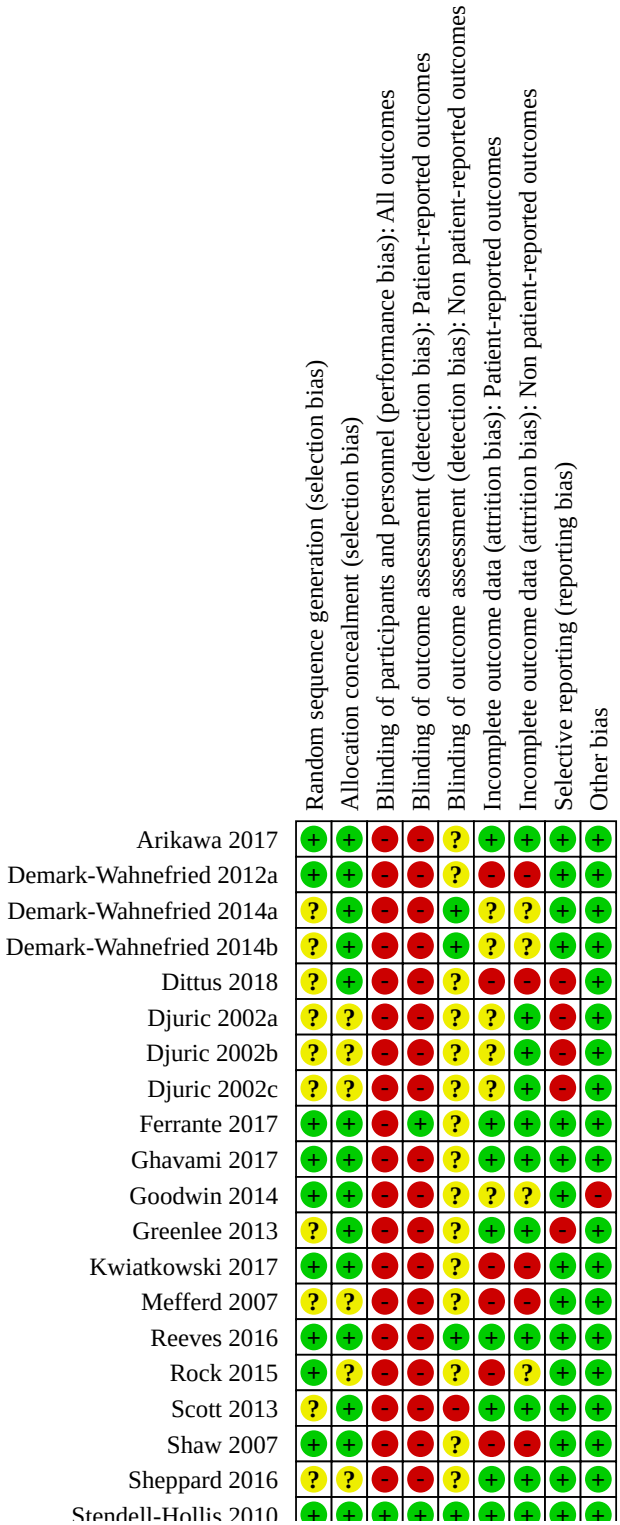
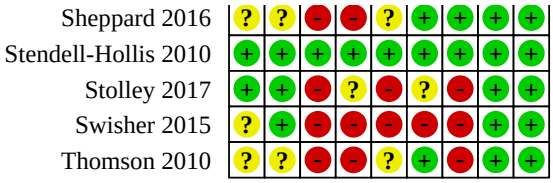


Figure 2. (Continued)



Allocation concealment

Sixteen out of the 23 intervention-comparisons described their method of allocation concealment and were judged to have a low risk of bias (Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Ferrante 2017; Ghavami 2017; Goodwin 2014; Greenlee 2013; Kwiatkowski 2017; Reeves 2016; Scott 2013; Shaw 2007; Stendell-Hollis 2010; Stolley 2017; Swisher 2015). The remaining seven intervention-comparisons did not describe their method of allocation concealment and were therefore judged as having an unclear risk of bias (Djuric 2002a; Djuric 2002b; Djuric 2002c; Mefferd 2007; Rock 2015; Sheppard 2016; Thomson 2010).

Blinding

Blinding of participants and personnel

Only one intervention-comparison was judged to be at low risk of bias for blinding of participants and personnel (Stendell-Hollis 2010). This was a trial comparing two different types of tea, and was described as being 'double-blind'. The remaining 22 intervention-comparisons were judged to be at a high risk of bias (Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ferrante 2017; Ghavami 2017; Goodwin 2014; Greenlee 2013; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Shaw 2007; Sheppard 2016; Stolley 2017; Swisher 2015; Thomson 2010). Blinding of participants would have been difficult due to the nature of most interventions (e.g. one group receiving an active exercise or diet intervention or a psychosocial intervention, whilst the other group received usual care). Blinding of personnel was often not mentioned, although was mentioned to have occurred for some studies, but we still judged these intervention-comparisons to be at high risk of bias as participants were not blinded (with the exception of Stendell-Hollis 2010).

Blinding of outcome assessors

Regarding patient-reported outcomes, 20 intervention-comparisons were judged to have a high risk of bias (Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ghavami 2017; Goodwin 2014; Greenlee 2013; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Shaw 2007; Sheppard 2016; Swisher 2015; Thomson 2010). As outlined above, this related to difficulty blinding participants for many diet, exercise and psychological interventions. Two intervention-comparisons were judged to have a low risk of bias (Ferrante 2017; Stendell-Hollis 2010); with the former utilising an active control group and the latter reporting being 'double-blind'. One treatment comparison was judged to have an unclear risk of bias (Stolley 2017) as no patient-reported outcomes from this trial were applicable to this review.

Regarding non patient-reported outcomes, 16 intervention-comparisons were judged to have an unclear risk of bias (Arikawa 2017; Demark-Wahnefried 2012a; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ferrante 2017; Ghavami 2017; Goodwin 2014; Greenlee 2013; Kwiatkowski 2017; Mefferd 2007; Rock 2015; Shaw 2007; Sheppard 2016; Thomson 2010). In most cases, this was because the study did not mention blinding of assessors. Four intervention-comparisons were determined to have a low risk of bias because they reported that assessors were blinded (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Reeves 2016; Stendell-Hollis 2010). The remaining three intervention-comparisons were classified as having a high risk of bias (Scott 2013; Stolley 2017; Swisher 2015).

Incomplete outcome data

Regarding patient-reported outcomes, nine intervention-comparisons had a low risk of attrition bias (Arikawa 2017; Ferrante 2017; Ghavami 2017; Greenlee 2013; Reeves 2016; Scott 2013; Sheppard 2016; Stendell-Hollis 2010; Thomson 2010). These comparisons tended to have a relatively low dropout rate (often with reasons given for dropouts), conducted analyses of completers versus non-completers and utilised imputation for missing data. Seven intervention-comparisons were judged to have a high risk of attrition bias (Demark-Wahnefried 2012a; Dittus 2018; Kwiatkowski 2017; Mefferd 2007; Rock 2015; Shaw 2007; Swisher 2015). These trials tended to have higher dropout rates (which may have been significantly higher in one group) and did not conduct analyses to explore the cause and/or effects of this dropout (e.g. comparing completers and non-completers). The remaining seven intervention-comparisons were classified as having an unclear risk of bias (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Djuric 2002a; Djuric 2002b; Djuric 2002c; Goodwin 2014; Stolley 2017). For Demark-Wahnefried 2014a and Demark-Wahnefried 2014b, we contacted authors (and received) data regarding participants with stage I-III breast cancer, however this did not include the number lost to follow-up. In Djuric 2002a; Djuric 2002b and Djuric 2002c, nine out of 48 (19%) participants were lost to follow-up, with eight of these participants allocated to the three intervention groups (four, three and one for the different interventions) and one participant in the control group. The significance of this loss to follow-up was difficult to determine and therefore classified as 'unclear'. In Goodwin 2014, we could only extract data for participants with BMI ≥ 30 kg/m^2 and therefore could not determine the loss to follow-up in this group. Stolley 2017 did not contain any data regarding patient-reported outcomes for inclusion in our review.

Regarding non patient-reported outcomes, 11 intervention-comparisons were determined to have a low risk of bias due to the relatively low dropout rate and analysis of the impact of these non-completers (Arikawa 2017; Djuric 2002a; Djuric 2002b; Djuric 2002c;

Ferrante 2017; Ghavami 2017; Greenlee 2013; Reeves 2016; Scott 2013; Sheppard 2016; Stendell-Hollis 2010). Eight intervention-comparisons were allocated a high risk of bias, again mostly due to having higher dropout rates without any analysis regarding this loss to follow-up (Demark-Wahnefried 2012a; Dittus 2018; Kwiatkowski 2017; Mefferd 2007; Shaw 2007; Stolley 2017; Swisher 2015; Thomson 2010). The remaining four comparisons had an unclear risk of bias (Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Goodwin 2014; Rock 2015). For Demark-Wahnefried 2014a; Demark-Wahnefried 2014b and Goodwin 2014, we were unable to determine the number lost to follow-up. In Rock 2015, an analysis found that participants who dropped out were significantly heavier than completers at 12-month follow-up, however they were not statistically significantly heavier at baseline and six-month follow-up, and the overall dropout rate was relatively low.

Selective reporting

Eighteen intervention-comparisons were determined to have a low risk of reporting bias, as they conducted pre-planned analyses as per trial registries or protocols (Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Ferrante 2017; Ghavami 2017; Goodwin 2014; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Shaw 2007; Sheppard 2016; Stendell-Hollis 2010; Stolley 2017; Swisher 2015; Thomson 2010). The remaining five intervention-comparisons were determined to have a high risk of reporting bias (Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Greenlee 2013). For Dittus 2018 QOL data were not reported in the manuscript (despite it being mentioned in the registry), but the authors did provide these data on request. For Djuric 2002a; Djuric 2002b; Djuric 2002c, the trial mentioned collecting questionnaire data but did not present these data. For Greenlee 2013 the study mentioned that the main outcomes were reported, however it was unclear what (or why) other outcomes were omitted.

Other potential sources of bias

Twenty-two intervention-comparisons were determined to have a low risk of other potential sources of bias (Arikawa 2017; Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ferrante 2017; Ghavami 2017; Greenlee 2013; Kwiatkowski 2017; Mefferd 2007; Reeves 2016; Rock 2015; Scott 2013; Shaw 2007; Sheppard 2016; Stendell-Hollis 2010; Stolley 2017; Swisher 2015; Thomson 2010). One intervention-comparison was determined to have a high risk of other potential sources of bias (Goodwin 2014). For Goodwin 2014 the trial included participants with BMI ≥ 24 kg/m^2, and participants with BMI ≥ 25 kg/m^2 would be eligible for our review. However, we could only extract data for participants with BMI ≥ 30 kg/m^2.

Effects of interventions

See: **Summary of findings 1** All weight loss interventions for overweight and obese breast cancer survivors; **Summary of findings 2** Weight loss interventions involving diet, exercise and psychosocial support for overweight and obese breast cancer survivors

Overall survival

No time-to-event data for pooled hazard ratio (HR) estimation were extractable for 'overall survival'. One intervention-comparison (Rock 2015) reported the number of deaths in each arm during the 24-month follow-up period (0 deaths out of 348 intervention participants and five deaths out of 349 control participants). We are uncertain about the effect of these interventions on overall survival.

Breast cancer recurrence

No time-to-event data for pooled HR estimation were extractable for 'breast cancer recurrence'. However, four intervention-comparisons (Greenlee 2013; Mefferd 2007; Sheppard 2016; Kwiatkowski 2017) reported the number of breast cancer recurrences in each arm during their maximum follow-up periods (six, four, three and 36 months, respectively), and these data were pooled using meta-analyses (but with risk ratios (RRs) rather than HRs as the measure of effect). Of these four intervention-comparisons, all 281 randomised participants were analysed. Fourteen participants had recurrence of their breast cancer, with 10 of these participants being in the intervention group and the remaining four in the control group. We are uncertain about the effect of these interventions on breast cancer recurrence. There was no significant difference in the incidence of cancer recurrence between the intervention and control groups, with a RR of 1.95 (95% confidence interval (CI): 0.68 to 5.60, P = 0.21;low-quality evidence). There was no heterogeneity identified across trials (P = 0.60; I^2 = 0%) (Analysis 1.1).

Change in body weight

Twenty-two of 23 intervention-comparisons assessed change in body weight as an outcome, with 21 comparisons providing adequate data for pooling in meta-analyses. From these 21 intervention-comparisons, 1751 out of 2190 (80.0%) randomised patients were assessed at follow-up. The weight loss intervention appears to reduce body weight compared to the control group (mean difference (MD): -2.25 kg, 95% CI: -3.19 to -1.30, P < 0.00001; low-quality evidence), although there was considerable heterogeneity identified (P < 0.00001; I^2 = 69%) (Analysis 1.2;Figure 3; Figure 4).

Figure 3. Forest plot of comparison: 1 All weight loss interventions vs controls (no subgrouping), outcome: 1.2 Change in body weight [kg].

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**

Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%
Test for overall effect: Z = 4.67 (P < 0.00001)
Test for subgroup differences: Not applicable

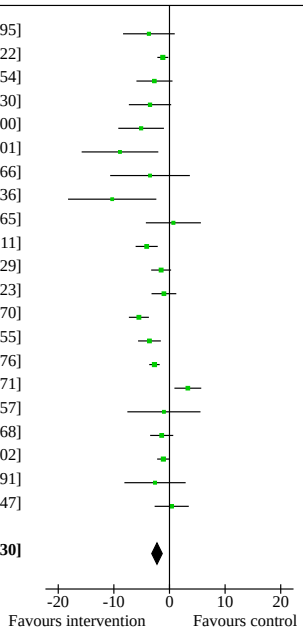
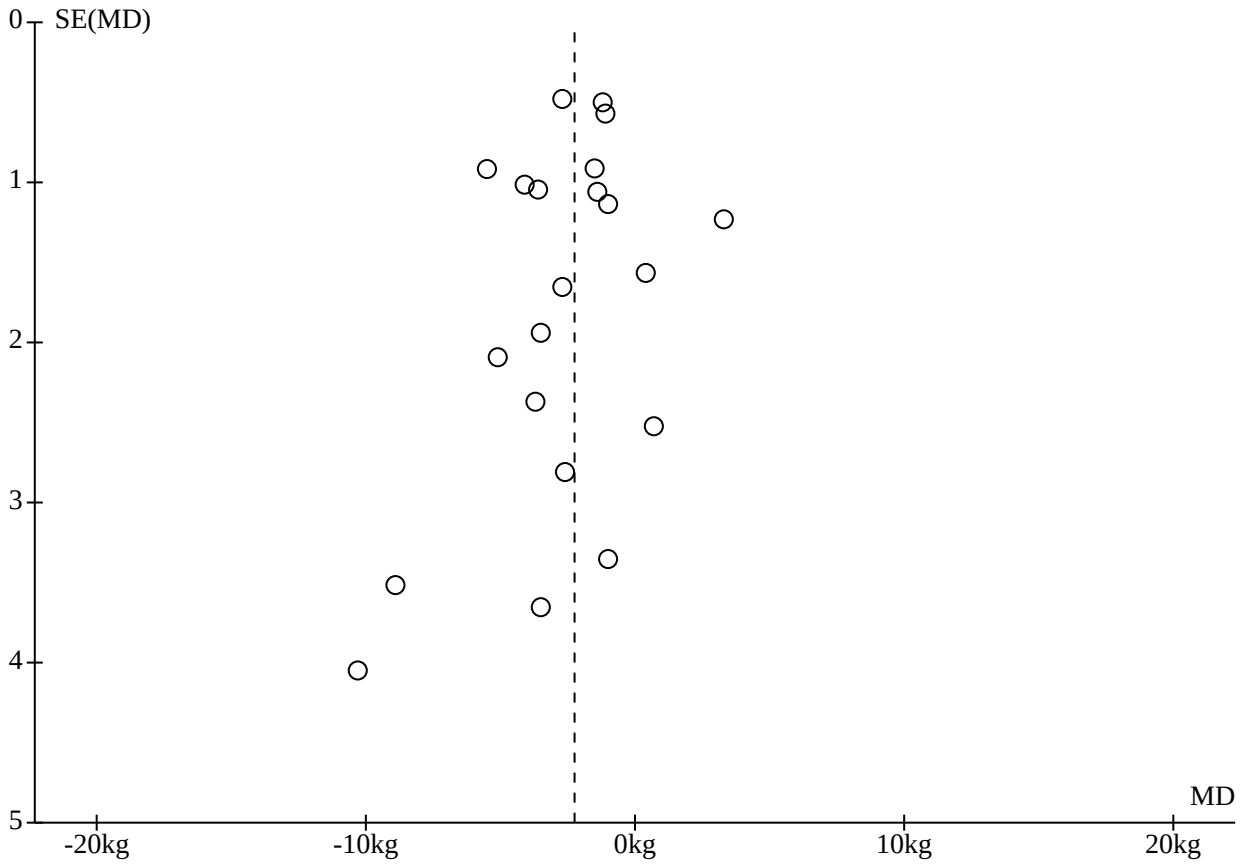


Figure 4. Funnel plot 1: Change in body weight [kg]. Assessing publication bias and/or small-study effects. Plot includes all intervention-comparisons with extractable data for change in body weight. The plot does not show substantial asymmetry (Egger's test P value 0.40).



Subgroup analyses

- There were no significant differences in change in body weight between the different subgroups of types of intervention (diet, diet + exercise, diet + exercise + psychosocial support) and control groups (active or passive control groups) (P = 0.21; I^2 = 32%). However, there was some suggestion that bimodal interventions such as combined diet and exercise interventions might perform better than diet interventions alone, and that multimodal interventions such as combined diet and exercise and psychosocial interventions might perform better than just diet and exercise (diet only: MD: 0.09 kg, 95% CI: -3.88 to 4.05, P = 0.006, heterogeneity P = 0.008, I^2 = 79%, 3 studies, 72 participants; diet + exercise: MD: -2.03 kg, 95% CI: -3.48 to -0.58, P = 0.006; heterogeneity P = 0.58, I^2 = 0%; 3 studies, 93 participants; diet + exercise + psychosocial: MD: -2.88 kg, 95% CI: -3.98 to -1.77, P < 0.00001; heterogeneity P = 0.0001, I^2 = 69%; 13 studies, 1526 participants). (Analysis 2.1).
- There were no significant differences in change in body weight between ethnicity subgroups (P = 0.11; I^2 = 54.3%) (Analysis 3.1), between subgroups based on menopausal status (P = 0.67; I^2 = 0%) (Analysis 4.1) and between subgroups based on duration of follow-up (P = 0.76; I^2 = 0%) (Analysis 5.1).

Change in body mass index (BMI)

Eighteen of 23 intervention-comparisons included 'change in BMI' as an outcome, with 17 comparisons providing adequate data for pooling in meta-analyses. From these 17 intervention-comparisons, 1353 of 1682 (80.4%) randomised patients were assessed at follow-up. The weight loss intervention appears to reduce BMI compared to the control group (MD:-1.08 kg/m^2, 95% CI: -1.61 to -0.56, P < 0.0001; low-quality evidence) although large heterogeneity is noted (P < 0.00001; I^2 = 84%) (Analysis 1.3; Figure 5; Figure 6).

Figure 5. Forest plot of comparison: 1 All weight loss interventions vs controls (no subgrouping), outcome: 1.3 Change in body mass index [kg/m^2].

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**

Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%
Test for overall effect: Z = 4.03 (P < 0.0001)
Test for subgroup differences: Not applicable

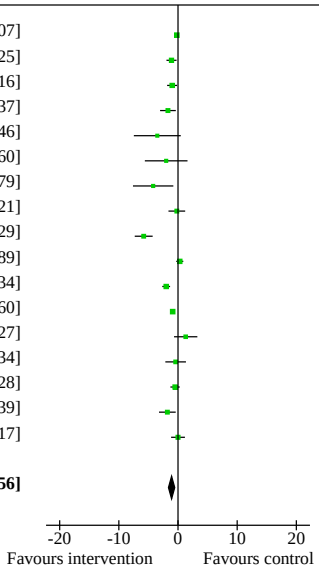
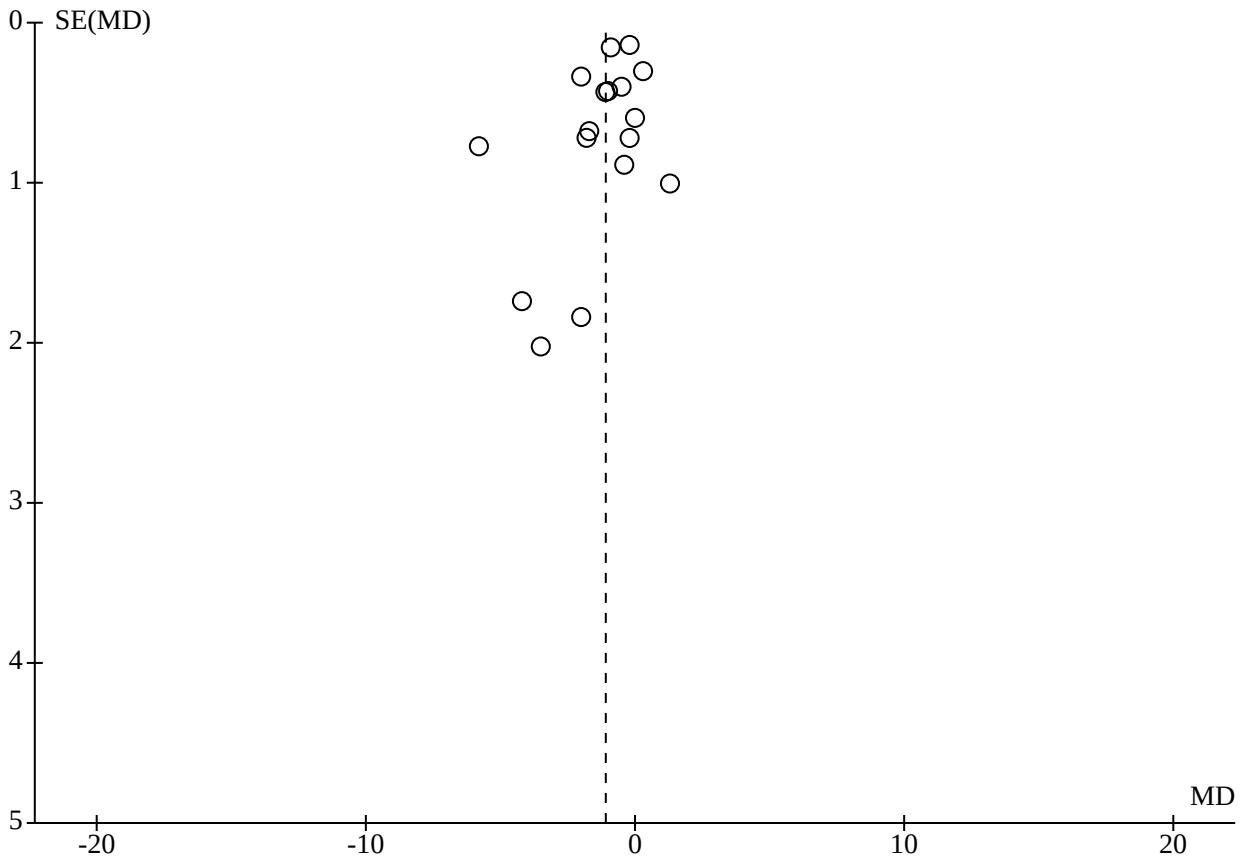


Figure 6. Funnel plot 2: Change in body mass index [kg/m^2]. Assessing publication bias and/or small-study effects. Plot includes all intervention-comparisons with extractable data for change in body mass index. The plot does not show substantial asymmetry (Egger's test P value 0.13).



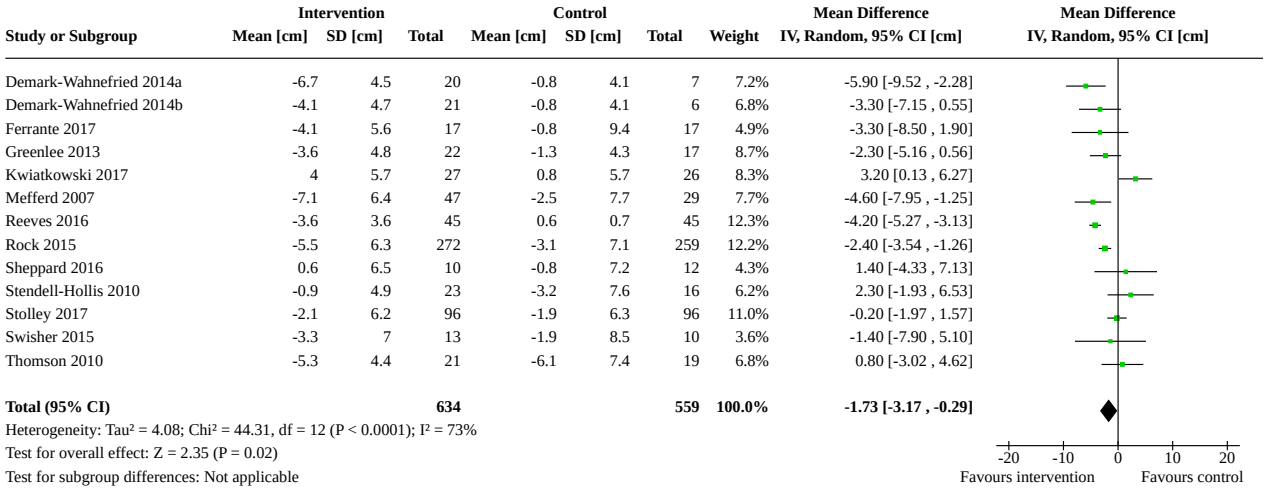
Subgroup analyses

- There were no significant differences in change in BMI between subgroups of different types of intervention and control groups (P = 0.13; I^2 = 46.9%). (Analysis 2.2).
- There were no significant differences in change in BMI between ethnicity subgroups (P = 0.25; I^2 = 26.9%) (Analysis 3.2), between subgroups based on menopausal status (P = 0.21; I^2 = 36.4%) (Analysis 4.2) and between subgroups based on duration of follow-up (P = 0.48; I^2 = 0%) (Analysis 5.2).

Change in waist circumference

Fourteen of 23 intervention-comparisons assessed 'change in waist circumference' as an outcome, with 13 comparisons providing sufficient data for pooling in meta-analyses. From these 13 intervention-comparisons, 1193 of the 1541 (77.4%) randomised patients were assessed at follow-up. The weight loss intervention appears to decrease weight circumstance compared to the control group(MD: -1.73 cm, 95% CI: -3.17 to -0.29, P = 0.02; low-quality evidence) although considerable heterogeneity was identified (P < 0.0001; I^2 = 73%) (Analysis 1.4; Figure 7).

Figure 7. Forest plot of comparison: 1 All weight loss interventions vs controls (no subgrouping), outcome: 1.4 Change in waist circumference [cm].



subgroup analyses

- There was a marginally significant difference in change in waist circumference between the different subgroups of types of intervention and control groups (P = 0.04). This difference was most pronounced between the 'diet + exercise' subgroup compared to the 'diet' subgroup (diet + exercise: MD: -3.63 cm, 95% CI: -5.76 to -1.51, within group P = 0.0008; heterogeneity P = 0.31, I^2 = 15%; 3 studies, 93, participants; diet: MD: 2.30 cm, 95% CI: -1.93 to 6.53, within group P = 0.29; heterogeneity not applicable; 1 study, 39 participants) (Analysis 2.3).
- There were no significant differences in change in waist circumference between ethnicity subgroups (P = 0.22; I^2 = 33.9%) (Analysis 3.3), between subgroups based on menopausal status (P = 0.51; I^2 = 0%) (Analysis 4.3) and between subgroups based on duration of follow-up (P = 0.66; I^2 = 0%) (Analysis 5.3).

Disease-free survival

None of the intervention-comparisons reported information on disease-free survival.

Adverse events

Six of 23 intervention-comparisons recorded adverse events as an outcome, with four comparisons providing sufficient data for pooling in meta-analyses. From these four intervention-comparisons, 394 of the 446 (88.3%) randomised patients were assessed at follow-up. There were no differences between the weight loss program and control groups with regards to adverse events (RR 0.94 events, 95% CI: 0.76 to 1.17, P = 0.59; high-quality evidence) and there was no evidence of heterogeneity (P= 0.71; I^2 = 0%) (Analysis 1.5).

Change in quality of life (QOL)

Change in overall QOL

Fifteen of 23 intervention-comparisons assessed change in QOL outcomes. Of these, 10 comparisons reported on 'change in overall QOL', and all 10 comparisons had sufficient data for pooling in meta-analyses. From these 10 intervention-comparisons, we analysed 867 of the 1148 (75.5%) randomised patients. The weight loss intervention appears to improve quality of life compared to the control group. There was (standardised mean difference (SMD): 0.74, 95% CI: 0.20 to 1.29, P = 0.008; low-quality evidence) although large heterogeneity was identified (P < 0.00001; I^2 = 89%) (Analysis 1.6).

Change in physical QOL subscales

Ten of 23 intervention-comparisons assessed 'change in physical QOL' subscales as an outcome and provided sufficient data for pooling in meta-analyses. Of these 10 intervention-comparisons, 1024 of the 1351 (75.5%) randomised patients were assessed at follow-up. There was a significant difference favouring the intervention group (SMD: 0.33, 95% CI: 0.10 to 0.56, P = 0.005) although there was evidence of moderate heterogeneity (P = 0.06; I^2 = 45%) (Analysis 1.7).

Change in social QOL subscales

Six of 23 intervention-comparisons assessed 'change in social QOL' subscales as an outcome and provided sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 389 of the 464 (83.8%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in social subscale QOL (SMD: 0.19, 95% CI: -0.01 to 0.39, P = 0.07) and there was no evidence of statistically significant heterogeneity (P = 0.49; I^2 = 0%) (Analysis 1.8).

Change in emotional QOL subscales

Eight of 23 intervention-comparisons assessed 'change in emotional QOL' subscales as an outcome and provided sufficient data for pooling in meta-analyses. Of these eight intervention-comparisons, 498 out of the 633 (78.7%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in emotional subscale QOL (SMD: 0.11, 95% CI: -0.09 to 0.30, P = 0.28) and heterogeneity was minimal (P = 0.40; I^2 = 4%) (Analysis 1.9.)

Change in mental health QOL subscales

Three of 23 intervention-comparisons assessed 'change in mental health QOL' subscales as an outcome and provided sufficient data for pooling in meta-analyses. Of these three intervention-comparisons, 355 of the 400 (88.8%) randomised patients were assessed at follow-up. There was a significant difference favouring the intervention group (SMD: 0.60, 95% CI: 0.17 to 1.02, P = 0.006), although moderate heterogeneity was identified (P = 0.09; I^2 = 59%) (Analysis 1.10).

Change in anxiety and depression QOL subscales

Three of 23 intervention-comparisons assessed 'change in anxiety and depression QOL' subscales as an outcome and provided sufficient data for pooling in meta-analyses. Of these 3 intervention-comparisons, 669 of the 910 (73.5%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups in change in anxiety and depression subscale QOL (SMD: 0.63, 95% CI: -0.07 to 1.33, P = 0.08) but there was evidence of significant heterogeneity (P = 0.0001; I^2 = 91%) (Analysis 1.11).

Change in oestradiol

One of 23 intervention-comparisons reported data on 'change in oestradiol'. Scott 2013reported the median changes in oestradiol levels was -0.5 pg/mL for the intervention group and -1.0 pg/mL for the control group (P = 0.58 for difference between groups).

Change in testosterone

One of 23 intervention-comparisons reported data on 'change in testosterone'. Scott 2013reported the median changes in testosterone levels was 0.0 nmol/L for the intervention group and 0.1 nmol/L for the control group (P = 0.44 for difference between groups).

Change in insulin

Seven of 23 intervention-comparisons measured 'change in insulin' concentrations as an outcome, with six comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 134 of the 192 (69.8%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to insulin concentrations (MD: -1.49 mcU/mL, 95% CI: -6.62 to 3.64, P = 0.57) and moderate heterogeneity was identified (P = 0.05; I^2 = 54%) (Analysis 1.12).

Change in insulin-like growth factor 1 (IGF-1)

Two of 23 intervention-comparisons reported data on IGF-1, however this was insufficient for pooling in meta-analyses because one intervention-comparison reported medians, while the other reported means. Scott 2013reported that the median changes in IGF-1 levels was -1.7 pg/mL for the intervention group and -1.3 pg/mL for the control group (P = 0.84 for difference between groups). Arikawa 2017 reported the mean changes in IGF-1 levels was 13.6 ng/mL for the intervention group and 5.8 ng/mL for the control group (SDs for change scores and P values for group differences were not reported).

Change in fasting glucose

Six of 23 intervention-comparisons measured 'change in fasting glucose' concentrations as an outcome, with all 6 comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 133 of the 192 (69.3%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in fasting glucose concentrations (MD: -0.46 mg/dl, 95% CI: -4.86 to 3.93, P = 0.84), and there was no evidence of significant heterogeneity (P = 0.68; I^2 = 0%) (Analysis 1.13).

Lipids profile

Change in total cholesterol

Seven of 23 intervention-comparisons measured 'change in total cholesterol (TC) concentrations' as an outcome, with six comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons,189 of the 256 (73.8%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in TC concentrations (MD: -0.34 mmol/L, 95% CI: -0.84 to 0.16, P = 0.18) and there was evidence of moderate heterogeneity (P = 0.07; I^2 = 50%) (Analysis 1.14).

Change in high-density lipoprotein (HDL) cholesterol

Seven of 23 intervention-comparisons measured HDL concentrations as an outcome, with six comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 189 of the 256 (73.8%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in HDL concentrations (MD: 0.00 mmol/L, 95% CI: -0.08 to 0.08, P = 0.98) and there was no evidence of statistically significant heterogeneity (P = 0.70; I^2=0%) (Analysis 1.15).

Change in low-density lipoprotein (LDL) cholesterol

Six of 23 intervention-comparisons measured LDL concentrations as an outcome, with all six comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 189 of the 256 (73.8%) randomised patients were assessed at follow-up. There were no significant differences between the intervention and control groups with regards to change in LDL concentrations (MD: -0.18 mmol/L, 95% CI: -0.59 to 0.22, P = 0.38) and there was evidence of some heterogeneity (P -0.19; I^2 = 32%) (Analysis 1.16).

Change in triglycerides (TG)

Six of 23 intervention-comparisons measured TG concentrations as an outcome, with all six comparisons providing sufficient data for pooling in meta-analyses. From these six intervention-comparisons, 189 of the 256 (73.8%) randomised patients were assessed at follow-up. There was a significant difference favouring the intervention group (MD: -0.26 mmol/L, 95% CI: -0.45 to -0.07, P = 0.008) and there was no evidence of statistically significant heterogeneity (P = 0.92; I^2 = 0%) (Analysis 1.17).

Change in leptin

Six of 23 intervention-comparisons measured leptin concentrations as an outcome, with three comparisons (all from a single study: Djuric 2002a; Djuric 2002b; Djuric 2002c) providing sufficient data

for pooling in meta-analyses. From these three intervention-comparisons, 39 of the 74 (52.7%) randomised patients were assessed at follow-up. There was a significant difference favouring the intervention group (MD: -14.67 ng/mL, 95% CI: -26.36 to -2.98, P = 0.01) and there was no evidence of significant heterogeneity (P = 0.53; I^2 = 0%) (Analysis 1.18).

Change in adiponectin

Two of 23 intervention-comparisons reported data on 'change in adiponectin' concentrations but one intervention-comparison reported medians while the other reported means. Swisher 2015 reported the median changes in adiponectin levels was -0.9 ng/mL for the intervention group and -1.3 ng/mL for the control group (P = 0.58 for difference between groups). Arikawa 2017 reported the mean changes in adiponectin levels was 1 ng/mL for the intervention group and 0.6 ng/mL for the control group (SDs for change scores and P values for group differences were not reported).

Change in interleukin-6

Four of 23 intervention-comparisons reported data on 'change in IL-6 concentrations', however the data were insufficient for pooling in meta-analyses.Swisher 2015 reported the median changes in IL-6 levels was 0.02 pg/mL for the intervention group and 0.3 pg/mL for the control group (P = 0.26 for difference between groups). Scott 2013reported the median changes in IL-6 levels was 0.09 pg/mL for the intervention group and 0.18 pg/mL for the control group (P value for difference between groups not reported). Arikawa 2017 reported the mean changes in IL-6 levels was -0.3 pg/mL for the intervention group and -0.1 pg/mL for the control group (SDs for change scores and P values for group differences were not reported). Mefferd 2007 reported the mean changes in IL-6 levels was -0.3 pg/mL for the intervention group and -0.3 pg/mL for the control group (SDs for change scores and P values for group differences were not reported).

Change in tumour necrosis factor alpha (TNF-α)

Three of 23 intervention-comparisons reported data on 'change in TNF-α' concentrations, however the data were insufficient for pooling in meta-analyses. Swisher 2015 reported the median changes in TNF-α levels was -0.3 pg/mL for the intervention group and -0.8 pg/mg for the control group (P = 0.11 for difference between groups). Scott 2013reported the median changes in TNF-α levels was 0.03 pg/mg for the intervention group and -0.07 pg/mg for the control group (P value for difference between groups not reported). Mefferd 2007 reported the mean changes in TNF-α levels was -0.5 pg/mg for the intervention group and -0.8 pg/mg for the control group (SDs for change scores and P values for group differences were not reported).

Change in C-reactive protein (CRP)

Four of 23 intervention-comparisons reported data on 'change in CRP concentrations', however the data were insufficient for pooling in meta-analyses. Swisher 2015 reported the median changes in CRP levels was -0.2 mg/L for the intervention group and 0.4 mg/L for the control group (P = 0.78 for difference between groups). Scott 2013reported the median changes in CRP levels was 0.1 mg/L for the intervention group and 0.03 mg/L for the control group (P = 0.80 for difference between groups). Arikawa 2017 reported the mean changes in CRP levels was -2.2 mg/L for the intervention group and 0.3 mg/L for the control group (SDs for change scores and P values for group differences were not reported). Thomson 2010 reported the mean changes in CRP levels was -0.4 mg/L for both the intervention and control groups (SDs for change scores and P values for group differences were not reported).

Sensitivity analyses

Repeating Analysis 1.2, Analysis 1.3 and Analysis 1.4 using a fixed-effect model did not appreciably change the pooled effect estimates for 'change in body weight', 'change in BMI' or 'change in waist circumference' (Analysis 6.1; Analysis 6.2; Analysis 6.3).

DISCUSSION

Summary of main results

This review analysed 2028 overweight or obese breast cancer survivors from 23 intervention-comparisons (from 20 studies) (see Table 1). Participants in the experimental groups received weight loss interventions using different strategies and combinations of modalities such as 'diet', 'diet and exercise', 'diet and psychosocial support' or 'diet, exercise and psychosocial support'. Overall, these different intervention approaches appeared to result in a reduction in body weight and waist circumference, were not associated with an increase in adverse events, and improved overall quality of life (refer to Summary of findings 1). However, the quality of this evidence (GRADE) was low, with the exception of adverse events (which had a high GRADE score). This was due to substantial heterogeneity for the above outcomes, a relatively high attrition rate (> 20%) at follow-up and inability to blind participants. Similarly, the interventions as a whole were effective in reducing body mass index (BMI).

Regarding the primary outcomes, no data were available for disease-free survival or overall survival. There was a relatively small amount of data available for cancer recurrence (281 participants from 4 intervention-comparisons (4 studies), with 14 recurrence events). Recurrence rates were not significantly different between the intervention and control groups, but this analysis was likely underpowered.

We also conducted a subgroup analysis of multimodal interventions incorporating all three elements of diet, exercise and psychosocial support (refer to Summary of findings 2). These interventions appeared to result in a reduction in body weight and waist circumference. However, the quality of this evidence was similarly graded to be low and there was substantial heterogeneity. Although there was not a significant difference between subgroups of intervention and control types, the subgroup analyses showed some indication of greater benefits for multimodal interventions, as interventions combining 'diet and exercise' or 'diet and exercise and psychosocial support' generally led to greater decreases in anthropometric measures (weight, BMI and waist circumference) compared to 'diet' only interventions.

Relative to controls, the intervention groups did not significantly impact analysed biomarkers (insulin, fasting glucose, total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL)) with the exception of triglycerides and leptin, however data for leptin were derived from three intervention-comparisons from a single study (Djuric 2002a; Djuric 2002b; Djuric 2002c), with very wide 95% confidence intervals suggestive of imprecision. Other biomarkers including sex hormones, adiponectin and

inflammatory markers were unable to be meta-analysed due to too few trials reporting the outcome. Although one explanation for these biomarker outcomes is that the duration of these weight loss interventions was not long enough to observe statistically significant differences in these biomarkers, subgroup analysis revealed duration of follow-up did not significantly affect other outcomes, including anthropometric measures (change in body weight, BMI, and waist circumference).

In terms of quality of life (QOL), the weight loss interventions appeared to improve overall QOL, including improved physical and mental health subscales compared to controls. In contrast, there were no significant differences in emotional, social and anxiety/depression subscales, however the social and anxiety/depression subscales were marginally non-statistically significant. This discrepancy in the significance between mental health subscales and anxiety/depression subscales suggests the intervention may improve aspects of mental health other than anxiety and depression, however this is difficult to interpret due to the low number of intervention-comparisons for both outcomes (three studies) and the marginally statistically insignificant P value for the anxiety/depression subscales.

Overall completeness and applicability of evidence

This review included 23 intervention-comparisons from 20 randomised trials which assessed body weight loss interventions in overweight or obese breast cancer survivors. From these 20 studies, 2360 breast cancer survivors were randomised, and we analysed 2028 (85.9%) of these participants (refer to Table 1). The remaining 332 (14.1%) participants were unable to be analysed primarily due to attrition. The attrition rate is in part explained by our decision to include data on the latest follow-up provided for each study. The ratio of patients analysed to patients randomised varied considerably by outcome, with ranges of 77.4% to 80.4% for anthropometric outcomes, 52.7% to 73.8% for biomarker outcomes and 73.5% to 92.5% for QOL outcomes. The number of intervention-comparisons (and studies) analysed per outcome was also highly variable, with several outcomes having an insufficient number of intervention-comparisons to be included in the meta-analyses. These outcomes included survival outcomes (overall survival and disease-free survival), biomarkers including sex hormones (oestradiol and testosterone), insulin growth factor IGF-1, adiponectin and inflammatory markers (tumour necrosis factor alpha (TNF-α), C-reactive protein (CRP) and interleukin-6 (IL-6)). As such, this review was unable to determine the impact of weight loss interventions in overweight or obese breast cancer survivors on these outcomes. In contrast, the anthropometric outcomes had the highest number of intervention-comparisons (and sample size), and this is explained by our inclusion criteria specifying that the aim of the interventions had to be weight loss. Whilst we had sufficient data to meta-analyse all QOL outcomes, two of the subscales only had data from three intervention-comparisons derived from three studies (mental health subscales and anxiety and depression subscales). In addition, all data for leptin was obtained from three intervention-comparisons derived from a single study (Djuric 2002a; Djuric 2002b; Djuric 2002c), thus further studies are required to investigate this outcome. Despite our extensive search strategy, no eligible trials regarding pharmacological therapy or bariatric surgery met the inclusion criteria for this review.

Regarding external validity, the included studies assessed many different types of weight loss interventions (see Characteristics of included studies table). These interventions were grouped based on the core elements of the intervention such as diet, exercise and psychological components. There are various forms of dietary interventions (e.g. low calorie diets, special diets such as modified-Atkins diet, use of dietician consultations and commercial dietary programs where mode of delivery varied), exercise interventions (e.g. different type of exercise such as aerobic and/or resistance exercise of varying intensity, conducted in individual or group settings, supervised or home-based) and psychosocial interventions (e.g. counselling, which could be either individualised in-person (versus group), mode of delivery such as online or via telephone, and use of techniques such as cognitive behavioural therapy (CBT)). Studies used various combinations of these three core elements (diet, exercise and psychosocial support). A variety of different controls were utilised, including usual care (e.g. written materials regarding healthy living guidelines), wait-list, placebo and active control groups. Control groups received usual care (or additional care e.g. active control groups) in 20 of 23 (87%) intervention-comparisons (17 of 20 studies). Of the remaining three studies, two intervention-comparisons (from two studies) utilised a wait-list approach where it was not clear whether participants received usual care during the wait-list period (Demark-Wahnefried 2012a; Greenlee 2013), and the remaining intervention-comparison (from one study) utilised a placebo with no mention of usual care (Stendell-Hollis 2010). This suggests that the observed significant differences between the intervention and control groups in this review are representative of how these active interventions may improve outcomes compared to the current standard of care for overweight and obese breast cancer survivors. This was especially true for combined interventions utilising 'diet and exercise' or 'diet and exercise and psychosocial support' owing to the significantly favourable outcomes compared to controls, and therefore usual care. Trials were conducted in many different countries and in a range of ethnic groups. We conducted subgroup analyses on anthropometric outcomes, and there were no significant differences stratified by ethnicity or menopausal status, suggesting the interventions had similar effects on these populations. Thus, the findings in this review are likely to be applicable to overweight and obese breast cancer survivors in general.

Quality of the evidence

We used the GRADE assessment criteria to describe the quality of the evidence provided for each outcome in the 'Summary of findings' tables, except for breast cancer-specific survival and disease-free survival because there were no data available on these two outcomes (refer to Summary of findings 1; Summary of findings 2). The quality of the evidence ranged from low to high due to several factors including substantial heterogeneity and a high risk of bias. There was a high risk of performance bias in 96% of intervention-comparisons due to the nature of weight loss interventions, and difficulty in blinding participants in almost all interventions. This lack of blinding of participants also led to a high risk of bias regarding blinding of outcome assessors for patient-reported outcomes (87% of intervention-comparisons). There was also evidence of attrition bias, with anthropometric outcomes having attrition rates ranging from 19.6% to 22.6%.

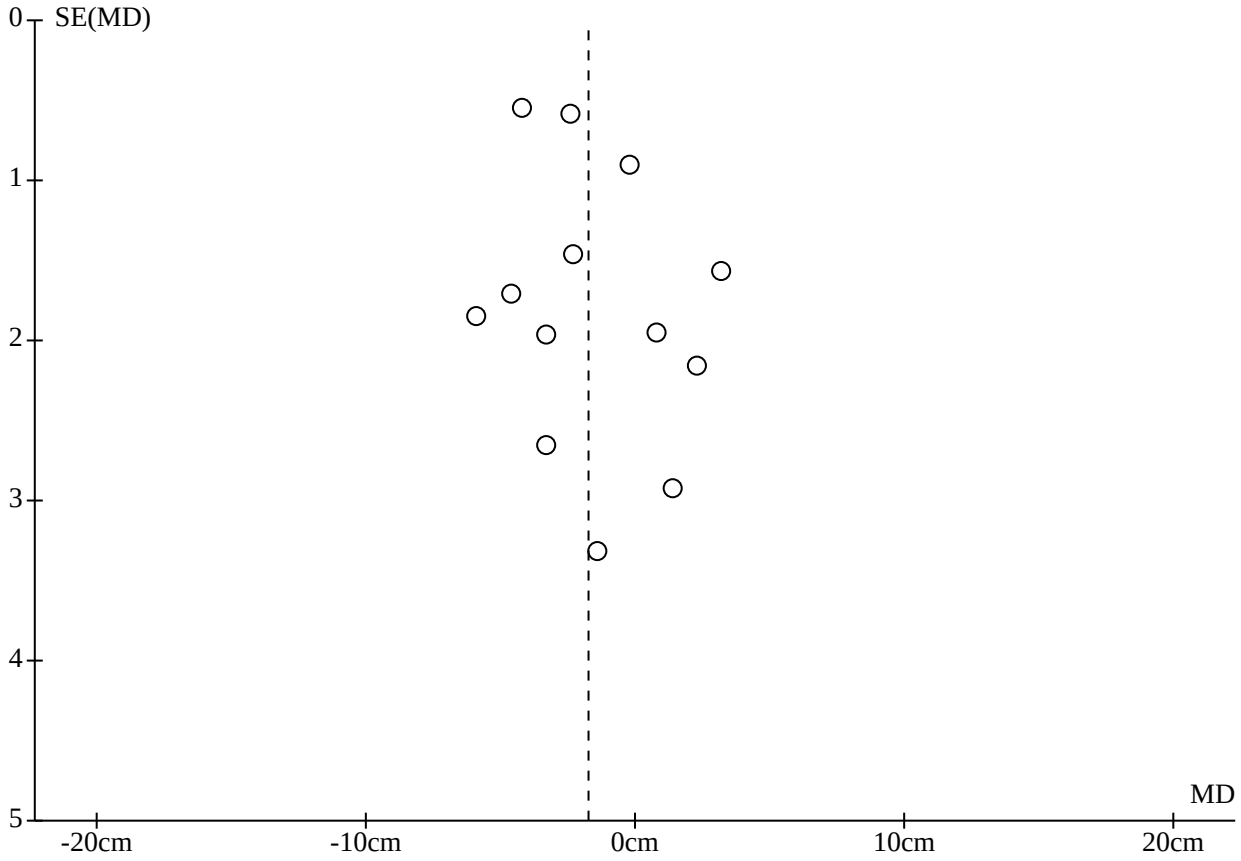
Regarding the comparison between all types of interventions versus controls, the quality of the evidence for breast cancer recurrence was downgraded by two levels to 'low' due to 'imprecision' because the 95% confidence intervals for the risk ratio estimate were very wide (suggesting that the intervention may reduce the risk of progression by up to 32% or increase the risk of progression by up to 460%), and this was based on only 14 events in 281 patients. The quality of the evidence for change in body weight was downgraded by two levels to 'low' due to the >20% attrition rate, lack of blinding of personnel (and assessment of patient-reported outcomes) and substantial heterogeneity. Waist circumference and QOL quality of evidence was downgraded two levels to 'low' for similar reasons. In contrast, the quality of evidence for adverse events was graded as 'high'.

Regarding the subgroup of interventions including all three components of diet, exercise and psychosocial support versus controls, we graded the quality of the evidence only for the outcomes 'change in body weight' and 'change in waist circumference' as there was an insufficient number of studies in other outcomes to conduct subgroup analyses. The quality of the evidence and justifications for these two outcomes in this subgroup analysis were similar to the corresponding outcomes in the overall analyses mentioned above (subgroup change in body weight: I^2 = 69%, P < 0.0001, subgroup change in waist circumference: I^2 = 79%, P < 0.0001).

Potential biases in the review process

This review utilised a comprehensive search strategy involving many different databases including Cochrane Breast Cancer Group's Specialised Register, Cochrane CENTRAL, MEDLINE, Embase, WHO ICTRP, Clinicaltrial.gov and Mainland Chinese academic literature databases. The searches had no language restriction, and potentially eligible trials were translated into English for evaluation by the study authors. This extensive search strategy suggests a low probability that other relevant studies have been missed. Many trials in the full-text screen would have been eligible for the review except they did not report outcomes in an extractable manner (e.g. not presenting data only for breast cancer patients participants with a baseline BMI ≥ 25 kg/m^2). In these cases, we contacted study authors for data which could be analysed in this review, however very few authors provided the required data to be subsequently included in the review (nine of 23 total intervention-comparisons representing six of 20 total included studies: Demark-Wahnefried 2012a; Demark-Wahnefried 2014a; Demark-Wahnefried 2014b; Dittus 2018; Djuric 2002a; Djuric 2002b; Djuric 2002c; Ferrante 2017; Kwiatkowski 2017). Thus, whilst a minority of contacted authors provided analysable data, the data we did receive represented a significant proportion of our total analysis (39% of intervention-comparisons and 30% of all included studies). Incorporating these data may have made our results more robust (e.g. as we could include the RENEW trial Demark-Wahnefried 2012a), but it is unclear whether our results would have differed if we had received data from all contacted authors, and this may therefore have introduced bias. Funnel plots showed no evidence of publication bias for anthropometric outcomes (changes in body weight, BMI and waist circumference, respectively: Figure 4; Figure 6; Figure 8).

Figure 8. Funnel plot 3: Change in waist circumference [cm]. Assessing publication bias and/or small-study effects. Plot includes all intervention-comparisons with extractable data for change in waist circumference. The plot does not show substantial asymmetry (Egger's test P value 0.20).



Agreements and disagreements with other studies or reviews

This is the first systematic review and meta-analysis assessing the impact of weight loss interventions on survival outcomes, anthropometric outcomes, QOL and biomarkers in overweight and obese breast cancer survivors. Our lack of randomised data for survival outcomes including disease-free survival and overall survival is in keeping with a systematic review conducted in 2017 which assessed the relationship between weight loss and mortality (both breast cancer-specific mortality and all-cause mortality) in overweight and obese breast cancer survivors (Jackson 2017). This systematic review by Jackson and colleagues identified only five studies assessing mortality and all were observational studies (not randomised and therefore ineligible for our review). However, even within these five non-randomised studies, only two of these studies included only participants with stages I-III breast cancer (not ductal carcinoma in situ (DCIS) and/or metastatic breast cancer), and neither of these two studies utilised weight loss interventions. A review article was published in 2018 following a National Cancer Policy Forum (NCPF) workshop which comprehensively summarised evidence regarding weight management throughout cancer care (Demark-Wahnefried 2018a). There is considerable overlap between both the completed and ongoing studies included in our review and the breast cancer studies mentioned in Demark-Wahefried and colleagues, with their review also highlighting the paucity of evidence regarding survival outcomes and recurrence in randomised weight loss trials.

AUTHORS' CONCLUSIONS

Implications for practice

This review identified insufficient data to reach firm conclusions regarding survival outcomes and breast cancer recurrence after body weight interventions in overweight and obese breast cancer survivors. Whilst there was sufficient data to perform meta-analyses on breast cancer recurrence (which suggested no evidence of effect), the total number of included intervention-comparisons, participants and recurrence events were very small (and thus likely underpowered), and the quality of the evidence was low. The effect of these interventions on survival outcomes and cancer recurrence remain unclear and clinical recommendations cannot be made when considering these primary outcomes in isolation. Our secondary outcomes suggest that these body weight interventions compared favourably to controls (which included usual care) and resulted in significant improvements in anthropometric outcomes (change in body weight, waist circumference, body mass index (BMI)) and various aspects of quality of life (QOL) (including overall QOL, physical subscales and mental health subscales), and were safe. Whilst the quality of the evidence was high for

safety (adverse events), it was low for the remaining outcomes (change in body weight, waist circumference, overall QOL) due to a high risk of bias and substantial heterogeneity. In contrast, there appeared to be no evidence of effect of these weight loss interventions on other QOL subscales (social subscales, emotional subscales and anxiety and depression subscales). There also appeared to be no evidence of effect for analysed biomarkers, with the exception of triglycerides and leptin. However biomarker analysis may have been underpowered as the interventions may not have been of sufficient duration and/or intensity to cause a detectable decrease in biomarkers. There was some evidence to suggest using a combination of different intervention modalities (e.g. 'diet and exercise' or 'diet and exercise and psychosocial support') may lead to a greater effect than an exclusively 'diet' intervention. However, there was a wide range of intervention programmes using multimodal interventions, and it is not known which particular intervention programme confers the most benefit. Thus, whilst the overall quality of evidence was low and the effects on survival and recurrence are unclear, the interventions were safe and were associated with favourable improvements in anthropometric outcomes and various aspects of QOL. Therefore clinicians may consider utilising such interventions in their clinical practice, although no definite recommendations can be made from this current review.

Implications for research

A major gap in the literature is the lack of studies assessing survival outcomes (overall survival, breast cancer-specific survival and disease-free survival) and very limited data regarding breast cancer recurrence in overweight and obese breast cancer survivors undergoing a body weight management intervention with the aim of weight loss. There is a need for adequately powered studies with long-term follow-up to assess these survival outcomes, such as the BWEL study. The BWEL study is an ongoing weight loss study with a sample size of 3136 breast cancer participants which will assess survival outcomes (overall survival, invasive disease-free survival, distant disease-free survival) at 10-year follow-up BWEL. Many biomarker outcomes had insufficient data for meta-analyses and therefore require further investigation. This includes sex hormones (oestradiol and testosterone), inflammatory markers (C-reactive protein (CRP), tumour necrosis factor alpha (TNF-α) and interleukin-6 (IL-6), insulin growth factor (IGF-1) and adiponectin. Further research is required to determine which particular intervention programme leads to the most favourable outcomes, and to determine whether weight loss is sustained after the intervention period.

ACKNOWLEDGEMENTS

We thank the editorial base of the Cochrane Breast Cancer Group and our review editor Melina Willson for assistance in the writing of the protocol. We thank our Information Specialists Ava Grace Tan-Koay and Slavica Berber for their help in development of the search strategies. We acknowledge the help of translators: Turhan Kahraman (Turkish), Ibrahim Yaylali (Turkish), Juan Carlos Quijano-Campos (Spanish), Auxiliadora Fraiz (Spanish), Bada Yang (Korean) and Milad Tavakoli (Persian). We also thank Li Xin Ma (LXM) for conducting the Chinese searches and translating the Chinese manuscripts. We acknowledge the following editors for providing feedback regarding this review: clinical editor: Dr Rachel Dear, St Vincent's Hospital, Darlinghurst; statistical editor: A/Prof Gian Luca Di Tanna, The George Institute for Global Health. The editors declare no conflicts of interest.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Arikawa 2017

Study characteristics	
Methods	Study design: RCT
	Number randomised: 21 (10 intervention, 11 control)
	Duration of study: 2009 to 2010
	Duration of latest follow-up: 4.5 months
Participants	Country of study: USA
	Breast cancer stages included: I-III
	Time since diagnosis: not stated
	Group comorbidities: not stated
	Age, mean (SD): experimental: 54.7 (8.4), control: 58.4 (7.6)
	Sex: female
	Menopausal status: 100% postmenopausal

Arikawa 2017 *(Continued)*

	Ethnicity: 100% White Relevant inclusion criteria: • postmenopausal • BMI ≥ 27 kg/ m^2 Relevant exclusion criteria: • inability to participate in physical activity due to severe disability • history of schizophrenia, psychosis or untreated major depression
Interventions	Intervention group (n = 10) Type of intervention: diet + exercise Duration of intervention: 3 months Setting: exercise centre Type of diet: 600 to 900 kcal deficit per day. All means provided for 12 weeks. Macronutrient breakdown: 55% carbohydrates, 15% protein and 30% fat Type of exercise: aerobic and resistance Frequency of exercise sessions: starting at 3 days per week progressively increasing to 5 - 6 days per week. Weight training twice per week. Duration of exercise sessions: starting at 15-20 minutes per session progressing to a total of 150 - 225 minutes per week (over 5 to 6 days) Intensity of exercise sessions: 60% - 70% of maximum predicted heart rate Additional information on intervention: fitness centre membership provided. Supervision by certified trainer initially twice per week for first 4 weeks and then once per week. Control group (n = 11) Type or setting of control: group in-person counselling Information on control: Weekly 1 hour weight management classes with a registered dietician for 12 weeks. First class included individualised guidelines for energy-restricted diet and physical activity recommendations. Remaining classes covered short and long term weight loss topics such as exercise and behaviour modification.
Outcomes	Anthropometric outcomes: body weight Biomarker outcomes: fasting insulin, IGF-1, fasting glucose, leptin, adiponectin, IL-6, CRP QOL outcomes: WHOQOL-BREF (Quality of life, Physical Health, Psychological, Social Relationships, Environment) Other outcomes: none Time points: baseline and 4.5 months for all outcomes
Notes	Funding: National Cancer Institute (NCI) and National Institutes of Health (NIH)

Risk of bias

Bias	Authors' judgement	Support for judgement

Arikawa 2017 *(Continued)*

Random sequence generation (selection bias)	Low risk	Computer-generated random sequence utilised.
Allocation concealment (selection bias)	Low risk	Participants were willing to be randomised into either group, suggesting allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of interventions participants and study staff were not blinded to treatment allocations.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants not blinded as they either received the exercise intervention or not
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Whilst blinding of laboratory outcomes was blinded, measurement of other non patient-reported outcomes e.g. weight was not blinded.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Low drop-out rate (1/21 = 4.8%) with reason given.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Low drop-out rate (1/21 = 4.8%) with reason given.
Selective reporting (reporting bias)	Low risk	Planned analyses conducted.
Other bias	Low risk	Nil identified.

Demark-Wahnefried 2012a

Study characteristics	
Methods	Study design: randomised cross-over trial (cross-over after 12 months) Number randomised: 289 (143 intervention, 146 control) Duration of study 2005 to 2007 Duration of latest follow-up: 24 months
Participants	Country of study: USA Breast cancer stages included: 0-III; ductal carcinoma in situ (DCIS): 3 (1.04%) Time since diagnosis, years, mean (SD): overall: 8.57 (2.71), intervention: 8.56 (2.84), control: 8.58 (2.59) Group comorbidities: not stated Age, mean (SD): overall: 72.07 (4.84) years, intervention: 71.81 (4.89), control: 72.32 (4.79)

Demark-Wahnefried 2012a *(Continued)*

	Sex: female Menopausal status: 100% postmenopausal Ethnicity: overall: n =254 (87.9%) White, intervention: n = 127 (88.8%) White, control: n = 127 (87.0%) White Relevant inclusion criteria: • Age ≥ 65 years • BMI of 25 kg/m^2 to 40 kg/m^2 • Sedentary (defined as < 150 minutes of moderate-to-vigorous physical activity a week) Relevant exclusion criteria: none
Interventions	Intervention group (n = 143) Type of intervention: telephone counselling (diet + exercise) + written materials Duration of intervention: 12 months Setting: telephone counselling Type of diet: fruit and vegetable servings daily: ≥7 for women and ≥9 for men. Saturated fat restricted to < 10% energy intake. Type of exercise: aerobic and resistance Frequency and duration of exercise sessions: 30 minutes endurance exercise daily, 15 minutes strength training every second day Intensity of exercise sessions: not mentioned Additional information on intervention: personally tailored workbook and quarterly newsletters provided. Telephone counselling with automated prompts (15 sessions over 12 months). Received a pedometer, resistance exercise bands, exercise poster with lower extremity strength exercises and personalised record logs to self-monitor daily exercise and dietary intake. Control group (n = 146) Type or setting of control: wait-list Information on control: 1 year before cross-over.
Outcomes	Anthropometric outcomes: BMI, body weight, Biomarker outcomes: none QOL outcomes: SF-36 (physical functioning, pain index, role-physical, general health perceptions, mental health index, vitality, social functioning, role-emotional, standardized physical component scale, standardised mental component scale) Other outcomes: adverse effects Time points: BMI and body weight at baseline, 1 year, 2 years. All other outcomes at baseline and 1 year.
Notes	Funding: NIH grants and an author (Wendy Demark-Wahnefried) Authors contacted and provided data only on breast cancer survivors including: baseline: age, years since diagnosis, ethnicity, stage, BMI, weight, QOL. Follow-up: BMI, weight, QOL, adverse events Additional papers: Blair 2014 - no data extracted as this paper reports data for various other forms of non-breast cancer.

Demark-Wahnefried 2012a *(Continued)*

Morey 2009 - no data extracted as this paper reports data for various other forms of non-breast cancer.

Winger 2014 - no data extracted as this paper reports data for various other forms of non-breast cancer.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation conducted by statistician with no participant contact via block randomisation.
Allocation concealment (selection bias)	Low risk	Allocation by statistician with no participant contacts, and block randomisation completed after baseline surveys to determine eligibility.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants could not be blinded as they either received intervention or waitlist. Personnel were blinded.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Personnel conducting QOL interviews were blinded, however participants were not.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Data such as height and weight were self-reported - does not appear to be relevant non-patient-reported outcomes.
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	Authors contacted for data on breast cancer participants. Appears 39/289 (13.5%) of participants did not complete 1-year follow-up and reasons unknown.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	Authors contacted for data on only breast cancer participants. Appears 39/289 (13.49%) of participants did not complete 1-year follow-up and reasons unknown.
Selective reporting (reporting bias)	Low risk	Pre-planned analysis conducted and reported as per protocol.
Other bias	Low risk	Nil identified.

Demark-Wahnefried 2014a

Study characteristics

Methods	Study design: RCT Number randomised: 54 (20 individualised intervention, 21 team intervention, 13 control) Duration of study: 2007 to 2009 Duration of latest follow-up: 12 months
Participants	Country of study: USA

Demark-Wahnefried 2014a *(Continued)*

	Breast cancer stages included: I-III Time since diagnosis, years, mean (SD): individualised: 2.4 (0.48), team: 1.85 (0.94), control: 2.18 (1.07) Group comorbidities: none Age, years, mean (SD): individualised: 62 (8.16), team: 56.9 (6.03), control: 58.1 (6.71) Sex: female Menopausal status: 100% postmenopausal Ethnicity: individualised: n = 16 (80%) White, n = 4 (20%) Black. team: n = 16 (76.2%) White, n = 4 (19.1%) Black, n = 1 (4.8%) Asian, control: n = 12 (92.3%) White, n = 1 (7.7%) Black Relevant inclusion criteria: • completed primary treatment but were within 5 years of diagnosis • has a biological daughter aged ≥ 21 years with no previous diagnoses of cancer (except non melanoma skin cancer) • mother and daughter both have a BMI between 25 kg/m^2 and 39.9 kg/m^2 Relevant exclusion criteria: • currently exercising at least 150 minutes per week • currently enrolled in a weight loss program
Interventions	Individualised intervention (n = 20) Type of intervention: written materials (diet + exercise) Duration of intervention: 12 months Setting: N/A (Written materials) Type of diet: Caloric restriction calculated using Mifflin-St.Jeor equation, and following national guidelines. Type of exercise: aerobic and resistance (unsupervised) Frequency and duration of exercise sessions: 150 minutes per week aerobic exercise and twice weekly strength training Intensity of exercise sessions: not mentioned Additional information on intervention: Individually tailored print materials given which included individual weight goals and energy requirements to achieve target weight loss. Advice regarding how current intake compared with national guidelines, lower calorie substitutes and portion control. Surveyed bimonthly on progress and readiness to change in order to receive tailored messages in newsletters using the transtheoretical model of behaviour change. Also received supplies and equipment for self-monitoring e.g. logbooks and shoe chips with pedometers. Team intervention (n = 21) Additional information on intervention: Same as above (individualised) intervention except these participants also received information on their daughters. Utilised concepts of interdependence theory including structuring goals to guide mother-daughter interactions and cooperation to deal with common stressors. Control group (n = 13) Type or setting of control: written materials

Demark-Wahnefried 2014a *(Continued)*

	Information on control: Provided with brochures including the National Cancer Institute brochure Facing Forward and the American Institute for Cancer Research publication Facts on Weight Management and Cancer. Subsequent brochures were mailed on a bimonthly basis.
Outcomes	Anthropometric outcomes: BMI, body weight, waist circumference (assessed at the level of the iliac crest at exhale using a non-stretch tape measure) Biomarker outcomes: none QOL outcomes: SF-36 (physical functioning, general health perceptions, vitality, role-physical, role-emotional, standardized physical component scale, standardized mental component scale Other outcomes: Adverse effects Time points: All at baseline and 1 year
Notes	Funding: NIH Authors contacted for data on stage I-III breast cancer patients including: baseline: age, years since diagnosis, ethnicity, stage, treatment modality, weight, waist circumference, BMI, QOL. Follow-up: weight, waist circumference, BMI, QOL, adverse events

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described, however mentioned to be determined by an off-site statistician.
Allocation concealment (selection bias)	Low risk	Randomisation done by off-site statistician after baseline data measured.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Study described as single-blind and as participants would know what intervention they received this suggests assessors were blinded (participants cannot be blinded)
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants not blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Low risk	Assessors were blinded to group allocations.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Data for stage I-III participants received from authors and loss to follow-up/dropouts for this focus population is unknown.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Unclear risk	Data for stage I-III participants received from authors and loss to follow-up/dropouts for this focus population is unknown.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.

Demark-Wahnefried 2014a *(Continued)*

Other bias	Low risk	Nil identified

Demark-Wahnefried 2014b

Study characteristics	
Methods	Study design: RCT Number randomised: 54 (20 individualised intervention, 21 team intervention, 13 control) Duration of study: 2007 to 2009 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-III Time since diagnosis, years, mean (SD): individualised: 2.4 (0.48), team: 1.85 (0.94), control: 2.18 (1.07) Group comorbidities: none Age, years, mean (SD): individualised: 62 (8.16), team: 56.9 (6.03), control: 58.1 (6.71) Sex: female Menopausal status: 100% postmenopausal Ethnicity: individualised: n = 16 (80%) White, n = 4 (20%) Black. team: n = 16 (76.2%) White, n = 4 (19.1%) Black, n = 1 (4.8%) Asian, control: n = 12 (92.3%) White, n = 1 (7.7%) Black Relevant inclusion criteria: • completed primary treatment but were within 5 years of diagnosis • Has a biological daughter aged ≥ 21 years with no previous diagnoses of cancer (except non melanoma skin cancer) • Mother and daughter both have a BMI between 25 kg/m^2 and 39.9 kg/m^2 Relevant exclusion criteria: • Currently exercising at least 150 minutes per week • Currently enrolled in a weight loss program
Interventions	Individualised intervention (n = 20) Type of intervention: written materials (diet + exercise) Duration of intervention: 12 months Setting: N/A (written materials) Type of diet: caloric restriction calculated using Mifflin-St.Jeor equation, and following national guidelines. Type of exercise: aerobic and resistance (unsupervised) Frequency and duration of exercise sessions: 150 minutes per week aerobic exercise and twice weekly strength training Intensity of exercise sessions: not mentioned

Demark-Wahnefried 2014b *(Continued)*

	Additional information on intervention: individually-tailored print materials given which included individual weight goals and energy requirements to achieve target weight loss. Advice regarding how current intake compared with national guidelines, lower calorie substitutes and portion control. Surveyed bimonthly on progress and readiness to change in order to receive tailored messages in newsletters using the transtheoretical model of behaviour change. Also received supplies and equipment for self-monitoring e.g. logbooks and shoe chips with pedometers. Team intervention (n = 21) Additional information on intervention: same as above (individualised) intervention except these participants also received information on their daughters. Utilised concepts of interdependence theory including structuring goals to guide mother-daughter interactions and cooperation to deal with common stressors. Control group (n = 13) Type or setting of control: written materials Information on control: provided with brochures including the National Cancer Institute brochure Facing Forward and the American Institute for Cancer Research publication Facts on Weight Management and Cancer. Subsequent brochures were mailed on a bimonthly basis.
Outcomes	Anthropometric outcomes: BMI, body weight, waist circumference (assessed at the level of the iliac crest at exhale using a non- stretch tape measure) Biomarker outcomes: none QOL outcomes: SF-36 (physical functioning, general health perceptions, vitality, role-physical, role-emotional, standardised physical component scale, standardised mental component scale Other outcomes: adverse effects Time points: all at baseline and 1 year
Notes	Funding: NIH Authors contacted for data on stage I-III breast cancer patients including: baseline: age, years since diagnosis, ethnicity, stage, treatment modality, weight, waist circumference, BMI, QOL. Follow-up: weight, waist circumference, BMI, QOL, adverse events

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described, however mentioned to be determined by an off-site statistician.
Allocation concealment (selection bias)	Low risk	Randomisation done by off-site statistician after baseline data measured.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Study described as single-blind and as participants would know what intervention they received this suggests assessors were blinded (participants cannot be blinded)
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants not blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias)	Low risk	Assessors were blinded to group allocations.

Demark-Wahnefried 2014b *(Continued)*

Non patient-reported outcomes		
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Data for stage I-III participants received from authors and loss to follow-up/ dropouts for this focus population is unknown.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Unclear risk	Data for stage I-III participants received from authors and loss to follow-up/ dropouts for this focus population is unknown.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified

Dittus 2018

Study characteristics	
Methods	Study design: RCT Number randomised: 52 (24 intervention, 28 control) Duration of study: 2009 to 2011 Duration of latest follow-up: 6 months
Participants	Country of study: USA Breast cancer stages included: I-III Time since diagnosis, years, mean (SD): overall: 2.65 (1.43), intervention: 3 (1.46), control: 2.26 (1.3) Group comorbidities: none Age, years, mean (SD): overall: 53 (6.2), intervention: 54.3 (5), control: 52.4 (7.1) Sex: female Menopausal status: 100% postmenopausal Ethnicity: 100% Caucasian Relevant inclusion criteria: • breast cancer survivors who received chemotherapy • completed initial treatment at least 6 weeks before start of study • BMI between 26 kg/m^2 and 50 kg/m^2 • Postmenopausal • Age ≤ 65 years Relevant exclusion criteria: • pre-existing diagnosis of diabetes mellitus
Interventions	Intervention group (n = 24)

Dittus 2018 *(Continued)*

	Type of intervention: diet + exercise + group counselling (diet + exercise) Duration of intervention: 6 months Setting: exercise centre Type of diet: 1000 kcal/day deficit, however must consume a minimum of 1200 kcal/day. Goals determined by multiplying baseline weight (in pounds) by 12 and subtracting 1000 cal. Authors state this should cause 1-2 pounds weight loss per week. Type of exercise: aerobic and resistance Frequency and duration of exercise sessions: aerobic exercise starting at 50 minutes/week progressively increased to 400 minutes/week with ≥ 5 days/week exercising. Resistance training included 3 sessions per week, each approximately 30 minutes Intensity of exercise sessions: described as moderate intensity aerobic exercise, brisk walking primary activity. Additional information on intervention: at least 1 resistance training session per week supervised by an exercise trainer. Behavioural intervention consisted of an online weight control program which included calorie restriction, physical activity and behavioural modification principles such as stimulus control, problem-solving, self-monitoring, social support and relapse prevention. Weekly online group meeting led by lifestyle change interventionist, who also provided individual feedback. Control group (n = 28) Type or setting of control: online behavioural intervention Information on control: same as intervention group except the control group did not receive the resistance exercise component.
Outcomes	Anthropometric outcomes: BMI, body weight, Biomarker outcomes: none QOL outcomes: SF-36 (physical component subscale, mental component subscale) Other outcomes: none Time points: all at baseline and 6 months
Notes	Funding: Lake Champlain Cancer Research Organization and the Vermont Cancer Center and NIH Authors contacted and data received on the chemotherapy (randomised) group only including anthropometric outcomes and QOL data. Registry (Clinicaltrials.gov): NCT01482702

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described.
Allocation concealment (selection bias)	Low risk	Randomisation took place after recruitment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding. Participants cannot be blinded due to nature of intervention.

Dittus 2018 *(Continued)*

Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded due to nature of intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	No mention of blinding of assessors.
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	QOL data available for 48/52 participants at baseline and 27/52 at 6-months follow-up - no explanation for missing data at baseline or analysis of completers vs non-completers at follow-up.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	34/52 (65%) participants completed anthropometric follow-up at 6 months with no reasons given or analysis of completers vs non-completers.
Selective reporting (reporting bias)	High risk	QOL data not reported in manuscript, despite being in registry and authors providing data on request
Other bias	Low risk	Nil identified.

Djuric 2002a

Study characteristics	
Methods	Study design: RCT Number randomised: 48 (13 individualised, 11 Weightwatchers, 11 comprehensive, 13 control) Duration of study: started 2002 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-II Time since diagnosis, years, mean (SD): not stated Group comorbidities: none Age, years, mean (SD): overall: 51.7 (8.4). Range: 36 to 70 years Sex: female Menopausal status: 75% postmenopausal Ethnicity: overall: 73% White, 25% African American, 2% Native American Relevant inclusion criteria: • age 18 to 70 years • stage I-II breast cancer diagnosed within past 4 years • chemotherapy or radiation therapy completed at least 3 months previously (except tamoxifen) • BMI > 30 kg/m^2

Djuric 2002a *(Continued)*

	Relevant exclusion criteria: none
Interventions	Individualised intervention group (n = 13) Type of intervention: diet + individual telephone counselling (diet + exercise) Duration of intervention: 12 months Setting: individual telephone counselling Type of diet: 500 kcal/day to 1000 kcal/day deficit goal. Energy intake aimed to have 20% to 25% energy from fat and 20% protein. Fruit and vegetable intake at least 5 servings per day. Increased fibre intake through whole grain choices was emphasised. Type of exercise: not mentioned Frequency and duration of exercise sessions: 30-45 minutes per day, for most days of the week was encouraged Intensity of exercise sessions: described as 'moderate' Additional information on intervention: dietician meetings weekly for first 3 months, biweekly for 3 to 6 months and then monthly. Patients were able to call the dietician if needed. In addition, monthly group meetings were held where written information on weight loss topics (environmental control, serving size control, exercise motivation, goal setting, holiday eating, seasonal foods) was given or mailed to patients. Weightwatchers intervention group (n = 11) Type of intervention: diet+group counselling (diet + exercise) Duration of intervention: 12 months Setting: group counselling Type of diet: Weight Watcher's diet. Type of exercise: none Frequency and duration of exercise sessions: none Intensity of exercise sessions: none Additional information on intervention: women encouraged to attend weekly Weight Watcher's meetings, but received no other dietary instruction or exercise instruction. Coupons provided for weekly attendance. Weigh-in data from these meetings sent to dietician to assess weight loss and attendance. Comprehensive group (n = 11) Type of intervention: diet+individual telephone counselling (diet+exercise)+group counselling (diet+exercise) Duration of intervention: 12 months Setting: group counselling and individual telephone counselling Additional information on intervention: combination of Weight Watcher's intervention plus individualised intervention, except the monthly dietician meeting was excluded. Control group (n = 13) Type or setting of control: usual care

Djuric 2002a *(Continued)*

	Information on control: received pamphlets focused on healthy diet and caloric intake (National Cancer Institute's "Action Guide to Healthy Eating" and the "Food Guide Pyramid"). Allowed to engage in any diet on their own.
Outcomes	Anthropometric outcomes: BMI, body weight Biomarker outcomes: fasting insulin, fasting glucose, total cholesterol, HDL, LDL, triglycerides, leptin QOL outcomes: FACT-G (physical, social, emotional, functional, total). FACT-An (anaemia subscore, fatigue subscore) Other outcomes: none Time points: All outcomes at baseline and 12 months
Notes	Funding: NIH, The Weight Watchers Group, Inc, Farmington Hills, Michigan, and the Ford Motor Company Fund. Potential conflicts of interest such as Weight watchers. Additional studies: Darga 2007 - no data extracted Sen 2007 - no data extracted

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	No information on allocation concealment described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of personnel not mentioned and blinding of participants not possible due to nature of intervention.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of personnel not mentioned.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Total exclusions and loss to follow-up is stated with reasons, however the significance of this loss to follow-up is not known.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Total exclusions and loss to follow-up is stated with reasons. Another publication (Jens 2004) analyses this loss to follow-up with respect to non-PRO and determines no difference between average BMI between completers and non-completers.

Djuric 2002a *(Continued)*

Selective reporting (reporting bias)	High risk	Mentions collecting questionnaire data but does not present these data.
Other bias	Low risk	Nil identified.

Djuric 2002b

Study characteristics	
Methods	Study design: RCT Number randomised: 48 (13 individualised, 11 Weightwatchers, 11 comprehensive, 13 control) Duration of study: started 2002 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-II Time since diagnosis, years, mean (SD): not stated Group comorbidities: none Age, years, mean (SD): overall: 51.7 (8.4). Range: 36 to 70 years Sex: female Menopausal status: 75% postmenopausal Ethnicity: overall: 73% White, 25% African American, 2% Native American Relevant inclusion criteria: • age 18 to 70 years • stage I-II breast cancer diagnosed within past 4 years • chemotherapy or radiation therapy completed at least 3 months previously (except tamoxifen) • BMI > 30 kg/m^2 Relevant exclusion criteria: none
Interventions	Individualised intervention group (n = 13) Type of intervention: diet + individual telephone counselling (diet + exercise) Duration of intervention: 12 months Setting: individual telephone counselling Type of diet: 500 kcal/day to 1000 kcal/day deficit goal. Energy intake aimed to have 20% to 25% energy from fat and 20% protein. Fruit and vegetable intake at least 5 servings per day. Increased fibre intake through whole grain choices was emphasised. Type of exercise: not mentioned Frequency and duration of exercise sessions: 30-45 minutes per day, for most days of the week was encouraged Intensity of exercise sessions: Described as 'moderate'

Djuric 2002b *(Continued)*

	Additional information on intervention: dietician meetings weekly for first 3 months, biweekly for months 3-6 and then monthly. Patients were able to call the dietician if needed. In addition, monthly group meetings were held where written information on weight loss topics (environmental control, serving size control, exercise motivation, goal setting, holiday eating, seasonal foods) was given or mailed to patients. Weightwatchers intervention group (n = 11) Type of intervention: diet + group counselling (diet + exercise) Duration of intervention: 12 months Setting: group counselling Type of diet: Weight Watcher's diet. Type of exercise: none Frequency and duration of exercise sessions: none Intensity of exercise sessions: none Additional information on intervention: women encouraged to attend weekly Weight Watcher's meetings, but received no other dietary instruction or exercise instruction. Coupons provided for weekly attendance. Weigh-in data from these meetings sent to dietician to assess weight loss and attendance. Comprehensive group (n = 11) Type of intervention: diet + individual telephone counselling (diet + exercise) + group counselling (diet + exercise) Duration of intervention: 12 months Setting: group counselling and individual telephone counselling Additional information on intervention: combination of Weight Watcher's intervention plus individualised intervention, except the monthly dietician meeting was excluded. Control group (n = 13) Type or setting of control: usual care Information on control: received pamphlets focused on healthy diet and caloric intake (National Cancer Institute's "Action Guide to Healthy Eating" and the "Food Guide Pyramid"). Allowed to engage in any diet on their own.
Outcomes	Anthropometric outcomes: BMI, body weight Biomarker outcomes: fasting insulin, fasting glucose, total cholesterol, HDL, LDL, triglycerides, leptin QOL outcomes: FACT-G (physical, social, emotional, functional, total). FACT-An (anaemia subscore, fatigue subscore) Other outcomes: none Time points: all outcomes at baseline and 12 months
Notes	Funding: NIH, The Weight Watchers Group, Inc, Farmington Hills, Michigan, and the Ford Motor Company Fund. Potential conflicts of interest such as Weight watchers. Additional studies: Darga 2007 - no data extracted Sen 2007 - no data extracted

Djuric 2002b *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	No information on allocation concealment described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of personnel not mentioned and blinding of participants not possible due to nature of intervention.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of personnel not mentioned.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Total exclusions and loss to follow-up is stated with reasons, however the significance of this loss to follow-up is not known.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Total exclusions and loss to follow-up is stated with reasons. Another publication (Jens 2004) analyses this loss to follow-up with respect to non-PRO and determines no difference between average BMI between completers and non-completers.
Selective reporting (reporting bias)	High risk	Mentions collecting questionnaire data but does not present the data.
Other bias	Low risk	Nil identified.

Djuric 2002c

Study characteristics	
Methods	Study design: RCT Number randomised: 48 (13 individualised, 11 Weightwatchers, 11 comprehensive, 13 control) Duration of study: started 2002 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-II Time since diagnosis, years, mean (SD): not stated

Djuric 2002c *(Continued)*

	Group comorbidities: none Age, years, mean (SD): overall: 51.7 (8.4). Range: 36 to 70 years Sex: female Menopausal status: 75% postmenopausal Ethnicity: overall: 73% White, 25% African American, 2% Native American Relevant inclusion criteria: • age 18 to 70 years • stage I-II breast cancer diagnosed within past 4 years • chemotherapy or radiation therapy completed at least 3 months previously (except tamoxifen) • BMI > 30kg/m^2 Relevant exclusion criteria: none
Interventions	Individualised intervention group (n = 13) Type of intervention: diet + individual telephone counselling (diet + exercise) Duration of intervention: 12 months Setting: individual telephone counselling Type of diet: 500 cal/day to 1000 kcal/day deficit goal. Energy intake aimed to have 20% to 25% energy from fat and 20% protein. Fruit and vegetable intake at least 5 servings per day. Increased fibre intake through whole grain choices was emphasised. Type of exercise: not mentioned Frequency and duration of exercise sessions: 30-45 minutes per day, for most days of the week was encouraged Intensity of exercise sessions: described as 'moderate' Additional information on intervention: dietician meetings weekly for first 3 months, biweekly for months 3-6 and then monthly. Patients were able to call the dietician if needed. In addition, monthly group meetings were held where written information on weight loss topics (environmental control, serving size control, exercise motivation, goal setting, holiday eating, seasonal foods) was given or mailed to patients. Weightwatchers intervention group (n = 11) Type of intervention: diet + group counselling (diet + exercise) Duration of intervention: 12 months Setting: group counselling Type of diet: Weight Watcher's diet. Type of exercise: none Frequency and duration of exercise sessions: none Intensity of exercise sessions: none Additional information on intervention: women encouraged to attend weekly Weight Watcher's meetings, but received no other dietary instruction or exercise instruction. Coupons provided for weekly attendance. Weigh-in data from these meetings sent to dietician to assess weight loss and attendance. Comprehensive group (n = 11)

Djuric 2002c *(Continued)*

	Type of intervention: diet+individual telephone counselling (diet+exercise)+group counselling (diet+exercise) Duration of intervention: 12 months Setting: group counselling and individual telephone counselling Additional information on intervention: combination of Weight Watcher's intervention plus individualised intervention, except the monthly dietician meeting was excluded. Control group (n = 13) Type or setting of control: usual care Information on control: received pamphlets focused on healthy diet and caloric intake (National Cancer Institute's "Action Guide to Healthy Eating" and the "Food Guide Pyramid"). Allowed to engage in any diet on their own.
Outcomes	Anthropometric outcomes: BMI, body weight Biomarker outcomes: fasting insulin, fasting glucose, total cholesterol, HDL, LDL, triglycerides, leptin QOL outcomes: FACT-G (physical, social, emotional, functional, total). FACT-An (anaemia subscore, fatigue subscore) Other outcomes: none Time points: all outcomes at baseline and 12 months
Notes	Funding: NIH, The Weight Watchers Group, Inc, Farmington Hills, Michigan, and the Ford Motor Company Fund. Potential conflicts of interest such as Weight watchers. Additional studies: Darga 2007 - no data extracted Sen 2007 - no data extracted

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	No information on allocation concealment described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of personnel not mentioned and blinding of participants not possible due to nature of intervention.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of personnel not mentioned.

Djuric 2002c *(Continued)*

Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Total exclusions and loss to follow-up is stated with reasons, however the significance of this loss to follow-up is not known.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Total exclusions and loss to follow-up is stated with reasons. Another publication (Jens 2004) analyses this loss to follow-up with respect to non-PRO and determines no difference between average BMI between completers and non-completers.
Selective reporting (reporting bias)	High risk	Mentions collecting questionnaire data but does not present these data.
Other bias	Low risk	Nil identified.

Ferrante 2017

Study characteristics	
Methods	Study design: randomised cross-over trial (cross-over at 6 months) Number randomised: 35 (18 intervention, 17 control) Duration of study (2015–2018) Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-III Time since diagnosis, years, mean (SD): overall: 7.27 (5.74), intervention: 6.91 (5.97), control: 7.68 (5.74) Group comorbidities: none Age, years, mean (SD): total: 61.54 (8.83), experimental: 60.78 (10.74), control: 62.35 (6.46) Sex: female Menopausal status: not mentioned Ethnicity: 100% Black Relevant inclusion criteria: not mentioned Relevant exclusion criteria: not mentioned
Interventions	Intervention group (n = 18) Type of intervention: diet+exercise+behavioural (diet+exercise) Duration of intervention: 6 months Setting: website Type of diet: not mentioned Type of exercise: not mentioned Frequency and duration of exercise sessions: not mentioned

Ferrante 2017 *(Continued)*

	Intensity of exercise sessions: not mentioned Additional information on intervention: participants receive a 30-minute training session of how to use the SparkPeople website. Instructed to self-monitor their diet weekly using this website and self-monitor physical activity levels daily using a Fitbit device, which integrates with this website. Weekly motivational reminders provided for first 3 months only (email, text or phone). Participants receive a personalised handout of goals for weight loss, diet and physical activity. Control group (n = 17) Type or setting of control: not applicable Information on control: participants received the Fitbit device and the weight loss handout.
Outcomes	Anthropometric outcomes: BMI, body weight, waist circumference Biomarker outcomes: none QOL outcomes: Quality of Life in Adult Cancer Survivors (QLACS): total score, generic subscale, cancer subscale Other outcomes: none Time points: baseline for both intervention and control, 6 months for participants initially randomised to control and 12 months for participants initially randomised to intervention
Notes	Funding: NCI No full text. Authors contacted and provided information about this study.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Sequence generation achieved via a computer-based random number generator.
Allocation concealment (selection bias)	Low risk	Randomisation conducted after recruitment, and done via a computer-based random number generator and kept in sealed envelopes.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of personnel but participants cannot be blinded due to nature of the intervention.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	Low risk	Uses validated questionnaire scales such as quality of life in adult cancer survivors (QLACS). Utilises an active control group (Fitbit).
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of assessors not mentioned.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Correspondence received from authors indicate that there was a loss to follow-up at 6 months of 1/18 (5.6%) in the intervention group and 0/17 (0%) in the control group.

Ferrante 2017 *(Continued)*

Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Correspondence received from authors indicate that there was a loss to follow-up at 6 months of 1/18 (5.6%) in the intervention group and 0/17 (0%) in the control group.
Selective reporting (reporting bias)	Low risk	Pre-planned analysis conducted.
Other bias	Low risk	Nil identified.

Ghavami 2017

Study characteristics	
Methods	Study design: RCT Number randomised: 80 (40 intervention, 40 control) Duration of study 2012 to 2015 Duration of latest follow-up: 6 months
Participants	Country of study: Iran Breast cancer stages included: I-III Time since diagnosis: not stated Group comorbidities: none Age, years, mean (SD): total: 48.99 (9.42), experimental: 48.75 (9.49), control: 49.23 (9.46) Sex: female Menopausal status: not stated Ethnicity: not stated Relevant inclusion criteria: • completed primary treatment (surgery, chemotherapy, radiotherapy) between 3 and 18 months ago • must be able to read and write in Persian Relevant exclusion criteria: • participants with terminal disease or metastatic breast cancer • participants who have severe anorexia, nausea, or 'other diseases that affect health' • use of oral contraceptives or hormone replacement therapy during the last 4 months • participants who receive high-dose antioxidant supplements or follow alternative/complementary diets • participants who were engaged in exercise at the beginning of study
Interventions	Intervention group (n = 40) Type of intervention: diet+exercise+individual in-person counselling (diet) Duration of intervention: 6 months Setting: exercise centre

Ghavami 2017 *(Continued)*

	Type of diet: 600 kcal daily deficit Type of exercise: aerobic Frequency and duration of exercise sessions: 50 minute sessions conducted 3 to 5 days per week Intensity of exercise sessions: 70% to 85% of heart rate reserve for 30 minutes. Note first 10 minutes was light aerobic exercise and final 10 minutes was low intensity aerobic exercise. Additional information on intervention: all exercise sessions supervised by an exercise coach and conducted in groups of 15 to 20 participants. First 10 minutes included range of motion exercises (warm-up) and last 10 minutes had low intensity exercise (cool-down). Positive attitudes used to promote adherence. Aimed for a steady 0.5 kg/week weight loss. Weekly meetings with researcher to receive individualised dietary counselling. Control group (n = 40) Type or setting of control: usual care Information on control: participants in the control group continued their routine care.
Outcomes	Anthropometric outcomes: BMI Biomarker outcomes: none QOL outcomes: EORTC QLQ-C30, scales and subscales: Global health status/QOL, Physical functioning, Role functioning, Emotional functioning, Cognitive functioning, Social functioning Other outcomes: none Time points: all outcomes at baseline and 6 months
Notes	Funding: none

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random numbers.
Allocation concealment (selection bias)	Low risk	Computer-generated sequence with original order kept off-site.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of personnel. Participants cannot be blinded as they either receive the dietary counselling and supervised exercise or not.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants not blinded due to nature of intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of personnel not mentioned.
Incomplete outcome data (attrition bias)	Low risk	Does not appear to have any significant missing data.

Ghavami 2017 *(Continued)*

Patient-reported outcomes		
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Does not appear to have any significant missing data.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

Goodwin 2014

Study characteristics	
Methods	Study design: RCT Number randomised: 189 (98 intervention, 91 control) Duration of study 2007 to 2010 Duration of latest follow-up: 24 months
Participants	Country of study: Canada Breast cancer stages included: I-III Time since diagnosis: not stated Group comorbidities: none Age: not stated Sex: female Menopausal status: 100% postmenopausal Ethnicity: not stated Relevant inclusion criteria: • postmenopausal • diagnosed with T1-3N0-3M0 breast cancer during previous 36 months • received definitive surgery • currently receiving letrozole • chemotherapy (if given) completed ≥4 weeks before study • BMI ≥ 24 kg/m^2 (note we utilised BMI≥ 30 kg/m^2 data only due to reporting of BMI < 30 and BMI ≥ 30 data) • fluent in English or French Relevant exclusion criteria: • life expectancy less than 5 years • diabetes requiring insulin • recurrence of breast cancer • history of other invasive cancers

Goodwin 2014 *(Continued)*

Interventions	Intervention group (n = 98) Type of intervention: individual telephone counselling (diet+exercise)+diet+exercise Duration of intervention: 24 months Setting: individual telephone counselling Type of diet: 500 kcal to 1000 kcal daily deficit. Initial recommended daily intake of 1250, 1500 or 1750 kcal, reduction in fat to 20% of calories and increased consumption of fruits, vegetables and grains. Type of exercise: aerobic Frequency and duration of exercise sessions: gradually increased to 150-200 minutes per week Intensity of exercise sessions: 'moderate-intensity' (walking for the majority of patients) Additional information on intervention: 2-year telephone-based individualised intervention conducted by trained lifestyle coaches. Intervention emphasised behavioural change including motivation, relapse prevention, reducing emotional distress, time management and overcoming barriers. Telephone sessions were scheduled as follows: 19 during the intensive phase (weeks 0-4), every 2 weeks during the consolidation phase (months 2-3), every month during months 4-6, every 2 months during the maintenance phase (months 7-12) and every 3 months during months 13-24. A workbook was provided containing detailed information regarding each call. Calls were 30-60 minutes in duration, and were scripted, semi-structured and standardised. These calls involved reviews of progress and issues since each previous call and goal-setting (diet, activity and behavioural) to be addressed prior to the next call. Control group (n = 91) Type or setting of control: written materials Information on control: received publicly available information on healthy living at randomisation and 1 year. Information sourced from various groups including Canadian Cancer Society and Health Canada. Content contained information regarding healthy diets, physical activity and breast cancer. Also received a 2-year subscription to the Canadian Health Magazine.
Outcomes	Anthropometric outcomes: body weight Biomarker outcomes: none QOL outcomes: none Other outcomes: none Time points: baseline and 24 months utilised. Note body weight also measured at months 6, 12 and 18.
Notes	Funding: financial support provided by study authors (Pamela J. Goodwin, Mark Levine, Kathleen I. Pritchard) Trial contains BMI<25 participants, however is analysed by BMI <30 or BMI ≥30. Thus there is an analysis of BMI ≥30 participants which is eligible, but only has body weight as an outcome of interest. Hence data for participants with 25 ≤ BMI < 30 were not able to be utilised.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random sequence.

Goodwin 2014 *(Continued)*

Allocation concealment (selection bias)	Low risk	Randomisation performed centrally.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding. Participants cannot be blinded as they either receive telephone counselling or not.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	No mention of blinding. Participants cannot be blinded due to the nature of the intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	No mention of blinding. Participants cannot be blinded due to the nature of the intervention.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	Data extracted for BMI ≥ 30 participants. Completeness of data for this subgroup not known.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Unclear risk	Data extracted for BMI ≥30 participants. Completeness of data for this subgroup not known.
Selective reporting (reporting bias)	Low risk	Pre-planned analyses conducted except for disease-free survival and overall-survival, which is explained to be due to the study not recruiting sufficiently for these outcomes.
Other bias	High risk	Although trial permits BMI ≥24, We were only above to extract BMI≥30 participants so the outcomes of participants between BMI 25 to 30 was not extracted (and is therefore unknown).

Greenlee 2013

Study characteristics	
Methods	Study design: randomised cross-over trial (cross-over at 6 months) Number randomised: 42 (22 intervention, 20 control) Duration of study: 2007-2008 Duration of latest follow-up: 6 months
Participants	Country of study: USA Breast cancer stages included: 0-III. DCIS n = 4 (9.5%) Time since diagnosis, years, mean (SD): overall: 4.1 (2.7), intervention: 3.5 (2.1), control: 4.7 (3.2) Group comorbidities: none Age, years, mean (SD): total: 50.7 (8.9), experimental: 52.6 (8), control: 48.6 (9.6)

Greenlee 2013 *(Continued)*

	Sex: female Menopausal status, n (%): premenopausal overall: 8 (19), intervention: 5 (22.7), control: 3 (15). postmenopausal overall: 34 (81), intervention: 17 (77.3), control: 17 (85) Ethnicity: 79% Hispanic, 21% Black Relevant inclusion criteria: • age 21-70 years old • self-identified as Hispanic or of African descent (African American or Caribbean) • diagnosed with stage 0-IIIa breast cancer • completed surgery, chemotherapy and radiotherapy at least 6 months prior • no evidence of recurrent or metastatic disease • BMI > 25 kg/m^2 • Sedentary (defined as participating in < 20 minutes per week of physical activity to the point of sweating) Relevant exclusion criteria: • actively engaged in a weight loss program • smoker • HbA1c > 8% • blood pressure > 140/90 • change in LDL cholesterol > 150 mg/dL
Interventions	Intervention group (n = 22) Type of intervention: diet+exercise Duration of intervention: 6 months Setting: exercise centre Type of diet: consumed 1200 cal/day for 1-2 weeks then 1600 cal/day. Distribute caloric intake as 45% protein, 30% carbohydrates, 25% fat. Encouraged to eat daily: breakfast, 5 small meals, ≥2 servings fruit, ≥3 servings vegetables and drink 2 litres of water. Also encouraged to read food labels when choosing foods. Type of exercise: aerobic and resistance Frequency and duration of exercise sessions: beginning at 15 minute sessions per day, increasing to 30 minutes per day, with a goal of 3 days per week Intensity of exercise sessions: at beginning target was ≤ 60% maximum heart rate, which was gradually increased by week 8 to 70% to 75% maximum heart rate. Additional information on intervention: 'Curves' weight management program curriculum utilised. This included use of Curves fitness centres and a Curves diet plan taught by Curves staff through a standardised nutrition course. Included a book, DVD and instructor manual. Exercise was circuit-based which alternates 30 seconds of bi-directional resistance machine exercises with 30 seconds of aerobic exercise. Exercise sessions progressed to include 25 minutes of this circuit then 5 minutes of cool-down and stretching. At the beginning participants received individual supervision by a Curves trainer for 3 sessions. Control group (n = 20) Type or setting of control: wait-list. Information on control: participants instructed not to change diet or physical activity.

Greenlee 2013 *(Continued)*

Outcomes	Anthropometric outcomes: body weight, waist circumference Biomarker outcomes: none QOL outcomes: none Other outcomes: recurrence Time point: baseline and 6 months.
Notes	Funding: Gateway for Cancer Research, Women At Risk, the Susan G. Komen Foundation, NIH

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Although mentions use of randomly permuted blocks, does not detail how the sequence was generated.
Allocation concealment (selection bias)	Low risk	Participants randomised using randomly permuted blocks.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of personnel not mentioned but blinding of participants not feasible due to nature of the intervention.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded as they were either assigned to an exercise program or wait-list control.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Assessor blinding not mentioned.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	For first arm of study (six months follow-up) experimental: no dropouts; control: three discontinuations with reasons explained (one for BC recurrence, one for undiagnosed cardiac condition, one for 'too busy')
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	For first arm of study (6 months follow-up) experimental: no dropouts; control: three discontinuations with reasons explained (one for BC recurrence, one for undiagnosed cardiac condition, one for 'too busy')
Selective reporting (reporting bias)	High risk	Study mentions that the main study outcomes were reported - unclear what was omitted.
Other bias	Low risk	Nil identified.

Kwiatkowski 2017

Study characteristics

Methods	Study design: RCT

Kwiatkowski 2017 *(Continued)*

	Number randomised: 123 (62 intervention, 61 control) Duration of study: 2008 to 2010 Duration of latest follow-up: 60 months
Participants	Country of study: France Breast cancer stages included: II-III Time since diagnosis: not stated. Time post treatment, years, mean (SD): overall: 0.27 (0.21), intervention: 0.25 (0.19), control: 0.29 (0.23) Group comorbidities: none Age, years, mean (SD): total: 53.5 (9.6), experimental: 52.6 (9.5), control: 54.3 (9.7) Sex: female Menopausal status, n (%): premenopausal: overall: 39 (31.7), intervention: 22 (35.5), control: 17 (27.9) postmenopausal: overall: 84 (68.3), intervention: 40 (64.5), control: 44 (72.1) Ethnicity: 100% Caucasian Relevant inclusion criteria: • non-metastatic invasive breast cancer patients • age 18-75 years old • in complete remission after treatment Relevant exclusion criteria: none
Interventions	Intervention group (n = 62) Type of intervention: diet+exercise+group counselling (diet, exercise) Duration of intervention: 0.5 months Setting: thermal centre Type of diet:iIntake of 1700 cal/day to 2000 cal/day. Type of exercise: aerobic and resistance Frequency and duration of exercise sessions: 2 hours per day for 13 days Intensity of exercise sessions: not stated Additional information on intervention: intervention carried out in groups of 7-11 patients. Involved consultations with medical, nutritionist and psycho-oncologists. Physical activity was supervised by a physiotherapist. Endurance activities included walking over flat ground or using a cycloergometer. Aquagymnastics was utilised. Dietary meals provided as was daily dietary education involving cooking lessons related to the participant's lunch or supper meals. At each meal the chef visited the dining room to answer participant questions about the menu and recipes. Control group (n = 61) Type or setting of control: usual care Information on control: received personal consultations with a dietician every 6 months for 3 years. Provided dietary advice regarding low-fat cooking and encouraged daily physical activity.
Outcomes	Anthropometric outcomes: BMI, body weight, waist circumference

Kwiatkowski 2017 *(Continued)*

	Biomarker outcomes: none QOL outcomes: SF-36, scales and subscales: total score, physical functioning, general health, vitality, role-physical, role-emotional. HAD (hospital anxiety and depression), scales and subscales: total score, anxiety subscale, depression subscale Other outcomes: recurrence, mortality Time points: BMI, body weight, waist circumference, recurrence and mortality all at baseline and 36 months. SF-36 and HAD at baseline and 60 months.
Notes	Funding: AFRETH (French association for hydrothermal research). Funding by AFRETH (French association for hydrothermal research) however no role in manuscript or management. Authors contacted for BMI ≥ 25 data, which were provided.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Used randomisation software.
Allocation concealment (selection bias)	Low risk	Randomisation occurred after recruitment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding not mentioned
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Blinding not mentioned, and participants cannot be blinded due to nature of intervention.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of non-patient-reported outcomes not mentioned
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	Significant dropout without reasons or analysis of completers vs non-completers (baseline n = 122 compared to five-years n=78 for QOL data)
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	Significant dropout without reasons or analysis of completers vs non-completers (baseline n = 123 compared to 3 years n = 53 for anthropometric outcomes)
Selective reporting (reporting bias)	Low risk	Planned analyses conducted.
Other bias	Low risk	Nil identified.

Mefferd 2007

Study characteristics	
Methods	Study design: RCT Number randomised: 85 (56 intervention, 29 control) Duration of study: 2002 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: I-IIIa Time since diagnosis: 3.5 years. Time post treatment: not stated Group comorbidities: none Age, years, mean (SD): total: 56.3 (8.2), experimental: 56 (9.0), control: 56 (8) Sex: female Menopausal status, n (%): premenopausal: overall: 12 (16) postmenopausal: overall: 64 (84) Ethnicity: 93.4% Caucasian Relevant inclusion criteria: • age 18 years and older • stage I-IIIa breast cancer diagnosed in the past 14 years • have completed initial cancer treatments Relevant exclusion criteria: • inability to exercise • pregnancy
Interventions	Intervention group (n = 56) Type of intervention: group CBT+ exercise+individual telephone counselling (diet, exercise) Duration of intervention: 4 months Setting: Group CBT Type of diet: 500 kcal/day to 1000 kcal/day deficit goal Type of exercise: aerobic Frequency and duration of exercise sessions: 1 hour of exercise per day Intensity of exercise sessions: moderate to vigorous Additional information on intervention: participants assigned to the intervention group attended group sessions using curriculum based on the new elements of CBT for obesity in addition to many elements of standard behavioral treatment for obesity, included self-monitoring, realistic goal-setting and cognitive restructuring, as applied to behavior and attitudinal change (relevant to increased physical activity, food choices, and body image). Participants were advised to self-monitor with food diaries and exercise logs, monitoring negative and positive thoughts and feelings in addition to actual behavior. Telephone contact was made four times in the initial 2 weeks and once weekly following this period. Content of the calls reviewed the previous days' physical activity and food choices and provided feedback to develop subgoals and goals.

Mefferd 2007 *(Continued)*

	Control group (n = 29) Type or setting of control: wait-list Information on control: control participants were wait-listed for the intervention. There was no change to usual care.
Outcomes	Anthropometric outcomes: height, body weight, BMI, waist circumference, hip circumference, whole body fat, percentage body fat Biomarker outcomes: Cholesterol, triglycerides, LDL, HDL QOL outcomes: N/A Time points: height, body weight, BMI, waist circumference, hip circumference, whole body fat, percent body fat, cholesterol, triglycerides, LDL, HDL all at baseline and 16 weeks.
Notes	Funded by NIH

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Does not mention how randomisation was achieved.
Allocation concealment (selection bias)	Unclear risk	Participants willing to be randomised to either group at recruitment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of personnel e.g. DXA technician achieved, but blinding of participants not feasible (attending group sessions vs wait-list)
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants not blinded
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	DXA technician blinded, however other outcomes do not mention blinding.
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	Out of the 85 participants beginning the study all 9 dropouts were from intervention group and they were excluded from the final analysis. No analysis of completers versus non-completers.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	Out of the 85 participants beginning the study all 9 dropouts were from intervention group and they were excluded from the final analysis. No analysis of completers versus non-completers.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted, part of a larger study.
Other bias	Low risk	Nil identified

Reeves 2016

Study characteristics	
Methods	Study design: RCT Number randomised: 90 (45 intervention, 45 control) Duration of study: 2010 to 2012 Duration of latest follow-up: 18 months
Participants	Country of study: Australia Breast cancer stages included: I-III Time since diagnosis: 1.3 years. Time post treatment: not stated Group comorbidities: none Age, years, mean (SD): total: 55.3 (8.7), experimental: 56.4 (9.0), control: 54.3 (8.4) Sex: female Menopausal status, n (%): premenopausal: overall: 34 (37.8) postmenopausal: overall: 41 (45.6) perimenopausal: overall: 15 (16.7) Ethnicity: 96.7% Caucasian Relevant inclusion criteria: • age 18-75 years • BMI 25 to 45 kg/m^2 • have completed primary cancer treatments Relevant exclusion criteria: • contraindications to participating in an unsupervised program • pregnancy • taking pharmacological doses of warfarin • 5% weight loss in the last 6 months or greater • insufficient English to complete assessments • anxiety or other mental health problem that would interfere with participation
Interventions	Intervention group (n = 50) Type of intervention: individual telephone counselling (diet and exercise) Duration of intervention: 12 months Setting: individual telephone counselling Type of diet: reduce kilojoule intake by 2000 kJ per day aiming for intake between 5000 kj to 7500 kJ depending on age and weight. Improved diet quality with five serves per day of vegetables and two serves per day of fruit; total fat intake ≤ 30 % of energy; saturated fat intake < 7 % of energy; and, limit alcohol intake to one standard drink per day Type of exercise: Aerobic + Resistance Frequency and duration of exercise sessions: 210 minutes of aerobic exercise per week with at least 30 minutes per day. 2-3 resistance sessions per week.

Reeves 2016 *(Continued)*

	Intensity of exercise sessions: moderate to vigorous Additional information on intervention: participants assigned to the intervention group have an initial 6-month period of weekly and fortnightly coaching calls which provide education about the importance of physical activity, healthy eating and weight management (by working through workbook content both during and in-between calls), encourage skill building through self-monitoring and goal setting, and work towards behavior change and weight loss. Followed by 6-month maintenance phase with monthly phone calls to review progress, problem solve, and identify barriers and solutions to maintaining weight loss, physical activity and dietary changes. Control group (n = 50) Type or setting of control: usual care Information on control: participants in the usual care group continue to receive their standard medical care. In addition, these participants are posted materials after each of their study assessments (baseline, 6 months, 12 months, 18 months), which includes brief written feedback from their study assessment, a copy of a newsletter from the national breast cancer consumer organisation and a study newsletter.
Outcomes	Anthropometric outcomes: height, body weight, BMI, waist circumference, hip circumference, body composition, bone mineral density, blood pressure Biomarker outcomes: Cardio-metabolic & cancer-related biomarkers, glucose, lipids, HbA1c QOL outcomes: SF-36 physical scale and SF-36 mental scale Other outcomes: physical functioning, dietary intake, physical activity, sitting time Time points: data collected at initial clinic visit and at 6 months, 12 months and 18 months
Notes	Funding by University of Queensland, NHMRC, National Breast Cancer Foundation

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random sequence
Allocation concealment (selection bias)	Low risk	Participants randomised after recruitment
Blinding of participants and personnel (performance bias) All outcomes	High risk	Research staff blinded but not possible to blind participants (either receive the counselling or not).
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Research staff blinded but not possible to blind participants (either receive the counselling or not).
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Low risk	Research staff blinded
Incomplete outcome data (attrition bias)	Low risk	Supplementary material 1 contains an analysis of completers and non completers for both PRO and non-PRO which suggests a low risk of attrition bias

Reeves 2016 *(Continued)*

Patient-reported outcomes		
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Supplementary material 1 contains an analysis of completers and non completers for both PRO and non-PRO which suggests a low risk of attrition bias
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

Rock 2015

Study characteristics	
Methods	Study design: RCT Number randomised: 697 (348 intervention, 349 control) Duration of study: 2010 to 2012 Duration of latest follow-up: 24 months
Participants	Country of study: USA Breast cancer stages included: I-III Time since diagnosis: 2.62 (intervention), 2.78 (control) Time post treatment: not stated Group comorbidities: none Age, years, mean (SD): experimental: 56 (9), control: 56 (9) Sex: female Menopausal status, n (%): postmenopausal: overall: 563 (81.4) Ethnicity: Caucasian 71%, African American 10.5%, Hispanic 7.6% Relevant inclusion criteria: • age > 21 • BMI 25 kg/m^2 to 45 kg/m^2 • stage I-III breast cancer diagnosed within 5 years • completion of initial breast cancer therapy Relevant exclusion criteria: • history of malignancy aside from primary breast cancer • serious psychiatric or physical condition which prevented participation
Interventions	Intervention group (n = 348) Type of intervention: group counselling (diet and exercise) followed by further individual counselling (diet and exercise)

Rock 2015 *(Continued)*

	Duration of intervention: 24 months Setting: face-to-face counselling sessions Type of diet: the goal of dietary guidance was to promote a reduction in energy intake, aiming for a deficit of 500 to 1000 kcal a day relative to expenditure. Type of exercise: aerobic Frequency and duration of exercise sessions: 60 minutes per day Intensity of exercise sessions: moderate Additional information on intervention: the intervention began with an intensive phase that consisted of 4 months of weekly 1-hour group sessions for closed groups of an average of 15 women, tapering to every other week for 2 months. From 6 months onward, the groups met monthly for the remainder of the first year. The strategies and guidance discussed in the group sessions were reinforced by brief (10- to 15-minute) personalised guidance delivered by telephone and/or e-mail. Control group (n = 349) Type or setting of control: usual care Information on control: control group participants were provided weight management resources and materials in the public domain. An individualised diet counselling session was provided at baseline and 6 months, and current physical activity recommendations (at least 30 minutes per day) were advised. Control group participants also received monthly telephone calls and/or e-mails from the study co-ordinator and were invited to attend optional informational seminars on aspects of healthy living other than weight control every other month during the first year.
Outcomes	Anthropometric outcomes: height, body weight, BMI, waist circumference, blood pressure Biomarker outcomes: N/A QOL outcomes: QOL data reported in a secondary paper (Demark-Wahnefried 2015) Other outcomes: physical activity level, fitness level Time points: data collected at initial clinic visit and at 6 months, 12 months, 18 months and 24 months
Notes	Funded by NIH and NCI (National Cancer Institute). Although funded by NCI grant there are extensive conflicts of interests, particularly with the dietary industry

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Centralised, computerised-generated sequence
Allocation concealment (selection bias)	Unclear risk	Allocation concealment not specifically mentioned
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants cannot be blinded (received intensive group sessions or not) and blinding of assessors not mentioned.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participants cannot be blinded (received intensive group sessions or not) and blinding of assessors not mentioned.

Rock 2015 *(Continued)*

Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Assessor blinding not mentioned.
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	PRO data (physical activity data) available at 24 months follow-up (compared to baseline) for 256/343 experimental participants and 250/348 control participants. Furthermore, authors acknowledge that physical activity data were self-reported and therefore may not be accurate.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Unclear risk	Relatively low dropout for non-PRO, however dropouts were significantly heavier than completers
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted, except for QOL outcomes which are reported in another paper (Denmark-Wahnefried 2015).
Other bias	Low risk	Nil identified.

Scott 2013

Study characteristics	
Methods	Study design: RCT Number randomised: 90 (47 intervention, 43 control) Duration of study: 2012 Duration of latest follow-up: 6 months
Participants	Country of study: UK Breast cancer stages included: I-III Time since diagnosis: not stated Time post treatment, years, mean (SD) : Expermimental: 0.75 (0.46), Control: 0.59 (0.37) Group comorbidities: none Age, years, mean (SD): experimental: 55.6 (10.2), control: 55.9 (8.9) Sex: female Menopausal status, n (%): postmenopausal: overall: 61 (67.7), premenopausal: overall: 8 (8.9), perimenopausal: 12 (13.3) Ethnicity: Caucasian 96% Relevant inclusion criteria: • BMI > 25 kg/m^2 • completed initial breast cancer treatment within 3-18 months • stage I-III at diagnosis Relevant exclusion criteria: • concomitant HRT or oral contraceptive

Scott 2013 *(Continued)*

- metastatic or active locoregional disease
- physical or psychiatric impairment impairing exercise ability
- following alternative or complementary diet regimens
- taking high dose anti-oxidant supplements

Interventions	Intervention group (n = 47) Type of intervention: diet modification and exercise sessions Duration of intervention: 6 months Setting: exercise centre and 1:1 dietary counselling Type of diet: the goal of dietary guidance was to restrict calories to 600 kCal below calculated energy requirements thereby inducing weight loss calculated at 0.5kg per week. There were additional seminars on alcohol intake, balanced diet, dietary fat intake and hydration. Type of exercise: aerobic and resistance Frequency and duration of exercise sessions: 45 minutes, three times a week Intensity of exercise sessions: moderate Additional information on intervention: the 24-week lifestyle intervention combined three weekly supervised exercise sessions and an individually tailored hypocaloric healthy eating program. Exercise sessions comprised 30 min of aerobic exercise (65% to 85 % age-predicted maximum heart rate) using treadmill, cross-trainer, cycle ergometer, and/or rowing ergometer, followed by 10 to 15 minutes of muscle-strengthening exercises using resistance bands, hand weights, and stability balls. Each participant also received one-to-one individualised dietary advice and written information. Control group (n = 43) Type or setting of control: usual care Information on control: the control group received a healthy eating booklet, Eat Well (Food Standards Agency, UK), which also included brief advice on keeping active.
Outcomes	Anthropometric outcomes: height, body weight, BMI, waist circumference, hip circumference, waist to hip ratio, total body fat Biomarker outcomes: testosterone, SHBG, glucose, hs-CRP, blood lipid proteins, estrone, estradiol, insulin, IGF-1 and its binding proteins, leptin QOL outcomes: FACT-B Other outcomes: aerobic fitness Time points: data collected at study beginning and 6 months.
Notes	Funded by American Institute for Cancer Research (AICR)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation reportedly performed by independent researcher however sequence generation not described
Allocation concealment (selection bias)	Low risk	Allocations concealed until after baseline assessment

Scott 2013 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of participants not feasible, blinding of intervention personnel not feasible e.g. small-group nutrition seminars exclusive to intervention group.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Blinding of participants not feasible, blinding of intervention personnel not feasible e.g. small-group nutrition seminars exclusive to intervention group.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	High risk	Blinding of participants not feasible, blinding of intervention personnel not feasible e.g. small-group nutrition seminars exclusive to intervention group.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Although 6/47 women in intervention group and 5/43 women in control group were lost to follow-up, the study reports that this loss to follow-up did not significantly alter results (using imputed data)
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Although 6/47 women in intervention group and 5/43 women in control group were lost to follow-up, the study reports that this loss to follow-up did not significantly alter results (using imputed data)
Selective reporting (reporting bias)	Low risk	Pre-planned analyses conducted as per protocol.
Other bias	Low risk	Nil identified.

Shaw 2007

Study characteristics	
Methods	Study design: RCT Number randomised: 24 (12 intervention, 12 control) Duration of study: not stated Duration of latest follow-up: 3 months
Participants	Country of study: UK Breast cancer stages included: not stated Time since diagnosis: not stated Time post treatment: not stated Group comorbidities: lymphedema Age, years, median: experimental: 60, control: 59 Sex: female Menopausal status, n (%): not stated Ethnicity: not stated

Shaw 2007 *(Continued)*

	Relevant inclusion criteria: • BMI > 25 kg/m^2 • a swollen arm > 15% excess volume compared to the unaffected arm • no chemotherapy or radiotherapy in the past 12 months • cancer in remission Relevant exclusion criteria: • none
Interventions	Intervention group (n = 12) Type of intervention: individualised dietary advice Duration of intervention: 3 months Setting: 1:1 dietary counselling Type of diet: diet plans were designed to produce an energy deficit of 1000 kcal (4184 kJ) per day from habitual intake derived from the pre randomisation diet record, and no participant was recommended a daily intake < 1000 kcal (4184 kJ). Additional information on intervention: individualised dietary advice was given on a weight reduction diet with the objective of reducing body weight to the acceptable average weight for height. The majority of participants were advised to reduce their dietary intake to between 1000 kcal and 1200 kcal (4184 kj to 5020 kJ) per day. Advice was based around the participant's usual meal pattern, and the reduction of energy intake was achieved by reducing foods that contained fat and refined carbohydrate. A system of exchanges was used to enable consumption of a variety of foods that contained for protein, fat, and starchy carbohydrate. Control group (n = 12) Type or setting of control: usual care Information on control: no specific dietary intervention advice was given. Patients were given the Royal Marsden NHS Trust Patient Information Series Booklet No. 31 on healthy eating, which provides advice on how to maintain a healthy diet.
Outcomes	Anthropometric outcomes: arm volume, height, body weight, BMI, skin fold thickness Biomarker outcomes: None QOL outcomes: FACT-B Other outcomes: Dietary intake Time points: data collected initially and at three months
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated sequence utilised
Allocation concealment (selection bias)	Low risk	Randomisation occurred after a 7-day dietary assessment and therefore participants unaware of allocation at recruitment.

Shaw 2007 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participant blinding not feasible, dietician (and other personnel) blinding not mentioned.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	Participant blinding not feasible, dietician (and other personnel) blinding not mentioned.
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Non-PRO measured by same investigator but no mention of whether or not this was blinded.
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	3/24 (12.5%) of participants lost to follow-up, with 1 breast cancer recurrence and 2 due to non-commitment to the study. No mention of when these dropouts occurred (after recruitment, but was this before randomisation or during the initial 7-day pre-randomisation stage or after randomisation).
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	3/24 (12.5%) of participants lost to follow-up, with 1 breast cancer recurrence and 2 due to non-commitment to the study. No mention of when these dropouts occurred (after recruitment, but was this before randomisation or during the initial 7-day pre-randomisation stage or after randomisation).
Selective reporting (reporting bias)	Low risk	Study conducts preplanned analyses and this is similar to previous studies conducted by the authors (DOI 10.1002/cncr.22638)
Other bias	Low risk	Nil identified.

Sheppard 2016

Study characteristics	
Methods	Study design: RCT Number randomised: 31 (15 intervention, 16 control) Duration of study: 2010 to 2012 Duration of latest follow-up: 3 months
Participants	Country of study: USA Breast cancer stages included: Stage I-III Time since diagnosis: not stated Time post treatment, years (SD): Overall: 1.7 (0.88) Group comorbidities: nil Age, years, mean (SD): overall: 54.7 (9.8) Sex: female Menopausal status, n (%): not stated Ethnicity: 100% African American

Sheppard 2016 *(Continued)*

	Relevant inclusion criteria: • BMI 25 kg/m^2 to 40 kg/m^2 • African American • sedentary (less than 60 minutes exercise per week) • 6 months to 5 years since last active treatment Relevant exclusion criteria: • history of other cancer • current enrolment in other physical activity or diet program • pre-existing condition that affects ability to exercise
Interventions	Intervention group (n = 15) Type of intervention: group counselling (diet, exercise) and exercise sessions with individual telephone counselling (diet, exercise) Duration of intervention: 3 months Setting: group exercise sessions and individual telephone counselling Type of diet: > 5 fruits and vegetables per day and < 35% kcal from total fat Type of exercise: aerobic Frequency and duration of exercise sessions: 30 minutes of exercise 5 or more times per week Intensity of exercise sessions: moderate Additional information on intervention: participants met once every two weeks for 90-minute group sessions (30 minutes of supervised group physical activity and 60 minutes education sessions) that were co-led by an exercise physiologist and a nutritionist. On weeks when participants did not meet as a group they have individual telephone coaching sessions led by a trained survivor coach. Participants were given pedometers, notebooks, individualised step goals that gradually increased toward meeting and maintaining a goal of 10,000 steps/day for 12 weeks, tools to monitor and track their daily food intake, and binders to store resources and session materials. Control group (n = 16) Type or setting of control: usual care Information on control: received general information for breast cancer survivors (booklet)
Outcomes	Anthropometric outcomes: height, weight, BMI, waist circumference Biomarker outcomes: none QOL outcomes: none Other outcomes: dietary intake, physical activity, cardiovascular fitness Time points: data collected initially and at 3 months
Notes	Funded by NCI

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No mention of method of sequence generation.

Sheppard 2016 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Whether or not allocation concealment occurred is not mentioned.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of personnel but participants cannot be blinded (receive intervention or usual care).
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	No mention of blinding of personnel but participants cannot be blinded (receive intervention or usual care).
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	No mention of blinding of assessors.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Even though 5/15 (33.3%) intervention group and 4/16 (25%) control group did not complete intervention analysis reveals no differences between completers and non-completers
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Even though 5/15 (33.3%) intervention group and 4/16 (25%) control group did not complete intervention analysis reveals no differences between completers and non-completers
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

Stendell-Hollis 2010

Study characteristics	
Methods	Study design: RCT Number randomised: 54 (29 intervention, 25 control) Duration of study: 2010 Duration of latest follow-up: 6 months
Participants	Country of study: USA Breast cancer stages included: Stage I-III Time since diagnosis: not stated Time post treatment: not stated Group comorbidities: None Age, years, mean (SD): experimental: 56.6 (8.1), control: 57.8 (8.5) Sex: female

Stendell-Hollis 2010 *(Continued)*

	Menopausal status, n (%): not stated Ethnicity: not stated Relevant inclusion criteria: • BMI 25 kg/m^2 to 40 kg/m^2 • completed primary treatment for early stage breast cancer between 12 and 120 months prior to study • must have received chemotherapy (adjuvant or neoadjuvant) • nil diagnosis of chronic illness and not on any medications to control chronic illness • must have received chemotherapy (adjuvant or neoadjuvant) • nil diagnosis of chronic illness and not on any medications to control chronic illness Relevant exclusion criteria: • none
Interventions	Intervention group (n = 29) Type of intervention: dietary - 960 mL of green tea daily Duration of intervention: 6 months Setting: dietary intervention in addition to usual care Type of diet: in addition to a usual diet, the participants were required to drink 960 mL of decaffeinated herbal green tea. Additional information on intervention: women were asked to consume 960 mL of green tea daily. Specific instructions for tea preparation were provided by the study co ordinator during the initial clinic visit. To review, individual tea bags were placed in the provided tea mug and 240 mL of boiling water was added and allowed to steep for a period of 3 minutes. The tea bag was then removed from the cup and stored in a provided bag to track compliance to tea intake. Participants were asked to consume the tea product four times daily and up to two doses were allowed at any single dosing (two bags in 500 mL of boiling water). Control group (n = 25) Type or setting of control: placebo Information on control: participants in the control group received a placebo of citrus based herbal tea but were provided with the same information as intervention participants. Blinded taste testing prior to the study revealed that people were not able to tell the difference between the green and citrus based teas.
Outcomes	Anthropometric outcomes: body weight, height, BMI, waist and hip circumference, body composition Biomarker outcomes: fasting glucose, fasting insulin level, fasting lipids QOL outcomes: none Other outcomes: dietary intake, physical activity, resting metabolic rate Time points: data collected initially and at 6 months
Notes	Study funded by Unilever and NIH. Materials sourced from an external company (acknowledged but not mentioned as a conflict of interest or funding source).

Risk of bias

Bias	Authors' judgement	Support for judgement

Stendell-Hollis 2010 *(Continued)*

Random sequence generation (selection bias)	Low risk	Random number table utilised
Allocation concealment (selection bias)	Low risk	Randomisation conducted independent of study personnel
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Investigators and participants blinded
Blinding of outcome assessment (detection bias) Patient-reported outcomes	Low risk	Investigators and participants blinded
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Low risk	Investigators and participants blinded
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Of the 6/29 (21%) experimental and 9/25 (36%) control participants lost to follow-up, 4/15 (27%) have no reason provided. However comparisons of completers and non-completers revealed no significant differences at baseline.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	Low risk	Further issues with biomarkers resulting in reduced numbers, including issues with sampling volume or difficult blood draws. Overall comparison of completers and non-completers revealed no significant differences.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

Stolley 2017

Study characteristics	
Methods	Study design: RCT Number randomised: 246 (125 intervention, 121 control) Duration of study: 2011 to 2014 Duration of latest follow-up: 12 months
Participants	Country of study: USA Breast cancer stages included: stage I-III Time since diagnosis, years: overall: 6.7 Time post treatment: not stated Group comorbidities: none

Stolley 2017 *(Continued)*

	Age, years, mean (SD): experimental: 56.8 (10), control: 58.1 (10.1) Sex: female Menopausal status, n (%): overall: perimenopausal: 214 (87) Ethnicity: 100% African American Relevant inclusion criteria: • BMI > 25 kg/m^2 • self identify as African American • completed primary treatment for breast cancer at least 6 months prior to study • physically able to compete in a moderate physical activity program Relevant exclusion criteria: • pregnant or less than 3 months post partum • currently engaged in weight loss intervention such as medication, previous bariatric surgery or structured weight loss program
Interventions	Intervention group (n = 125) Type of intervention: group counselling (diet, exercise) and exercise sessions Duration of intervention: 6 months Setting: group counselling Type of diet: decreased caloric intake (-500 kcal daily), increased fruit and vegetable consumption Type of exercise: aerobic Frequency and duration of exercise sessions: 180 minutes of exercise per week Intensity of exercise sessions: moderate Additional information on intervention: 5% weight loss achieved by decreased caloric intake (-500 kcal daily), increased fruit and vegetable consumption, and increased physical activity (minimum 150 minutes per week). Twice-weekly in-person classes with supervised exercise and twice-weekly text messaging targeting enhanced self-efficacy, social support, and access to health promotion resources. Control group (n = 121) Type or setting of control: written materials Information on control: control participants met once with a non- intervention staff member to receive and review program materials
Outcomes	Anthropometric outcomes: body weight, height, BMI, waist and hip circumference, body composition Biomarker outcomes: estradiol, oestrogen, sex hormone-binding globulin, testosterone, IGF-I, IGBP3, C-peptide, C-reactive protein, IL-6, lipid profile, HbA1c, QOL outcomes: not reported Other outcomes: dietary intake, physical activity Time points: data collected initially and at 12 months
Notes	Funded by NCI and one of the authors; Patricia Sheean
Risk of bias	

Stolley 2017 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random digit generator used
Allocation concealment (selection bias)	Low risk	Randomised after recruitment (after a baseline interview)
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding, participants cannot be blinded as they either receive the weekly classes or not.
Blinding of outcome assessment (detection bias) Patient-reported outcomes	Unclear risk	No relevant patient-reported outcomes
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	High risk	No mention of blinding of assessors. Active intervention group versus passive control group.
Incomplete outcome data (attrition bias) Patient-reported outcomes	Unclear risk	No patient-reported outcomes were extracted from this study.
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	18/125 (14.4%) lost to 12-month follow-up in experimental and 21/121 (17.4%) in control group. No reasons or analyses of dropouts presented in study to determine the significance of this loss to follow-up.
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

Swisher 2015

Study characteristics	
Methods	Study design: RCT Number randomised: 28 (18 intervention, 10 control) Duration of study: 2011 to 2013 Duration of latest follow-up: 3 months
Participants	Country of study: USA Breast cancer stages included: stage I-III Time since diagnosis, years: overall: not stated Time post treatment: not stated

Swisher 2015 *(Continued)*

	Group comorbidities: none Age, years, mean: experimental: 53.8, control: 53.6 Sex: female Menopausal status, n (%): overall: perimenopausal: 214 (87) Ethnicity: not stated Relevant inclusion criteria: • BMI >25 kg/m^2 • completed primary treatment for breast cancer at least 3 months prior to study • triple negative breast cancer as proven on biopsy • less than 80 years of age Relevant exclusion criteria: • physical or psychological comorbidities that would prevent participation in an exercise program • significant lymphedema • cardiac or renal disease • diabetes mellitus • active smoking
Interventions	Intervention group (n = 18) Type of intervention: individual in-person counselling (diet) and exercise Duration of intervention: 3 months Setting: exercise centre Type of diet: decrease dietary fat caloric intake by 200 kcal per week" by decreasing portion sizes, substituting lower-calorie options, and increasing fruit and vegetable intake Type of exercise: aerobic Frequency and duration of exercise sessions: 150 minutes of exercise per week Intensity of exercise sessions: moderate Additional information on intervention: the goal of the program was to complete 150 minutes per week of moderate-intensity aerobic exercise, individually supervised by exercise physiologists. Three sessions per week were supervised at an exercise centre and two unsupervised sessions performed at home. Dietary counselling consisted of two individual sessions with the study dietitian. Control group (n = 10) Type or setting of control: written materials Information on control: participants randomised to the control group received written materials about healthy eating for cancer survivors and suggestions on ways to achieve regular physical activity. They were not instructed to avoid diet change or exercise, as it was felt that this would be unethical and contrary to best advice. However, they did not receive any specific counselling or supervision.
Outcomes	Anthropometric outcomes: body weight, height, BMI, waist and hip circumference, skinfold thickness Biomarker outcomes: IL-6, TNF-α, CRP, leptin, adiponectin, and insulin QOL outcomes: FACT-B Other outcomes: physical activity, peak exercise capacity

Swisher 2015 *(Continued)*

	Time points: data collected initially and at 3 months
Notes	Funded by American Cancer Society, West Virginia Higher Education Policy Commission, American Physical Therapy Association, NIH

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described
Allocation concealment (selection bias)	Low risk	Opaque sealed envelopes, allocation not revealed until after baseline testing
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of participants or personnel, participants cannot be blinded as they either receive supervised exercise sessions or not
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	No mention of blinding of participants or personnel, participants cannot be blinded as they either receive supervised exercise sessions or not
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	High risk	No mention of blinding of assessors in manuscript, registry mentions trial is 'open label'
Incomplete outcome data (attrition bias) Patient-reported outcomes	High risk	5/18 (28%) participants in intervention group lost to follow-up compared to 0/10 (0%) in control group with no explanation given and no comparison between completers and non-completers
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	5/18 (28%) participants in intervention group lost to follow-up compared to 0/10 (0%) in control group with no explanation given and no comparison between completers and non-completers
Selective reporting (reporting bias)	Low risk	Pre-planned analyses conducted as per registry.
Other bias	Low risk	Nil identified.

Thomson 2010

Study characteristics

Methods	Study design: RCT Number randomised: 43 (21 intervention, 22 control) Duration of study: 2006 to 2007 Duration of latest follow-up: 6 months

Thomson 2010 *(Continued)*

Participants	Country of study: USA Breast cancer stages included: Stage I-II Time since diagnosis, years (SD): overall: 3.7 (3.4) Time post treatment: not stated Group comorbidities: none Age, years, mean (SD): overall: 56.2 (9.4) Sex: female Menopausal status, n (%): overall: perimenopausal: 40 (100) Ethnicity: Caucasian 82.5% Relevant inclusion criteria: • BMI 25-35 kg/m^2 • oestrogen receptor positive • have completed primary treatment for breast cancer in the last 4 years • no recent significant weight loss or enrolment in weight loss program • currently on hormonal therapy for breast cancer Relevant exclusion criteria: • significant hepatic or renal dysfunction • diabetes mellitus
Interventions	Intervention group (n = 21) Type of intervention: dietary intervention (Low carbohydrate) and dietary counselling Duration of intervention: 6 months Setting: individual in-person counselling Type of diet: modified Atkins/reduced carbohydrate diet, “35% carbohydrate, 25% to 30% protein, and 35% to 40% fat with greater monounsaturated fat.” 500 kCal per day energy deficit. Type of exercise: N/A Frequency and duration of exercise sessions: N/A Intensity of exercise sessions: N/A Additional information on intervention: overweight breast cancer survivors were randomised 1:1 to one of two calorie-restricted diets—a low-fat diet or a modified Atkins/reduced carbohydrate diet. Energy requirements for participants were calculated to aim to induce a 1 to 1.5 pound weight loss in participants. Dietary counselling for the individual study subjects began with a clinic-based, face-to-face, 45-minute counselling session with a registered dietician. The women met with the dietician weekly for a period of 6 weeks. Each counselling session included a review of gram intake logs and a 24-hour recall to assess of adherence to targeted diet. Control group (n = 22) Type or setting of control: low-fat diet Information on control: counselling frequency and behavioral methods were similar across diet groups with only content focus related to macronutrient goals differing between arms.
Outcomes	Anthropometric outcomes: body weight, height, BMI, waist and hip circumference, body composition

Thomson 2010 *(Continued)*

	Biomarker outcomes: change in glucose, insulin, HbA1c, lipid panel, high sensitivity CRP QOL outcomes: nil Other outcomes: Dietary intake, physical activity Time points: data collected initially and at 6 months
Notes	Funded by Robert C. and Veronica Atkins Foundation, the University of Arizona Cancer Center. Funding by the 'Robert C. and Veronica Atkins Foundation' and no disclaimer of what role this organisation played in terms of the manuscript. Although Atkins Foundation appears to be unrelated and independent to other Atkin business interests, there is still a lack of a disclaimer.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	Allocation concealment not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding, participants cannot be blinded as they follow low carbohydrate or low fat diet
Blinding of outcome assessment (detection bias) Patient-reported outcomes	High risk	No mention of blinding, participants cannot be blinded as they follow low carbohydrate or low-fat diet
Blinding of outcome assessment (detection bias) Non patient-reported outcomes	Unclear risk	Blinding of outcome assessment not mentioned
Incomplete outcome data (attrition bias) Patient-reported outcomes	Low risk	Comparison of completers and non-completers conducted, unclear how this affected PRO (only non-PRO differences outlined)
Incomplete outcome data (attrition bias) Non patient-reported outcomes	High risk	Comparison of completers and non-completers conducted, significant differences (e.g. higher baseline body weight) in non-completers
Selective reporting (reporting bias)	Low risk	Preplanned analyses conducted.
Other bias	Low risk	Nil identified.

BMI: body mass index
CBT: cognitive behavioural therapy
CRP: C-reactive protein
DCIS: ductal carcinoma in situ
HDL: high-density lipoprotein
HRT: hormone replacement therapy

IGF: insulin growth factor
IL: interleukin
LDL: low-density lipoprotein
PRO: patient-reported outcomes
QOL: quality of life
RCT: randomised controlled trial
SD: standard deviation
SG 36: Short form 36
SHBG: Sex hormone-binding globuliN
TNF: tumour necrosis factor

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
16NCT00249015	The aim of the intervention was not weight loss.
Arneil 2017	The aim of the intervention was not weight loss.
Artene 2017	Authors contacted and clarified that the aim of the intervention was not weight loss.
Azamian 2015	This trial included participants with BMI < 25.
Bachmann 2014	The aim of the intervention was not weight loss.
Basen-Engquist 2009	The aim of the intervention was not weight loss.
Baumann 2010	The aim of the intervention was not weight loss.
Befort 2014	The aim of the intervention was not weight loss.
Befort 2016	The initial 6-month period included a non-randomised intervention, and therefore some participants may have had BMI < 25 at randomisation. The aim of the intervention was not weight loss.
Blackburn 2007	Included participants with BMI < 25.
Bucciarelli 2017a	The aim of the intervention was not weight loss.
Bucciarelli 2017b	The aim of the intervention was not weight loss.
Butalla 2012	The aim of the intervention was not weight loss.
Chen 2009	The aim of the intervention was not weight loss.
Chen 2017	The aim of the intervention was not weight loss.
Chen 2019	The aim of the intervention was not weight loss and Included participants with BMI < 25 (BMI of 24 included)
Chlebowski 1987	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Chlebowski 1993	(WINS study): Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Chlebowski 1994	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Chlebowski 2006	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.

Study	Reason for exclusion
Chlebowski 2008	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Chlebowski 2015	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Courneya 2003	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Courneya 2006	Wrong outcomes.
Courneya 2007	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Courneya 2013a	Included participants with BMI < 25 and aim of the intervention did not appear to be weight loss.
Courneya 2013b	The aim of the intervention did not appear to be weight loss.
Courneya 2014a	The aim of the intervention was not weight loss.
Courneya 2014b	The aim of the intervention was not weight loss.
Courneya 2014c	Wrong outcomes.
Courneya 2014d	The aim of the intervention was not weight loss.
De Luca 2016	The aim of the intervention was not weight loss.
Demark 2006	The aim of the intervention did not appear to be weight loss.
Demark-Wahnefried 2003	Wrong outcomes.
Demark-Wahnefried 2005	Included other forms of cancer including prostate cancer and the aim did not appear to be weight loss.
Demark-Wahnefried 2006	Included other forms of cancer including prostate cancer, the aim did not appear to be weight loss and included participants with BMI < 25.
Demark-Wahnefried 2007	Included other forms of cancer including prostate cancer, the aim did not appear to be weight loss and included participants with BMI < 25.
Demark-Wahnefried 2008	Included participants with BMI < 25. Unclear if weight loss was an aim of the intervention.
Demark-Wahnefried 2018b	Included patients with ductal carcinoma in situ.
Dieli-Conwright 2013	Included participants with body fat > 30% and therefore may include participants with BMI < 25. It was unclear if weight loss was an aim of the intervention.
Dieli-Conwright 2014	Included participants with body fat > 30% and therefore may include participants with BMI < 25. It was unclear if weight loss was an aim of the intervention.
Dieli-Conwright 2015a	It was unclear if weight loss was an aim of the intervention.
Dieli-Conwright 2016	It was unclear if weight loss was an aim of the intervention.
Dieli-Conwright 2017	The aim of the intervention did not appear to be weight loss.
Dieli-Conwright 2018a	Authors contacted and clarified that the primary aim of the intervention was not weight loss.

Study	Reason for exclusion
Dieli-Conwright 2018b	The aim of the intervention did not appear to be weight loss.
Dieli-Conwright 2018c	The aim of the intervention did not appear to be weight loss.
Djuric 2009	The aim of the intervention appeared to be weight maintenance. In addition, randomisation occurred after a 6-month non-randomised weight-loss intervention and therefore at randomisation some participants may have had a BMI < 25.
Djuric 2011	The aim of the intervention appeared to be weight maintenance, not weight loss, and appeared to include participants with BMI < 25.
Dong 2019	The aim of the intervention was not weight loss.
Fairey 2003	The aim of the intervention was not weight loss.
Fang 2017	The aim of the intervention was not weight loss.
Fang 2018	The aim of the intervention was not weight loss.
Fong 2015	Aim of intervention did not appear to be weight loss.
Fu 2015	The aim of the intervention was not weight loss.
Fu H 2017	The aim of the intervention was not weight loss.
Fu YQ 2017	The aim of the intervention was not weight loss.
Goodwin 2015	The aim of the intervention was not weight loss.
Greenlee 2015	Included participants with BMI < 25.
Guan 2018	Wrong study design and the aim of the intervention was not weight loss.
Guo 2017	The aim of the intervention was not weight loss.
Guo 2019	The aim of the intervention was not weight loss.
Hao 2018	The aim of the intervention was not weight loss.
Hayes 2009	Wrong outcomes.
Hayes 2010	Appears to have included participants with BMI < 25.
Hayes 2012	Appears to have included participants with BMI < 25.
Hayes 2013	Appears to have included participants with BMI < 25.
Hu 2013	The aim of the intervention was not weight loss.
Irwin 2008	Wrong outcomes.
Irwin 2009a	This trial included participants with BMI < 25 and > 10% of patients had ductal carcinoma in situ
Irwin 2009b	Wrong outcomes.

Study	Reason for exclusion
Irwin 2012	Unclear if the trial included participants with BMI < 25 and if the aim of the intervention was weight loss.
Irwin 2015a	Unclear if the trial included participants with BMI < 25 and if the aim of the intervention was weight loss.
Irwin 2015b	Appears to have included other forms of cancer and participants with BMI < 25.
Irwin 2017	Included participants with others types of cancer (e.g. lung cancer) and patients with BMI < 25.
Janelsins 2011	Included participants with BMI < 25.
Jenkins 2003	This trial reported data by psychiatric diagnosis and not by the intervention received.
Jin 2017	The aim of the intervention was not weight loss.
Jones 2000	(WHEL study): included participants with BMI < 25, and unclear if the aim of the intervention was weight loss
Kampshoff 2016	The aim of the intervention was not weight loss.
Kanera 2017	The aim of the intervention was not weight loss.
Kim 2017	The aim of the intervention was not weight loss.
Kimmick 2007	The aim of the intervention was not weight loss.
Knobf 2017a	Authors contacted and clarified that the primary aim of the intervention was not weight loss.
Knobf 2017b	The aim of the intervention was not weight loss.
Lahart 2018	The aim of the intervention was not weight loss.
Larkey 2016a	The aim of the intervention was not weight loss.
Li 2018	The aim of the intervention was not weight loss.
Ligibel 2008	This trial included participants with BMI > 25 or body fat percentage > 30% and thus not all participants may have had BMI > 25.
Ligibel 2009	This trial included participants with BMI > 25 or body fat percentage > 30% and thus not all participants may have had BMI > 25.
Ligibel 2012	This trial included other types of cancer e.g. colorectal cancer and included patients with BMI < 25.
Liu 2016	The aim of the intervention was not weight loss.
Liu 2018	The aim of the intervention was not weight loss.
Loftfield 2014	LEAN study included ductal carcinoma in situ (>10%)
Luo 2017	The aim of the intervention was not weight loss.
Mayer 2010	Aim of the intervention did not appear to be weight loss.

Study	Reason for exclusion
Mijwel 2018	The aim of the intervention was not weight loss.
Mutschler 2018	The aim of the intervention was not weight loss.
NCT00068458	Included participants with BMI < 25.
NCT00153894	This trial included participants with BMI > 25 or body fat percentage > 30% and thus not all participants may have had BMI > 25.
NCT00548236	This trial included other types of cancer e.g. colorectal cancer and included patients with BMI < 25.
NCT00583726	Included participants with BMI < 25 and the aim of the intervention appeared to be weight maintenance, not weight loss.
NCT00774371	This study did not compare the intervention and control groups and instead presented data by weight loss ≥ 5% or < 5%.
NCT00872677	The aim of the intervention appears to be weight maintenance. In addition, randomisation occurred after a 6-month non-randomised weight-loss intervention and therefore at randomisation some participants may have had a BMI < 25.
NCT02030353	The aim of the study was weight gain prevention and not necessarily weight loss.
NCT02109068	Registry, the study included people with ductal carcinoma in situ (> 10%)
NCT03091842	The aim of the intervention did not appear to be weight loss.
NCT03124095	The aim of the intervention was not weight loss.
NCT03284346	The aim of the intervention did not appear to be weight loss.
NCT03523195	The aim of the intervention was not weight loss.
Owusu 2019	Aim of the intervention did not appear to be weight loss.
Pegington 2018	This trial included participants with BMI < 25 and ductal carcinoma in situ.
Pelekasis 2016	The aim of the intervention was not weight loss.
Pierce 1997	Wrong outcomes.
Pierce 2002	(WHEL study): included participants with BMI < 25 and it was unclear if the primary aim was weight loss. Authors were contacted but no data received.
Pierce 2004	Wrong outcomes.
Pierce 2007a	(WHEL study): included participants with BMI < 25 and it was unclear if the primary aim was weight loss. Authors were contacted but no data received.
Pierce 2007b	Included participants with BMI < 25.
Pierce 2009	(WHEL study): included participants with BMI < 25 and it was unclear if the primary aim was weight loss. Authors were contacted but no data received.
Qin 2015	The aim of the intervention was not weight loss.

Study	Reason for exclusion
Qu 2012	The aim of the intervention was not weight loss.
Ramirez 2016	The aim of the intervention did not appear to be weight loss.
Ramirez 2017	The aim of the intervention did not appear to be weight loss.
Rao 2012	The aim of the intervention did not appear to be weight loss.
Ren HB 2015	The aim of the intervention was not weight loss.
Rock 2013	This study did not compare the intervention and control groups and instead presented data by weight loss ≥ 5% or < 5%.
Roveda 2017	The aim of the intervention was not weight loss.
Schmitt 2016	The aim of the intervention was not weight loss.
Su X 2013	The aim of the intervention was not weight loss.
Tang 2016	The aim of the intervention was not weight loss.
Thomas 2013	This trial included participants with BMI < 25 and >10% of patients had ductal carcinoma in situ.
Thomas 2017	The aim of the intervention was not weight loss.
Valle 2017	The aim of the intervention was not weight loss.
Waard 1993a	Anthropometric outcomes reported in graphs and unable to be precisely extracted. Authors were unable to be contacted as the study occurred approximately 25 years ago and contact details were unavailable.
Wan 2019	The aim of the intervention was not weight loss.
Wang 2011	The aim of the intervention was not weight loss.
Wang 2013	The aim of the intervention was not weight loss.
Wang 2017	The aim of the intervention was not weight loss.
Wang 2018	The aim of the intervention was not weight loss.
Wang 2019	The aim of the intervention was not weight loss.
Wang YL 2010	The aim of the intervention was not weight loss.
Wang YL 2011	The aim of the intervention was not weight loss and it did not mention the BMI of the participants
Wei 2016	The aim of the intervention was not weight loss.
Wengstrom 2017	The aim of the intervention was not weight loss.
Winters-Stone 2011	The aim of the intervention was not weight loss.
Winters-Stone 2013	The aim of the intervention was not weight loss.

Study	Reason for exclusion
Xianmuxiding 2015	The aim of the intervention was not weight loss.
Xiong 2018	The aim of the intervention was not weight loss.
Xu 2011	The aim of the intervention was not weight loss.
Xu 2013	The aim of the intervention was not weight loss.
Yuan 2017	The aim of the intervention was not weight loss.
Zeng 2017	The aim of the intervention was not weight loss.
Zhao 2011	The aim of the intervention was not weight loss.
Zhao 2015	The aim of the intervention was not weight loss.
Zhao 2016	The aim of the intervention was not weight loss.
Zhou 2015	The aim of the intervention was not weight loss.
Zou 2018	The aim of the intervention was not weight loss.

BMI: body mass index

Characteristics of studies awaiting classification *[ordered by study ID]*

BE-WEL

Methods	RCT
Participants	Aiming for n = 60 patients. Women receiving maintenance therapy for breast cancer related arm lymphoedema, BMI > 25 kg/m^2
Interventions	4 groups 1) Supervised weight control plus upper body exercise program - includes individualised diet and cardiovascular counselling from dietician and physiotherapist, and 12 weekly group exercise and diet sessions 2) Home-based weight control plus upper body exercise program - individualised advice as per above, received a booklet for a 12-week progressive upper body exercise program. twice-weekly telephone counselling from dietician/physiotherapist. Written materials mailed. 3) Upper body exercise only - as per above without written materials. 4) Control - standard written health advice
Outcomes	Weight, QOL (FACT-B+4, FACT-F).
Notes	Registry mentions trial is complete, however no full-text located. Authors contacted.

BRIGHT

Methods	RCT

BRIGHT *(Continued)*

Participants	n = 90 breast cancer survivors who completed initial treatment and have a BMI ≥ 25 kg/m^2
Interventions	12-week intervention with 3 arms 1) Weight Watchers program (and free vouchers) with additional breast cancer tailored dietitian-led group 2) Regular Weight Watchers program (and free vouchers) 3) Control group (wait-list)
Outcomes	Body weight and QOL
Notes	Registry mentions trial is complete, will likely be eligible once full text is published.

Fukui 2018

Methods	RCT
Participants	n = 53 stage I-III breast cancer survivors with BMI ≥ 30 kg/m^2
Interventions	12-week intervention including 12 group sessions on weight management and weight loss acupuncture sessions. Control group: active control with 12 group sessions on weight management (no acupuncture).
Outcomes	Weight loss (24 weeks), maintenance of weight loss (24 months), breast cancer recurrence (5 years)
Notes	Registry mentions study completed in December 2018, and no-full-text article available. Authors were contacted for full-text article to assess eligibility.

Hayes 2017

Methods	RCT
Participants	Newly diagnosed breast cancer (intervention commenced 6 weeks post surgery)
Interventions	8-month exercise intervention delivered either face-to-face or via telephone. Control is usual care.
Outcomes	Overall survival, disease-free survival
Notes	Conference abstract of the 'Exercise for Health' trial which may provide information on survival outcomes. Authors contacted for data regarding patients with BMI ≥ 25 kg/m^2 but no data were received.

Lasserre 2017

Methods	RCT
Participants	n = 11 breast cancer survivors between ages of 35 and 65 years-old

Lasserre 2017 *(Continued)*

Interventions	Individualised dietary therapy, semi-vegetarian diet, adjusted to energy requirements. Controls received one session of nutrition counselling.
Outcomes	Anthropometric outcomes (weight, waist circumference), lipid profile (TC, HDL, LDL and TG).
Notes	Conference abstract; authors were contacted but no data received. Unclear if the study includes participants with BMI < 25 kg/m^2.

Lee 2016

Methods	RCT
Participants	n = 56 breast cancer survivors.
Interventions	16 weeks of supervised aerobic and resistance exercise, 3 sessions a week. Controls were asked to maintain less than 120 minutes/week of exercise.
Outcomes	BMI, body weight, waist circumference.
Notes	Abstract only. Abstract strongly suggests that participants are all obese but this is not explicitly mentioned.

NCT01630499

Methods	RCT
Participants	n = 87 stage I-III breast cancer survivors with BMI between 27 kg/m^2 and 45 kg/m^2.
Interventions	3-months individually-tailored intervention incorporating nutrition, physical activity and behavioural components. Control is an active control: 3-months commercial weight loss program (Weight Watchers).
Outcomes	Weight loss, waist circumference, biomarkers including inflammatory markers (not further specified), lipids (TC, HDL, LDL, TG), glucose, QOL (EORTC-QLQ30, BR-23 (breast cancer specific addendum]).
Notes	Clinical trial registry mentions study is completed but no full-text article located.

NCT02681965

Methods	RCT
Participants	n = 200 overweight or obese (BMI ≥ 25) breast cancer survivors who have completed chemotherapy and/or radiation therapy
Interventions	Modified LEAN intervention including an information booklet, CD and flash drive with videos, pedometer, logbook for diet and physical activity. Control is wait-list for 6 months.
Outcomes	Body weight (primary outcome), QOL

NCT02681965 *(Continued)*

Notes	LEAN 3 study. No full text found. Authors were contacted but no data received. Registry has conflicting information - inclusion criteria mentions stage 0 is included whereas elsewhere it is mentioned that participants have stage I-IIIC breast cancer. Mentions that trial has been completed.

POWER-remote

Methods	RCT
Participants	n = 96 stage 0-III breast cancer survivors, BMI ≥ 25 kg/m^2, completed local therapy and adjuvant chemotherapy.
Interventions	Web-based weight loss program (POWER-remote). Includes an online portion and a telephone portion to monitor progress. Control is written materials.
Outcomes	Body weight, biomarkers (glucose, lipids, insulin, IGF, CRP, IL-6, TNF-α, leptin, adiponectin, estradiol).
Notes	Clinical trial registry mentions that the trial is completed but no full-text article available. Authors contacted.

Reach for Health

Methods	RCT
Participants	n = 333 randomised, stage IA-IIIC breast cancer survivors with BMI ≥ 25kg/m^2.
Interventions	6-month intervention with 4 groups Intervention group 1: metformin - started by taking one 500 mg metformin tablet at dinner, if tolerated then up to 2 tablets (1000 mg) at dinner. At 1-month and onwards: increase to 1 pill in morning and 2 pills after dinner (1500 mg) Control group 1: given placebo tablets instead of metformin for comparison with above Intervention group 2: received metformin pills as above and also 12 sessions of a telephone-based weight loss intervention by trained lifestyle coaches. Aimed for caloric deficit of 500 kcal/day to 1000 kcal/day and 300 minutes per week of moderate-intensity activity. Control group 2: received metformin pills as above and also dietary guideline materials.
Outcomes	Anthropometric outcomes (weight, waist circumference), QOL (SF-36), biomarkers (estradiol, insulin, glucose, CRP)
Notes	Clinical trial registry mentions that trial is completed but no full text located. Authors contacted.

Winkels 2017

Methods	RCT
Participants	n = 351 randomised. Breast cancer survivors with breast-cancer related lymphoedema, BMI ≥ 25 kg/m^2

Winkels 2017 *(Continued)*

Interventions	12-month, 4-armed trial 1) Exercise (aerobic and resistance exercise) - twice weekly weight training, 180 minutes aerobic exercise per week. 2) Weight-loss through lifestyle modification - 1 hour weekly group counselling meetings for first 24 weeks, food provided by commercial source. Four NutriSystem meals per day (breakfast, lunch, dinner, dessert), one protein shake a day, four servings vegetables, three servings fruit. 1200-1500 kcal/day deficit for first 20 to 24 weeks, after week-24 the aim was weight maintenance (not loss). 3) Both exercise and weight-loss - both interventions mentioned above. 4) Control group - usual care.
Outcomes	Weight loss, biomarkers (estradiol, testosterone, IL-6, CRP, leptin, adiponectin, insulin, glucose, IGF-1, mortality, cancer recurrence.
Notes	Clinical trial registry mentions that trial is completed and no full text found.

Yang 2017

Methods	Unclear
Participants	n = 34 breast cancer survivors
Interventions	14 weeks, including individualised nutrition counselling and education program. Invited into a mobile network group ('LINE').
Outcomes	Body composition and QOL outcomes.
Notes	Conference abstract, authors contacted. Does not mention randomisation so unclear if this is an RCT, and also unclear if includes participants with BMI < 25 kg/m^2.

BMI: body mass index
CRP: C-reactive protein
HDL: high-density lipoprotein
IGF: insulin growth factor
LDL: low-density lipoprotein
QOL: quality of life
RCT: randomised controlled trial
TC: total cholesterol
TG: triglyceride
TNF: tumour necrosis factor

Characteristics of ongoing studies *[ordered by study ID]*

BWEL

Study name	BWEL: Breast Cancer WEight Loss Study
Methods	RCT
Participants	n = 3136, non-metastatic histologically-confirmed invasive breast cancer within 14 months of diagnosis, BMI ≥ 27 kg/m^2.

BWEL *(Continued)*

Interventions	Intervention group receives a standardised 2-year telephone-based semi-structured individualised weight loss counselling, including individualised goals (caloric restriction, physical activity, weight loss) by trained coaches. Print and online information also provided. They will also receive a health education program including mailed health information at baseline and 1-year after, a 2-year health magazine subscription, invitations to twice-yearly webinars/teleconferences regarding breast cancer and health. Controls received only the health education program.
Outcomes	Invasive disease-free survival (primary outcome). Secondary outcomes include overall survival, distant disease-free survival, weight change, biomarkers (insulin, glucose, leptin, adiponectin, IGF-1, IL-6, CRP, TNF-α), QOL outcomes (physical functioning, fatigue, depression and anxiety, sleep disturbance, breast cancer treatment related symptoms, body image. Follow-up for maximum of 10 years.
Starting date	August 2016
Contact information	As per clinical trial registry: BWELStudy@partners.org
Notes	Large trial with long follow-up duration which measures survival outcomes.

Gnagnarella 2016

Study name	InForma: Promoting weight loss through diet and exercise in overweight women with breast cancer
Methods	RCT
Participants	Aiming for approximately n = 65 per group. Women with histologically confirmed, invasive, non-metastatic breast cancer, BMI > 25 kg/m^2, completed their main cancer treatment for more than 6 months.
Interventions	3 intervention groups and 1 control group. Intervention groups 1) Dietary Intervention (DI) - counselling mainly focusing on diet 2) Physical Activity Intervention (PAI) - counselling mainly focusing on physical activity 3) Physical Activity and Dietary Intervention (PADI) - combination of diet and physical activity All 3 intervention groups received individualised counselling on lifestyle habits aimed to reduce weight. Intervention begins with monthly contact including 3 face-to-face meetings, 1 group meeting and 2 motivational phone calls. Group sessions planned for 10 women per arm and involves motivation and information sessions to create long-lasting positive changes. Caloric restriction of about 500 to 1000 kilocalories per day. After 6 months, participants monitored by phone calls which utilises similar strategies to these counselling sessions. Control: less Intensive Intervention (LII) - received general counselling on health, materials, guidelines and 2 motivational phone calls.
Outcomes	Weight, waist circumference, biomarkers including lipids (TC, HDL, LDL, TG), estradiol, insulin, glucose, CRP, QOL outcomes (FACT-B, STAI (State-Trait Anxiety Inventory)). Latest follow-up conducted at 24 months.
Starting date	November 2015
Contact information	As per protocol: patrizia.gnagnarella@ieo.it
Notes	Clinical trial registry mentions estimated study completion date of December 2019.

LEAN 2

Study name	LEAN 2: Lifestyle, Exercise and Nutrition Study 2
Methods	RCT
Participants	n = 100 stage 0-IIIc breast cancer survivors with BMI > 25 kg/m^2.
Interventions	6-month intervention. 30-minute long sessions of in-person or telephone counselling involving diet, exercise and behavioural change (weekly for first month, every second week for months 2-3, monthly for months 4-6). Logbooks for diet and exercise. Control is wait-list.
Outcomes	BMI and body weight at 6 months, maintenance of weight loss at 12 months, biomarkers including insulin, leptin and CRP
Starting date	November 2013
Contact information	Not available on clinical trial registry record. Melinda L Irwin from Yale University.
Notes	Includes DCIS. Authors contacted.

NCT00120029

Study name	Peer counseling for weight loss
Methods	RCT
Participants	n = 100 African American breast cancer survivors stage I-IIIA, BMI between 25 kg/m^2 to 40 kg/m^2, free of recurrence)
Interventions	Three arms: one is individualised, dietitian-led counselling and another is dietitian-led counselling combined with telephone peer counselling by trained peers who were successful at weight control. The final arm is the control group.
Outcomes	Weight loss (primary outcome), biomarkers (including IGF, lipids).
Starting date	January 2004
Contact information	As per clinical trial registry: dford@med.wayne.edu
Notes	Unlikely to still be ongoing. Latest update found on WHO ICTRP (19 February 2015) which mentioned trial is still recruiting, despite initial registry posting over 10 years prior and estimated completion date of June 2008. Principal investigator contacted.

NCT03394690

Study name	Effects of green coffee extract supplementation on change in leptin, ghrelin, adiponectin, anthropometric measurements, lipid profile in breast cancer survivors
Methods	RCT
Participants	n = 50 breast cancer survivors post-treatment with BMI between 25 kg/m^2 to 40 kg/m^2.

NCT03394690 *(Continued)*

Interventions	12-week intervention, provided with green coffee and also advised to adherence to the investigator's diet and exercise program. Controls were given a placebo and similarly advised to adherence to the investigator's diet and exercise program.
Outcomes	Biomarkers including leptin and adiponectin, lipid profile and anthropometric measures
Starting date	March 12, 2018
Contact information	As per clinical trial registry: ehsanhejazi@gmail.com
Notes	No full text, authors contacted.

BMI: body mass index
CRP: C-reactive protein
DCIS: ductal carcinoma in situ
HDL: high-density lipoprotein
IGF: insulin growth factor
IL: interleukin
LDL: low-density lipoprotein
QOoL: quality of life
RCT: randomised controlled trial
TC: total cholesterol
TG: triglyceride
TNF: tumour necrosis factor

DATA AND ANALYSES

Comparison 1. All weight loss interventions vs controls (no subgrouping)

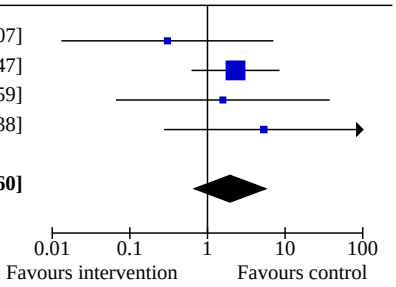
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Cancer recurrence	4	281	Risk Ratio (M-H, Random, 95% CI)	1.95 [0.68, 5.60]
1.2 Change in body weight	21	1751	Mean Difference (IV, Random, 95% CI)	-2.25 [-3.19, -1.30]
1.3 Change in body mass index [kg/m^2]	17	1353	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.61, -0.56]
1.4 Change in waist circumference	13	1193	Mean Difference (IV, Random, 95% CI)	-1.73 [-3.17, -0.29]
1.5 Adverse events	4	394	Risk Ratio (M-H, Random, 95% CI)	0.94 [0.76, 1.17]
1.6 Change in quality of life - overall scales	10	867	Std. Mean Difference (IV, Random, 95% CI)	0.74 [0.20, 1.29]
1.7 Change in quality of life - physical subscales	10	1024	Std. Mean Difference (IV, Random, 95% CI)	0.33 [0.10, 0.56]
1.8 Change in quality of life - social subscales	6	389	Std. Mean Difference (IV, Random, 95% CI)	0.19 [-0.01, 0.39]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.9 Change in quality of life - emotional subscales	8	498	Std. Mean Difference (IV, Random, 95% CI)	0.11 [-0.09, 0.30]
1.10 Change in quality of life - mental health subscales	3	355	Std. Mean Difference (IV, Random, 95% CI)	0.60 [0.17, 1.02]
1.11 Change in quality of life - anxiety/depression subscales	3	669	Std. Mean Difference (IV, Random, 95% CI)	0.63 [-0.07, 1.33]
1.12 Change in insulin	6	134	Mean Difference (IV, Random, 95% CI)	-1.49 [-6.62, 3.64]
1.13 Change in glucose	6	133	Mean Difference (IV, Random, 95% CI)	-0.46 [-4.86, 3.93]
1.14 Change in total cholesterol	6	189	Mean Difference (IV, Random, 95% CI)	-0.34 [-0.84, 0.16]
1.15 Change in HDL cholesterol	6	189	Mean Difference (IV, Random, 95% CI)	0.00 [-0.08, 0.08]
1.16 Change in LDL cholesterol	6	189	Mean Difference (IV, Random, 95% CI)	-0.18 [-0.59, 0.22]
1.17 Change in triglycerides	6	189	Mean Difference (IV, Random, 95% CI)	-0.26 [-0.45, -0.07]
1.18 Change in leptin	3	39	Mean Difference (IV, Random, 95% CI)	-14.67 [-26.36, -2.98]

Analysis 1.1. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 1: Cancer recurrence

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Greenlee 2013	0	22	1	20	11.2%	0.30 [0.01 , 7.07]
Kwiatkowski 2017	7	62	3	61	65.1%	2.30 [0.62 , 8.47]
Mefferd 2007	1	56	0	29	11.0%	1.58 [0.07 , 37.59]
Sheppard 2016	2	15	0	16	12.7%	5.31 [0.28 , 102.38]
Total (95% CI)		**155**		**126**	**100.0%**	**1.95 [0.68 , 5.60]**
Total events:	10		4			

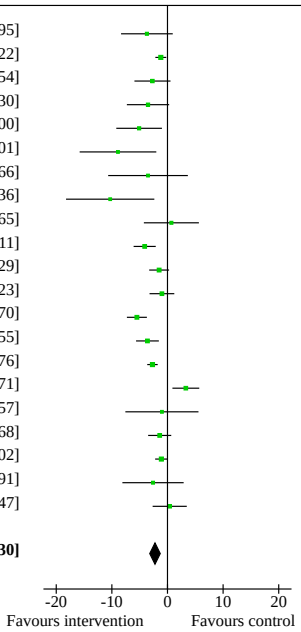
Heterogeneity: Tau² = 0.00; Chi² = 1.86, df = 3 (P = 0.60); I² = 0%
Test for overall effect: Z = 1.25 (P = 0.21)
Test for subgroup differences: Not applicable



Analysis 1.2. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 2: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**

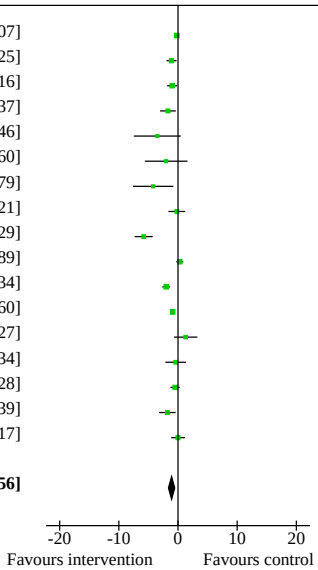
Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%
Test for overall effect: Z = 4.67 (P < 0.00001)
Test for subgroup differences: Not applicable



Analysis 1.3. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 3: Change in body mass index [kg/m²]

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**

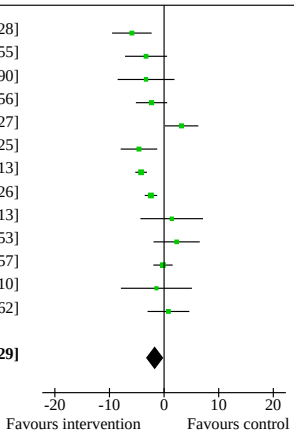
Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%
Test for overall effect: Z = 4.03 (P < 0.0001)
Test for subgroup differences: Not applicable



Analysis 1.4. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 4: Change in waist circumference

Study or Subgroup	Intervention Mean [cm]	Intervention SD [cm]	Intervention Total	Control Mean [cm]	Control SD [cm]	Control Total	Weight	Mean Difference IV, Random, 95% CI [cm]
Demark-Wahnefried 2014a	-6.7	4.5	20	-0.8	4.1	7	7.2%	-5.90 [-9.52 , -2.28]
Demark-Wahnefried 2014b	-4.1	4.7	21	-0.8	4.1	6	6.8%	-3.30 [-7.15 , 0.55]
Ferrante 2017	-4.1	5.6	17	-0.8	9.4	17	4.9%	-3.30 [-8.50 , 1.90]
Greenlee 2013	-3.6	4.8	22	-1.3	4.3	17	8.7%	-2.30 [-5.16 , 0.56]
Kwiatkowski 2017	4	5.7	27	0.8	5.7	26	8.3%	3.20 [0.13 , 6.27]
Mefferd 2007	-7.1	6.4	47	-2.5	7.7	29	7.7%	-4.60 [-7.95 , -1.25]
Reeves 2016	-3.6	3.6	45	0.6	0.7	45	12.3%	-4.20 [-5.27 , -3.13]
Rock 2015	-5.5	6.3	272	-3.1	7.1	259	12.2%	-2.40 [-3.54 , -1.26]
Sheppard 2016	0.6	6.5	10	-0.8	7.2	12	4.3%	1.40 [-4.33 , 7.13]
Stendell-Hollis 2010	-0.9	4.9	23	-3.2	7.6	16	6.2%	2.30 [-1.93 , 6.53]
Stolley 2017	-2.1	6.2	96	-1.9	6.3	96	11.0%	-0.20 [-1.97 , 1.57]
Swisher 2015	-3.3	7	13	-1.9	8.5	10	3.6%	-1.40 [-7.90 , 5.10]
Thomson 2010	-5.3	4.4	21	-6.1	7.4	19	6.8%	0.80 [-3.02 , 4.62]
Total (95% CI)			**634**			**559**	**100.0%**	**-1.73 [-3.17 , -0.29]**

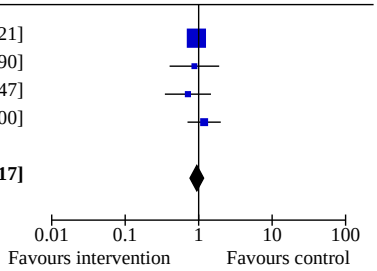
Heterogeneity: Tau² = 4.08; Chi² = 44.31, df = 12 (P < 0.0001); I² = 73%
Test for overall effect: Z = 2.35 (P = 0.02)
Test for subgroup differences: Not applicable



Analysis 1.5. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 5: Adverse events

Study or Subgroup	Intervention Events	Intervention Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Demark-Wahnefried 2012a	55	119	65	131	67.2%	0.93 [0.72 , 1.21]
Demark-Wahnefried 2014a	10	20	4	7	7.5%	0.88 [0.40 , 1.90]
Demark-Wahnefried 2014b	10	21	4	6	8.7%	0.71 [0.35 , 1.47]
Reeves 2016	19	45	16	45	16.7%	1.19 [0.71 , 2.00]
Total (95% CI)		**205**		**189**	**100.0%**	**0.94 [0.76 , 1.17]**
Total events:	94		89			

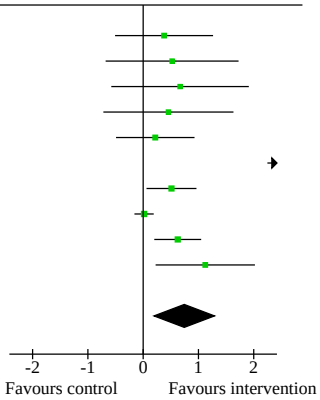
Heterogeneity: Tau² = 0.00; Chi² = 1.39, df = 3 (P = 0.71); I² = 0%
Test for overall effect: Z = 0.54 (P = 0.59)
Test for subgroup differences: Not applicable



Analysis 1.6. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 6: Change in quality of life - overall scales

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Arikawa 2017	5.8	6.94	10	3.3	5.66	10	9.5%	0.38 [-0.51 , 1.26]
Djuric 2002a	5.94	9.32	9	0.83	8.43	4	7.9%	0.52 [-0.68 , 1.73]
Djuric 2002b	7.39	9.34	8	0.83	8.43	4	7.7%	0.67 [-0.58 , 1.91]
Djuric 2002c	5.26	9.29	10	0.83	8.43	4	8.0%	0.46 [-0.72 , 1.63]
Ferrante 2017	14.49	36.08	14	7.45	26.81	17	10.5%	0.22 [-0.49 , 0.93]
Ghavami 2017	33.75	12.59	40	-0.21	10.68	40	10.9%	2.88 [2.25 , 3.51]
Kwiatkowski 2017	15.7	13.48	40	9.4	10.63	38	11.7%	0.51 [0.06 , 0.96]
Rock 2015	0.01	0.76	256	0	0.39	250	12.6%	0.02 [-0.16 , 0.19]
Scott 2013	13.3	14.8	47	5.1	10.7	43	11.8%	0.63 [0.20 , 1.05]
Swisher 2015	14	13.64	13	-6.1	21.12	10	9.5%	1.12 [0.23 , 2.02]
Total (95% CI)			**447**			**420**	**100.0%**	**0.74 [0.20 , 1.29]**

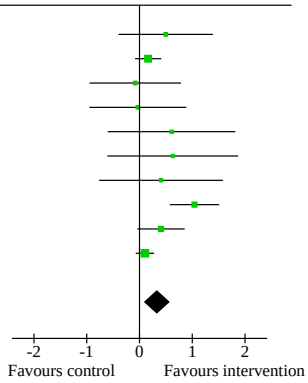
Heterogeneity: Tau² = 0.61; Chi² = 80.68, df = 9 (P < 0.00001); I² = 89%
Test for overall effect: Z = 2.66 (P = 0.008)
Test for subgroup differences: Not applicable



Analysis 1.7. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 7: Change in quality of life - physical subscales

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Arikawa 2017	8.4	10.03	10	1.9	14.61	10	5.3%	0.50 [-0.40 , 1.39]
Demark-Wahnefried 2012a	-1.99	31.64	119	-7.05	30.14	131	22.0%	0.16 [-0.09 , 0.41]
Demark-Wahnefried 2014a	0.83	27.99	19	3.08	24.58	7	5.6%	-0.08 [-0.95 , 0.79]
Demark-Wahnefried 2014b	2.21	28.01	19	3.08	24.58	6	5.1%	-0.03 [-0.95 , 0.89]
Djuric 2002a	1.87	3.56	9	-0.62	4.43	4	3.2%	0.61 [-0.60 , 1.82]
Djuric 2002b	2.11	3.81	8	-0.62	4.43	4	3.0%	0.63 [-0.61 , 1.87]
Djuric 2002c	1.7	5.6	10	-0.62	4.43	4	3.3%	0.41 [-0.77 , 1.58]
Ghavami 2017	25.84	16.35	40	4.5	23.56	40	13.2%	1.04 [0.57 , 1.51]
Kwiatkowski 2017	14.1	23.6	40	4.5	23.08	38	13.8%	0.41 [-0.04 , 0.86]
Rock 2015	-0.97	31.4	256	-4	27.1	250	25.4%	0.10 [-0.07 , 0.28]
Total (95% CI)			**530**			**494**	**100.0%**	**0.33 [0.10 , 0.56]**

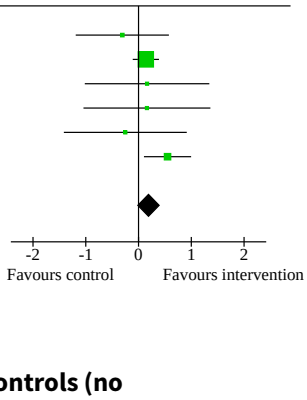
Heterogeneity: Tau² = 0.05; Chi² = 16.45, df = 9 (P = 0.06); I² = 45%
Test for overall effect: Z = 2.82 (P = 0.005)
Test for subgroup differences: Not applicable



Analysis 1.8. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 8: Change in quality of life - social subscales

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Arikawa 2017	0.4	20.29	10	7.1	21.41	10	5.2%	-0.31 [-1.19 , 0.58]
Demark-Wahnefried 2012a	-2.63	29.2	119	-6.6	27.99	131	65.7%	0.14 [-0.11 , 0.39]
Djuric 2002a	1.8	4.68	9	0.81	7.8	4	2.9%	0.16 [-1.02 , 1.34]
Djuric 2002b	1.92	5.76	8	0.81	7.8	4	2.8%	0.16 [-1.04 , 1.36]
Djuric 2002c	-1.03	6.53	10	0.81	7.8	4	3.0%	-0.25 [-1.42 , 0.91]
Ghavami 2017	26.67	30.52	40	7.5	38.14	40	20.3%	0.55 [0.10 , 1.00]
Total (95% CI)			**196**			**193**	**100.0%**	**0.19 [-0.01 , 0.39]**

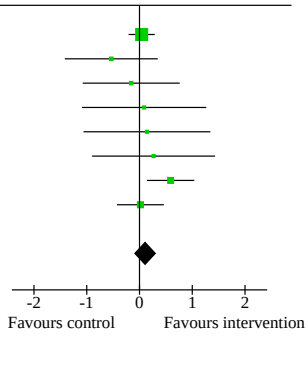
Heterogeneity: Tau² = 0.00; Chi² = 4.43, df = 5 (P = 0.49); I² = 0%
Test for overall effect: Z = 1.83 (P = 0.07)
Test for subgroup differences: Not applicable



Analysis 1.9. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 9: Change in quality of life - emotional subscales

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Demark-Wahnefried 2012a	1.76	31.85	119	0.35	36.5	131	48.3%	0.04 [-0.21 , 0.29]
Demark-Wahnefried 2014a	-9.38	48.7	19	15.39	30.67	7	4.7%	-0.53 [-1.42 , 0.35]
Demark-Wahnefried 2014b	8.02	48.68	19	15.39	30.67	6	4.3%	-0.16 [-1.08 , 0.76]
Djuric 2002a	1.07	5.16	9	0.63	3.33	4	2.7%	0.09 [-1.09 , 1.26]
Djuric 2002b	1.45	6.03	8	0.63	3.33	4	2.6%	0.14 [-1.06 , 1.34]
Djuric 2002c	1.61	3.47	10	0.63	3.33	4	2.7%	0.27 [-0.90 , 1.43]
Ghavami 2017	29.55	30.35	40	8.71	39.04	40	17.2%	0.59 [0.14 , 1.04]
Kwiatkowski 2017	17.2	33.94	40	16.6	33.97	38	17.5%	0.02 [-0.43 , 0.46]
Total (95% CI)			**264**			**234**	**100.0%**	**0.11 [-0.09 , 0.30]**

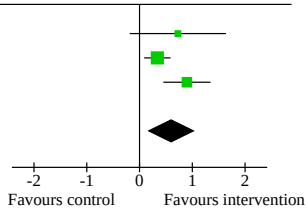
Heterogeneity: Tau² = 0.00; Chi² = 7.32, df = 7 (P = 0.40); I² = 4%
Test for overall effect: Z = 1.07 (P = 0.28)
Test for subgroup differences: Not applicable



Analysis 1.10. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 10: Change in quality of life - mental health subscales

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Arikawa 2017	10.9	10.92	10	2.3	11.75	10	15.8%	0.73 [-0.19 , 1.64]
Demark-Wahnefried 2012a	2.22	12.06	119	-2.52	15.56	131	48.8%	0.34 [0.09 , 0.59]
Scott 2013	4.8	7.9	44	-1.9	6.8	41	35.5%	0.90 [0.45 , 1.35]
Total (95% CI)			**173**			**182**	**100.0%**	**0.60 [0.17 , 1.02]**

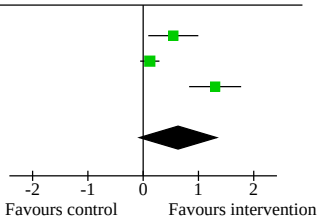
Heterogeneity: Tau² = 0.08; Chi² = 4.89, df = 2 (P = 0.09); I² = 59%
Test for overall effect: Z = 2.77 (P = 0.006)
Test for subgroup differences: Not applicable



Analysis 1.11. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 11: Change in quality of life - anxiety/depression subscales

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Kwiatkowski 2017	3.87	8.86	40	-1.23	9.67	38	32.1%	0.55 [0.09 , 1.00]
Rock 2015	1.64	12.1	256	0.2	11.88	250	36.2%	0.12 [-0.05 , 0.29]
Scott 2013	6.1	6.9	44	-2.3	5.8	41	31.7%	1.30 [0.83 , 1.77]
Total (95% CI)			**340**			**329**	**100.0%**	**0.63 [-0.07 , 1.33]**

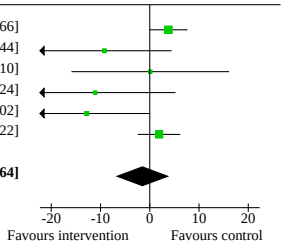
Heterogeneity: Tau² = 0.34; Chi² = 22.65, df = 2 (P < 0.0001); I² = 91%
Test for overall effect: Z = 1.77 (P = 0.08)
Test for subgroup differences: Not applicable



Analysis 1.12. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 12: Change in insulin

Study or Subgroup	Intervention Mean [mcU/ml]	SD [mcU/ml]	Total	Control Mean [mcU/ml]	SD [mcU/ml]	Total	Weight	Mean Difference IV, Random, 95% CI [mcU/ml]
Arikawa 2017	-2.1	4.4	10	-5.9	4.4	10	31.8%	3.80 [-0.06 , 7.66]
Djuric 2002a	-5.4	6.6	9	3.8	13.2	4	10.4%	-9.20 [-22.84 , 4.44]
Djuric 2002b	3.9	13.6	8	3.8	13.2	4	8.1%	0.10 [-15.90 , 16.10]
Djuric 2002c	-7.3	16.1	10	3.8	13.2	4	7.9%	-11.10 [-27.44 , 5.24]
Stendell-Hollis 2010	-3.7	17.11	21	9.1	20	14	11.4%	-12.80 [-25.58 , -0.02]
Thomson 2010	-2.6	4.9	21	-4.5	8.4	19	30.4%	1.90 [-2.42 , 6.22]
Total (95% CI)			**79**			**55**	**100.0%**	**-1.49 [-6.62 , 3.64]**

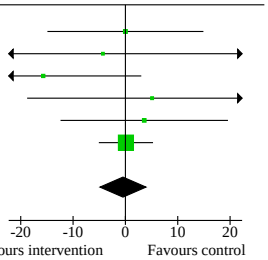
Heterogeneity: Tau² = 17.69; Chi² = 10.88, df = 5 (P = 0.05); I² = 54%
Test for overall effect: Z = 0.57 (P = 0.57)
Test for subgroup differences: Not applicable



Analysis 1.13. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 13: Change in glucose

Study or Subgroup	Intervention Mean [mg/dl]	SD [mg/dl]	Total	Control Mean [mg/dl]	SD [mg/dl]	Total	Weight	Mean Difference IV, Random, 95% CI [mg/dl]
Arikawa 2017	-2	17	10	-2	17	10	8.7%	0.00 [-14.90 , 14.90]
Djuric 2002a	-0.7	35.1	9	3.6	14.2	4	2.7%	-4.30 [-31.12 , 22.52]
Djuric 2002b	-12.1	18.1	8	3.6	14.2	4	5.5%	-15.70 [-34.43 , 3.03]
Djuric 2002c	8.7	31.3	10	3.6	14.2	4	3.4%	5.10 [-18.77 , 28.97]
Stendell-Hollis 2010	3.6	23.42	20	0	23.42	14	7.6%	3.60 [-12.40 , 19.60]
Thomson 2010	-1.1	8.6	21	-1.2	8.1	19	72.2%	0.10 [-5.08 , 5.28]
Total (95% CI)			**78**			**55**	**100.0%**	**-0.46 [-4.86 , 3.93]**

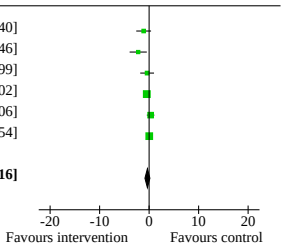
Heterogeneity: Tau² = 0.00; Chi² = 3.13, df = 5 (P = 0.68); I² = 0%
Test for overall effect: Z = 0.21 (P = 0.84)
Test for subgroup differences: Not applicable



Analysis 1.14. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 14: Change in total cholesterol

Study or Subgroup	Intervention Mean [mmol/L]	Intervention SD [mmol/L]	Intervention Total	Control Mean [mmol/L]	Control SD [mmol/L]	Control Total	Weight	Mean Difference IV, Random, 95% CI [mmol/L]
Djuric 2002a	-1.5	1.2	9	-0.4	1.3	4	8.6%	-1.10 [-2.60 , 0.40]
Djuric 2002b	-2.6	1.7	8	-0.4	1.3	4	6.8%	-2.20 [-3.94 , -0.46]
Djuric 2002c	-0.8	0.9	10	-0.4	1.3	4	9.6%	-0.40 [-1.79 , 0.99]
Mefferd 2007	-0.23	0.8	47	0.24	1.2	29	27.7%	-0.47 [-0.96 , 0.02]
Stendell-Hollis 2010	-0.3	0.9	21	-0.6	1.2	13	20.2%	0.30 [-0.46 , 1.06]
Thomson 2010	-0.1	0.84	21	-0.13	0.81	19	27.1%	0.03 [-0.48 , 0.54]
Total (95% CI)			**116**			**73**	**100.0%**	**-0.34 [-0.84 , 0.16]**

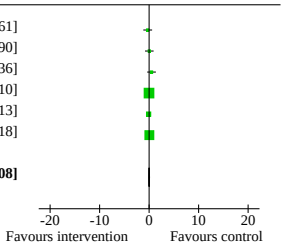
Heterogeneity: Tau² = 0.17; Chi² = 10.08, df = 5 (P = 0.07); I² = 50%
Test for overall effect: Z = 1.35 (P = 0.18)
Test for subgroup differences: Not applicable



Analysis 1.15. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 15: Change in HDL cholesterol

Study or Subgroup	Intervention Mean [mmol/L]	Intervention SD [mmol/L]	Intervention Total	Control Mean [mmol/L]	Control SD [mmol/L]	Control Total	Weight	Mean Difference IV, Random, 95% CI [mmol/L]
Djuric 2002a	-0.33	0.54	9	-0.05	0.83	4	0.9%	-0.28 [-1.17 , 0.61]
Djuric 2002b	-0.01	0.42	8	-0.05	0.83	4	0.9%	0.04 [-0.82 , 0.90]
Djuric 2002c	0.44	0.51	10	-0.05	0.83	4	0.9%	0.49 [-0.38 , 1.36]
Mefferd 2007	0.14	0.2	47	0.16	0.3	29	44.8%	-0.02 [-0.14 , 0.10]
Stendell-Hollis 2010	0.1	0.2	21	0.2	0.4	13	12.5%	-0.10 [-0.33 , 0.13]
Thomson 2010	0.06	0.21	21	0.01	0.21	19	40.1%	0.05 [-0.08 , 0.18]
Total (95% CI)			**116**			**73**	**100.0%**	**0.00 [-0.08 , 0.08]**

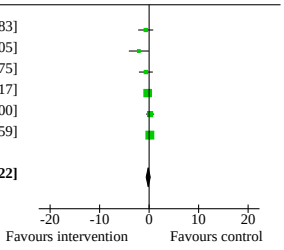
Heterogeneity: Tau² = 0.00; Chi² = 2.97, df = 5 (P = 0.70); I² = 0%
Test for overall effect: Z = 0.02 (P = 0.98)
Test for subgroup differences: Not applicable



Analysis 1.16. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 16: Change in LDL cholesterol

Study or Subgroup	Intervention Mean [mmol/L]	Intervention SD [mmol/L]	Intervention Total	Control Mean [mmol/L]	Control SD [mmol/L]	Control Total	Weight	Mean Difference IV, Random, 95% CI [mmol/L]
Djuric 2002a	-1.26	1.14	9	-0.57	1.35	4	6.3%	-0.69 [-2.21 , 0.83]
Djuric 2002b	-2.64	2.2	8	-0.57	1.35	4	3.8%	-2.07 [-4.09 , -0.05]
Djuric 2002c	-1.22	0.76	10	-0.57	1.35	4	7.3%	-0.65 [-2.05 , 0.75]
Mefferd 2007	-0.31	1	47	0.01	1.1	29	30.9%	-0.32 [-0.81 , 0.17]
Stendell-Hollis 2010	-0.5	1.1	21	-0.7	1.2	13	17.6%	0.20 [-0.60 , 1.00]
Thomson 2010	-0.05	0.72	21	-0.2	0.69	19	34.2%	0.15 [-0.29 , 0.59]
Total (95% CI)			**116**			**73**	**100.0%**	**-0.18 [-0.59 , 0.22]**

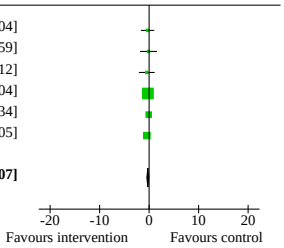
Heterogeneity: Tau² = 0.08; Chi² = 7.38, df = 5 (P = 0.19); I² = 32%
Test for overall effect: Z = 0.88 (P = 0.38)
Test for subgroup differences: Not applicable



Analysis 1.17. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 17: Change in triglycerides

Study or Subgroup	Intervention Mean [mmol/L]	Intervention SD [mmol/L]	Intervention Total	Control Mean [mmol/L]	Control SD [mmol/L]	Control Total	Weight	Mean Difference IV, Random, 95% CI [mmol/L]
Djuric 2002a	0.13	1.02	9	0.44	1.2	4	2.0%	-0.31 [-1.66 , 1.04]
Djuric 2002b	0.32	1.8	8	0.44	1.2	4	1.3%	-0.12 [-1.83 , 1.59]
Djuric 2002c	-0.03	1.73	10	0.44	1.2	4	1.5%	-0.47 [-2.06 , 1.12]
Mefferd 2007	-0.14	0.7	47	0.09	0.5	29	50.7%	-0.23 [-0.50 , 0.04]
Stendell-Hollis 2010	-0.2	0.8	21	-0.1	0.5	13	19.4%	-0.10 [-0.54 , 0.34]
Thomson 2010	-0.35	0.41	21	0.08	0.76	19	25.1%	-0.43 [-0.81 , -0.05]
Total (95% CI)			**116**			**73**	**100.0%**	**-0.26 [-0.45 , -0.07]**

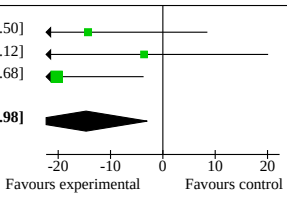
Heterogeneity: Tau² = 0.00; Chi² = 1.41, df = 5 (P = 0.92); I² = 0%
Test for overall effect: Z = 2.63 (P = 0.008)
Test for subgroup differences: Not applicable



Analysis 1.18. Comparison 1: All weight loss interventions vs controls (no subgrouping), Outcome 18: Change in leptin

Study or Subgroup	Intervention Mean [ng/ml]	Intervention SD [ng/ml]	Intervention Total	Control Mean [ng/ml]	Control SD [ng/ml]	Control Total	Weight	Mean Difference IV, Random, 95% CI [ng/ml]
Djuric 2002a	-9.5	27.3	9	4.8	14.5	4	26.3%	-14.30 [-37.10 , 8.50]
Djuric 2002b	1.2	27.4	8	4.8	14.5	4	24.3%	-3.60 [-27.32 , 20.12]
Djuric 2002c	-15.5	13.9	10	4.8	14.5	4	49.5%	-20.30 [-36.92 , -3.68]
Total (95% CI)			**27**			**12**	**100.0%**	**-14.67 [-26.36 , -2.98]**

Heterogeneity: Tau² = 0.00; Chi² = 1.28, df = 2 (P = 0.53); I² = 0%
Test for overall effect: Z = 2.46 (P = 0.01)
Test for subgroup differences: Not applicable



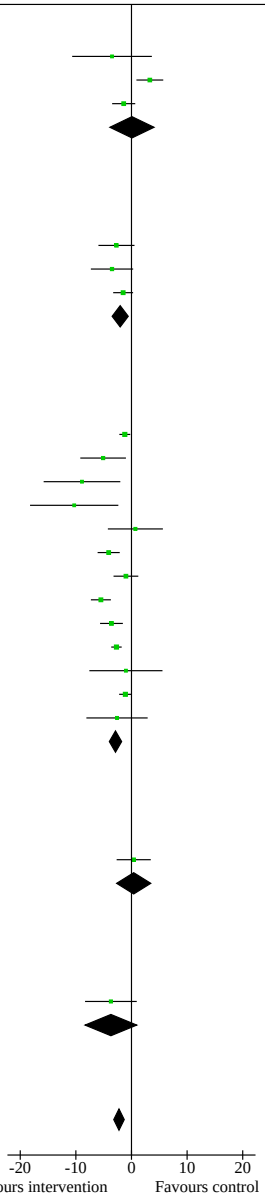
Comparison 2. Subgrouped by Intervention type vs control type

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.1 Change in body weight	21	1751	Mean Difference (IV, Random, 95% CI)	-2.25 [-3.19, -1.30]
2.1.1 Diet vs usual care, wait-list, written materials or placebo	3	72	Mean Difference (IV, Random, 95% CI)	0.09 [-3.88, 4.05]
2.1.2 Diet + exercise vs usual care, wait-list, written materials or placebo	3	93	Mean Difference (IV, Random, 95% CI)	-2.03 [-3.48, -0.58]
2.1.3 DIet + exercise + psychosocial vs usual care, wait-list, written materials or placebo	13	1526	Mean Difference (IV, Random, 95% CI)	-2.88 [-3.98, -1.77]
2.1.4 Diet + psychosocial vs active control (diet + psychosocial)	1	40	Mean Difference (IV, Random, 95% CI)	0.40 [-2.67, 3.47]
2.1.5 Diet + exercise vs active control (diet + exercise)	1	20	Mean Difference (IV, Random, 95% CI)	-3.70 [-8.35, 0.95]
2.2 Change in body mass index [kg/m^2]	17	1353	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.61, -0.56]
2.2.1 Diet vs usual care, wait-list, written materials or placebo	3	72	Mean Difference (IV, Random, 95% CI)	-0.15 [-1.57, 1.26]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.2.2 Diet + exercise vs usual care, wait-list, written materials or placebo	2	54	Mean Difference (IV, Random, 95% CI)	-1.05 [-1.65, -0.45]
2.2.3 DIet + exercise + psychosocial vs usual care, wait-list, written materials or placebo	11	1187	Mean Difference (IV, Random, 95% CI)	-1.44 [-2.16, -0.72]
2.2.4 Diet + psychosocial vs active control (diet + psychosocial)	1	40	Mean Difference (IV, Random, 95% CI)	0.00 [-1.17, 1.17]
2.2.5 Diet + exercise vs active control (diet + exercise)	0	0	Mean Difference (IV, Random, 95% CI)	Not estimable
2.3 Change in waist circumference	13	1193	Mean Difference (IV, Random, 95% CI)	-1.73 [-3.17, -0.29]
2.3.1 Diet vs usual care, wait-list, written materials or placebo	1	39	Mean Difference (IV, Random, 95% CI)	2.30 [-1.93, 6.53]
2.3.2 Diet + exercise vs usual care, wait-list, written materials or placebo	3	93	Mean Difference (IV, Random, 95% CI)	-3.63 [-5.76, -1.51]
2.3.3 DIet + exercise + psychosocial vs usual care, wait-list, written materials or placebo	8	1021	Mean Difference (IV, Random, 95% CI)	-1.66 [-3.49, 0.16]
2.3.4 Diet + psychosocial vs active control (diet + psychosocial)	1	40	Mean Difference (IV, Random, 95% CI)	0.80 [-3.02, 4.62]
2.3.5 Diet + exercise vs active control (diet + exercise)	0	0	Mean Difference (IV, Random, 95% CI)	Not estimable

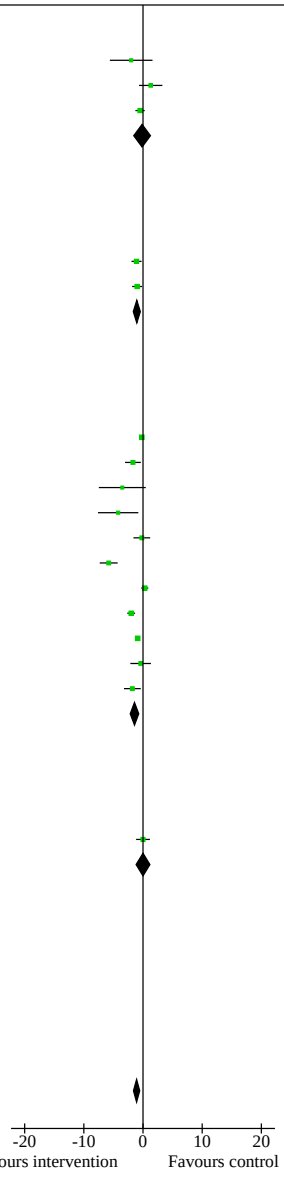
Analysis 2.1. Comparison 2: Subgrouped by Intervention type vs control type, Outcome 1: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
2.1.1 Diet vs usual care, wait-list, written materials or placebo								
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Subtotal (95% CI)			**42**			**30**	**13.6%**	**0.09 [-3.88 , 4.05]**
Heterogeneity: Tau² = 8.75; Chi² = 9.58, df = 2 (P = 0.008); I² = 79%								
Test for overall effect: Z = 0.04 (P = 0.97)								
2.1.2 Diet + exercise vs usual care, wait-list, written materials or placebo								
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Subtotal (95% CI)			**63**			**30**	**15.1%**	**-2.03 [-3.48 , -0.58]**
Heterogeneity: Tau² = 0.00; Chi² = 1.08, df = 2 (P = 0.58); I² = 0%								
Test for overall effect: Z = 2.75 (P = 0.006)								
2.1.3 DIet + exercise + psychosocial vs usual care, wait-list, written materials or placebo								
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Subtotal (95% CI)			**784**			**742**	**63.8%**	**-2.88 [-3.98 , -1.77]**
Heterogeneity: Tau² = 2.07; Chi² = 38.95, df = 12 (P = 0.0001); I² = 69%								
Test for overall effect: Z = 5.09 (P < 0.00001)								
2.1.4 Diet + psychosocial vs active control (diet + psychosocial)								
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Subtotal (95% CI)			**21**			**19**	**4.7%**	**0.40 [-2.67 , 3.47]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.26 (P = 0.80)								
2.1.5 Diet + exercise vs active control (diet + exercise)								
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Subtotal (95% CI)			**10**			**10**	**2.8%**	**-3.70 [-8.35 , 0.95]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.56 (P = 0.12)								
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**
Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%								
Test for overall effect: Z = 4.67 (P < 0.00001)								
Test for subgroup differences: Chi² = 5.88, df = 4 (P = 0.21), I² = 32.0%								

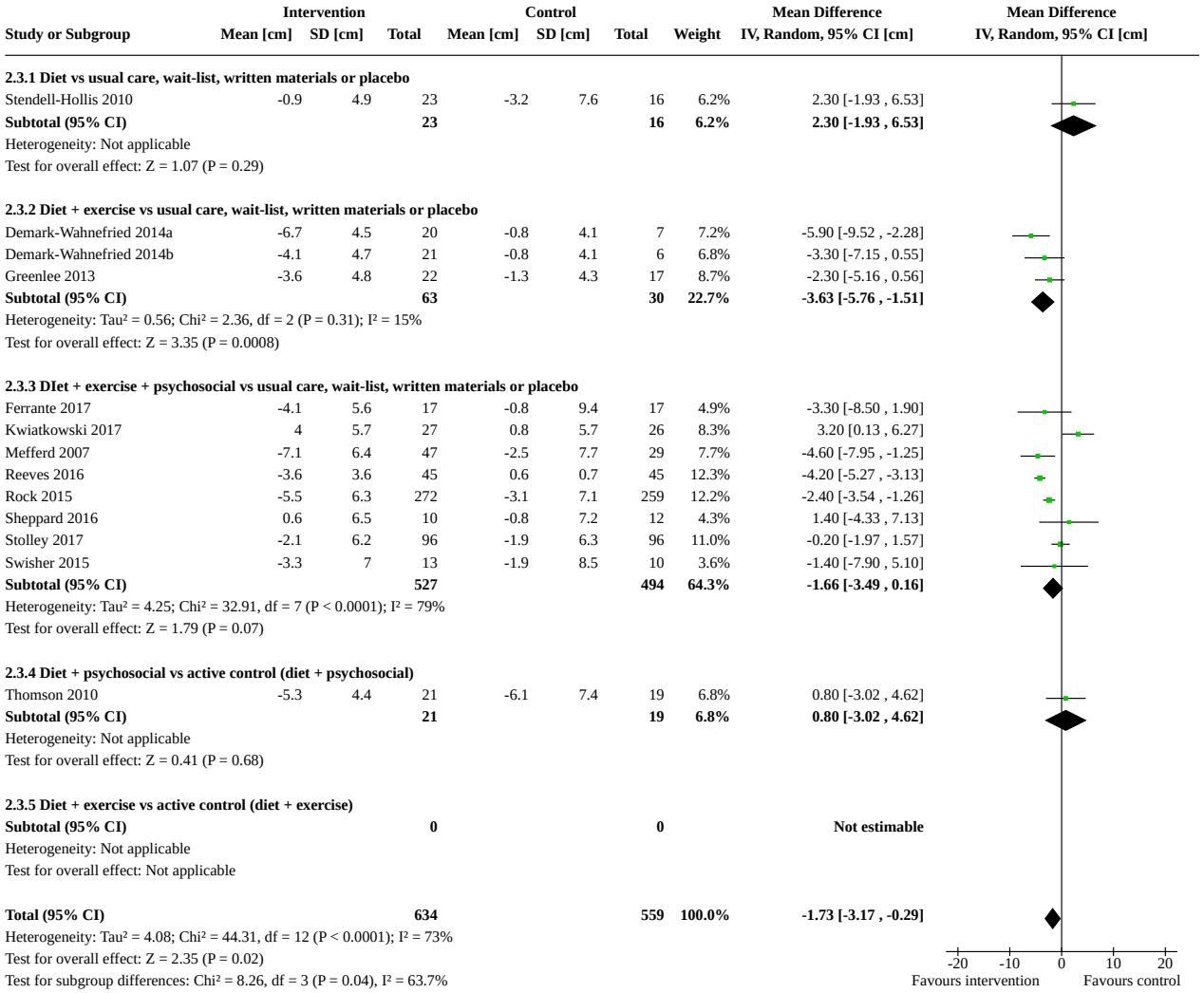


Analysis 2.2. Comparison 2: Subgrouped by Intervention type vs control type, Outcome 2: Change in body mass index [kg/m²]

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
2.2.1 Diet vs usual care, wait-list, written materials or placebo								
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Subtotal (95% CI)			**42**			**30**	**13.5%**	**-0.15 [-1.57 , 1.26]**
Heterogeneity: Tau² = 0.74; Chi² = 3.63, df = 2 (P = 0.16); I² = 45%								
Test for overall effect: Z = 0.21 (P = 0.83)								
2.2.2 Diet + exercise vs usual care, wait-list, written materials or placebo								
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Subtotal (95% CI)			**41**			**13**	**15.1%**	**-1.05 [-1.65 , -0.45]**
Heterogeneity: Tau² = 0.00; Chi² = 0.03, df = 1 (P = 0.87); I² = 0%								
Test for overall effect: Z = 3.45 (P = 0.0006)								
2.2.3 DIet + exercise + psychosocial vs usual care, wait-list, written materials or placebo								
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Subtotal (95% CI)			**610**			**577**	**65.0%**	**-1.44 [-2.16 , -0.72]**
Heterogeneity: Tau² = 1.00; Chi² = 94.93, df = 10 (P < 0.00001); I² = 89%								
Test for overall effect: Z = 3.92 (P < 0.0001)								
2.2.4 Diet + psychosocial vs active control (diet + psychosocial)								
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Subtotal (95% CI)			**21**			**19**	**6.4%**	**0.00 [-1.17 , 1.17]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.00 (P = 1.00)								
2.2.5 Diet + exercise vs active control (diet + exercise)								
Subtotal (95% CI)			**0**			**0**		**Not estimable**
Heterogeneity: Not applicable								
Test for overall effect: Not applicable								
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**
Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%								
Test for overall effect: Z = 4.03 (P < 0.0001)								
Test for subgroup differences: Chi² = 5.64, df = 3 (P = 0.13), I² = 46.9%								



Analysis 2.3. Comparison 2: Subgrouped by Intervention type vs control type, Outcome 3: Change in waist circumference



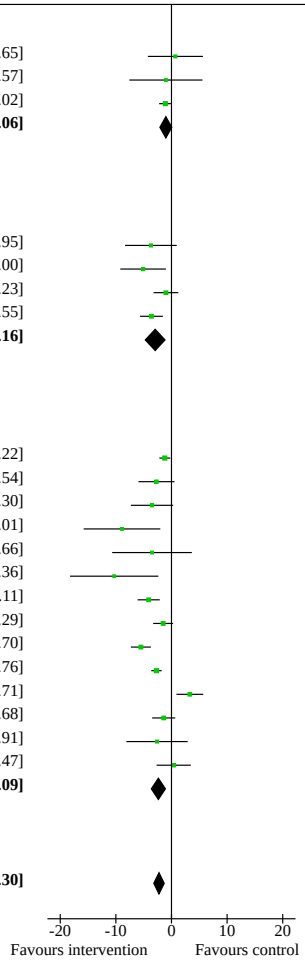
Comparison 3. Subgrouped by ethnicity

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Change in body weight	21	1751	Mean Difference (IV, Random, 95% CI)	-2.25 [-3.19, -1.30]
3.1.1 >95% African descent	3	248	Mean Difference (IV, Random, 95% CI)	-1.01 [-2.09, 0.06]
3.1.2 >95% white/caucasian	4	197	Mean Difference (IV, Random, 95% CI)	-2.93 [-4.70, -1.16]
3.1.3 Mixed (≤95% of any one ethnic group) or unspecified	14	1306	Mean Difference (IV, Random, 95% CI)	-2.36 [-3.62, -1.09]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.2 Change in body mass index [kg/m^2]	17	1353	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.61, -0.56]
3.2.1 >95% African descent	2	56	Mean Difference (IV, Random, 95% CI)	-0.28 [-1.38, 0.82]
3.2.2 >95% white/caucasian	2	88	Mean Difference (IV, Random, 95% CI)	-0.61 [-2.56, 1.34]
3.2.3 Mixed (≤95% of any one ethnic group) or unspecified	13	1209	Mean Difference (IV, Random, 95% CI)	-1.31 [-1.93, -0.68]
3.3 Change in waist circumference	13	1193	Mean Difference (IV, Random, 95% CI)	-1.73 [-3.17, -0.29]
3.3.1 >95% African descent	3	248	Mean Difference (IV, Random, 95% CI)	-0.37 [-1.98, 1.24]
3.3.2 >95% white/caucasian	2	143	Mean Difference (IV, Random, 95% CI)	-0.65 [-7.89, 6.60]
3.3.3 Mixed (≤95% of any one ethnic group) or unspecified	8	802	Mean Difference (IV, Random, 95% CI)	-2.33 [-3.87, -0.79]

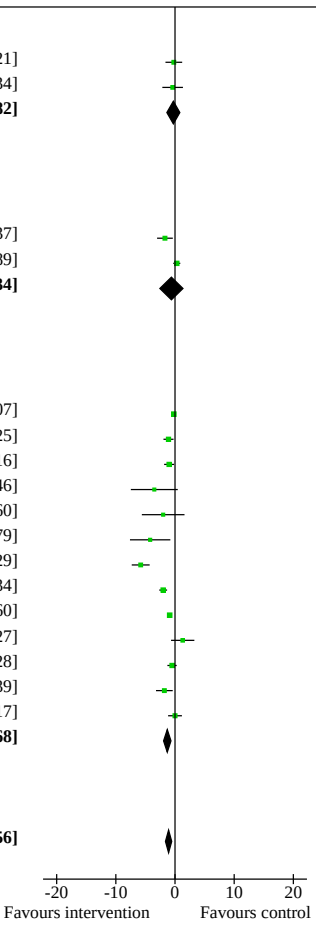
Analysis 3.1. Comparison 3: Subgrouped by ethnicity, Outcome 1: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
3.1.1 >95% African descent								
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Subtotal (95% CI)			**123**			**125**	**12.5%**	**-1.01 [-2.09 , 0.06]**
Heterogeneity: Tau² = 0.00; Chi² = 0.48, df = 2 (P = 0.79); I² = 0%								
Test for overall effect: Z = 1.84 (P = 0.07)								
3.1.2 >95% white/caucasian								
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Subtotal (95% CI)			**100**			**97**	**18.8%**	**-2.93 [-4.70 , -1.16]**
Heterogeneity: Tau² = 1.06; Chi² = 4.45, df = 3 (P = 0.22); I² = 33%								
Test for overall effect: Z = 3.25 (P = 0.001)								
3.1.3 Mixed (≤95% of any one ethnic group) or unspecified								
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Subtotal (95% CI)			**697**			**609**	**68.8%**	**-2.36 [-3.62 , -1.09]**
Heterogeneity: Tau² = 3.42; Chi² = 53.75, df = 13 (P < 0.00001); I² = 76%								
Test for overall effect: Z = 3.65 (P = 0.0003)								
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**
Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%								
Test for overall effect: Z = 4.67 (P < 0.00001)								
Test for subgroup differences: Chi² = 4.38, df = 2 (P = 0.11), I² = 54.3%								

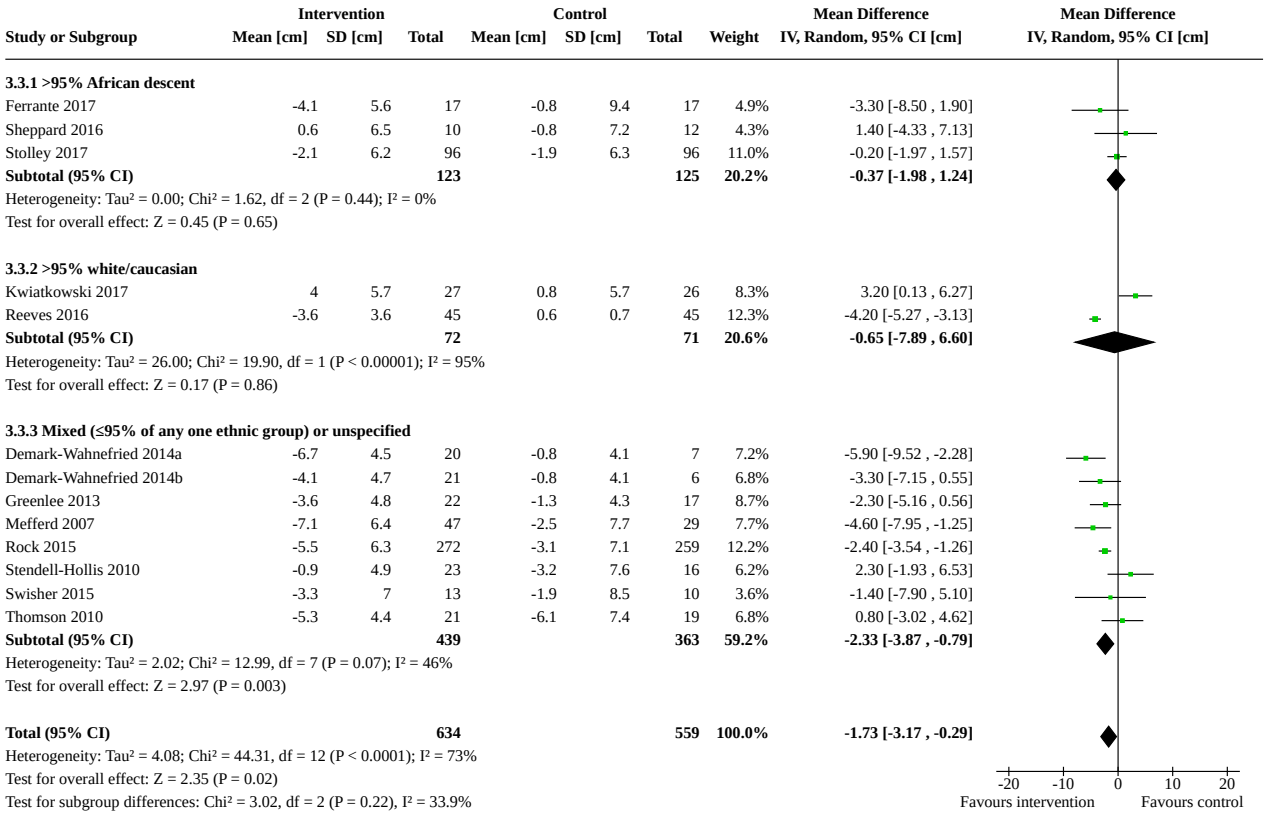


Analysis 3.2. Comparison 3: Subgrouped by ethnicity, Outcome 2: Change in body mass index [kg/m^2]

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
3.2.1 >95% African descent								
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Subtotal (95% CI)			**27**			**29**	**10.2%**	**-0.28 [-1.38 , 0.82]**
Heterogeneity: Tau² = 0.00; Chi² = 0.03, df = 1 (P = 0.86); I² = 0%								
Test for overall effect: Z = 0.50 (P = 0.62)								
3.2.2 >95% white/caucasian								
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Subtotal (95% CI)			**45**			**43**	**14.2%**	**-0.61 [-2.56 , 1.34]**
Heterogeneity: Tau² = 1.72; Chi² = 7.26, df = 1 (P = 0.007); I² = 86%								
Test for overall effect: Z = 0.61 (P = 0.54)								
3.2.3 Mixed (≤95% of any one ethnic group) or unspecified								
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Subtotal (95% CI)			**642**			**567**	**75.6%**	**-1.31 [-1.93 , -0.68]**
Heterogeneity: Tau² = 0.84; Chi² = 88.57, df = 12 (P < 0.00001); I² = 86%								
Test for overall effect: Z = 4.10 (P < 0.0001)								
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**
Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%								
Test for overall effect: Z = 4.03 (P < 0.0001)								
Test for subgroup differences: Chi² = 2.74, df = 2 (P = 0.25), I² = 26.9%								



Analysis 3.3. Comparison 3: Subgrouped by ethnicity, Outcome 3: Change in waist circumference



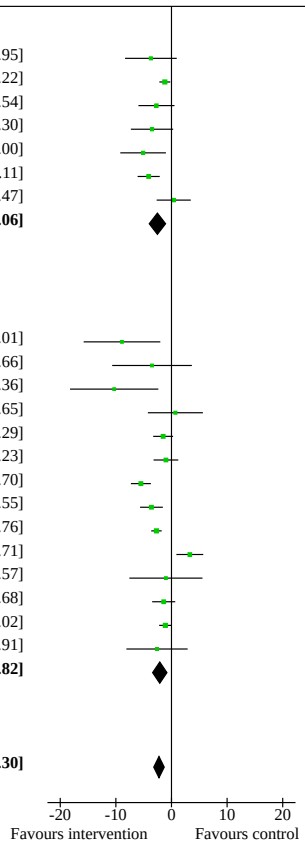
Comparison 4. Subgrouped by menopausal status

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.1 Change in body weight	21	1751	Mean Difference (IV, Random, 95% CI)	-2.25 [-3.19, -1.30]
4.1.1 100% postmenopausal women	7	536	Mean Difference (IV, Random, 95% CI)	-2.53 [-4.00, -1.06]
4.1.2 Mix of pre- and post-menopausal women or unspecified	14	1215	Mean Difference (IV, Random, 95% CI)	-2.11 [-3.39, -0.82]
4.2 Change in body mass index [kg/m²]	17	1353	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.61, -0.56]
4.2.1 100% postmenopausal women	5	379	Mean Difference (IV, Random, 95% CI)	-0.70 [-1.28, -0.12]
4.2.2 Mix of pre- and post-menopausal women or unspecified	12	974	Mean Difference (IV, Random, 95% CI)	-1.34 [-2.16, -0.53]
4.3 Change in waist circumference	13	1193	Mean Difference (IV, Random, 95% CI)	-1.73 [-3.17, -0.29]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.3.1 100% postmenopausal women	3	94	Mean Difference (IV, Random, 95% CI)	-2.83 [-6.68, 1.01]
4.3.2 Mix of pre- and post-menopausal women or unspecified	10	1099	Mean Difference (IV, Random, 95% CI)	-1.43 [-3.06, 0.20]

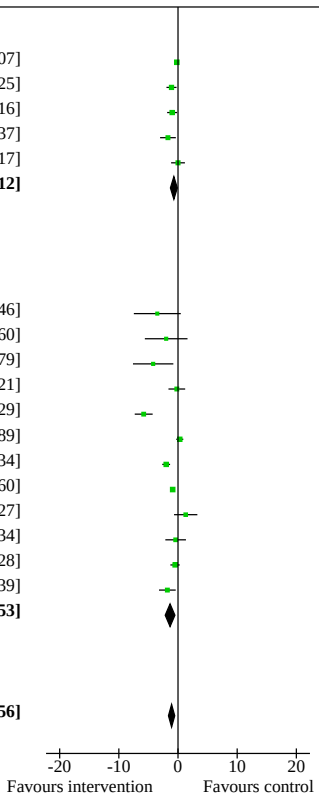
Analysis 4.1. Comparison 4: Subgrouped by menopausal status, Outcome 1: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
4.1.1 100% postmenopausal women								
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Subtotal (95% CI)			**282**			**254**	**34.0%**	**-2.53 [-4.00 , -1.06]**
Heterogeneity: Tau² = 1.79; Chi² = 12.65, df = 6 (P = 0.05); I² = 53%								
Test for overall effect: Z = 3.37 (P = 0.0007)								
4.1.2 Mix of pre- and post- menopausal women or unspecified								
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Subtotal (95% CI)			**638**			**577**	**66.0%**	**-2.11 [-3.39 , -0.82]**
Heterogeneity: Tau² = 3.39; Chi² = 50.88, df = 13 (P < 0.00001); I² = 74%								
Test for overall effect: Z = 3.20 (P = 0.001)								
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**
Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%								
Test for overall effect: Z = 4.67 (P < 0.00001)								
Test for subgroup differences: Chi² = 0.18, df = 1 (P = 0.67), I² = 0%								



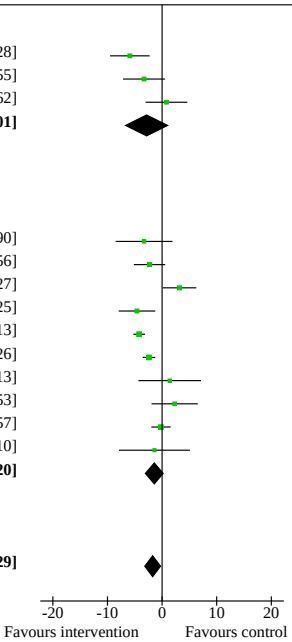
Analysis 4.2. Comparison 4: Subgrouped by menopausal status, Outcome 2: Change in body mass index [kg/m^2]

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
4.2.1 100% postmenopausal women								
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Subtotal (95% CI)			**199**			**180**	**36.4%**	**-0.70 [-1.28 , -0.12]**
Heterogeneity: Tau² = 0.25; Chi² = 10.74, df = 4 (P = 0.03); I² = 63%								
Test for overall effect: Z = 2.36 (P = 0.02)								
4.2.2 Mix of pre- and post- menopausal women or unspecified								
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Subtotal (95% CI)			**515**			**459**	**63.6%**	**-1.34 [-2.16 , -0.53]**
Heterogeneity: Tau² = 1.39; Chi² = 80.78, df = 11 (P < 0.00001); I² = 86%								
Test for overall effect: Z = 3.22 (P = 0.001)								
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**
Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%								
Test for overall effect: Z = 4.03 (P < 0.0001)								
Test for subgroup differences: Chi² = 1.57, df = 1 (P = 0.21), I² = 36.4%								



Analysis 4.3. Comparison 4: Subgrouped by menopausal status, Outcome 3: Change in waist circumference

Study or Subgroup	Intervention Mean [cm]	SD [cm]	Total	Control Mean [cm]	SD [cm]	Total	Weight	Mean Difference IV, Random, 95% CI [cm]
4.3.1 100% postmenopausal women								
Demark-Wahnefried 2014a	-6.7	4.5	20	-0.8	4.1	7	7.2%	-5.90 [-9.52 , -2.28]
Demark-Wahnefried 2014b	-4.1	4.7	21	-0.8	4.1	6	6.8%	-3.30 [-7.15 , 0.55]
Thomson 2010	-5.3	4.4	21	-6.1	7.4	19	6.8%	0.80 [-3.02 , 4.62]
Subtotal (95% CI)			**62**			**32**	**20.9%**	**-2.83 [-6.68 , 1.01]**
Heterogeneity: Tau² = 7.88; Chi² = 6.28, df = 2 (P = 0.04); I² = 68%								
Test for overall effect: Z = 1.44 (P = 0.15)								
4.3.2 Mix of pre- and post- menopausal women or unspecified								
Ferrante 2017	-4.1	5.6	17	-0.8	9.4	17	4.9%	-3.30 [-8.50 , 1.90]
Greenlee 2013	-3.6	4.8	22	-1.3	4.3	17	8.7%	-2.30 [-5.16 , 0.56]
Kwiatkowski 2017	4	5.7	27	0.8	5.7	26	8.3%	3.20 [0.13 , 6.27]
Mefferd 2007	-7.1	6.4	47	-2.5	7.7	29	7.7%	-4.60 [-7.95 , -1.25]
Reeves 2016	-3.6	3.6	45	0.6	0.7	45	12.3%	-4.20 [-5.27 , -3.13]
Rock 2015	-5.5	6.3	272	-3.1	7.1	259	12.2%	-2.40 [-3.54 , -1.26]
Sheppard 2016	0.6	6.5	10	-0.8	7.2	12	4.3%	1.40 [-4.33 , 7.13]
Stendell-Hollis 2010	-0.9	4.9	23	-3.2	7.6	16	6.2%	2.30 [-1.93 , 6.53]
Stolley 2017	-2.1	6.2	96	-1.9	6.3	96	11.0%	-0.20 [-1.97 , 1.57]
Swisher 2015	-3.3	7	13	-1.9	8.5	10	3.6%	-1.40 [-7.90 , 5.10]
Subtotal (95% CI)			**572**			**527**	**79.1%**	**-1.43 [-3.06 , 0.20]**
Heterogeneity: Tau² = 4.16; Chi² = 37.87, df = 9 (P < 0.0001); I² = 76%								
Test for overall effect: Z = 1.71 (P = 0.09)								
Total (95% CI)			**634**			**559**	**100.0%**	**-1.73 [-3.17 , -0.29]**
Heterogeneity: Tau² = 4.08; Chi² = 44.31, df = 12 (P < 0.0001); I² = 73%								
Test for overall effect: Z = 2.35 (P = 0.02)								
Test for subgroup differences: Chi² = 0.44, df = 1 (P = 0.51), I² = 0%								

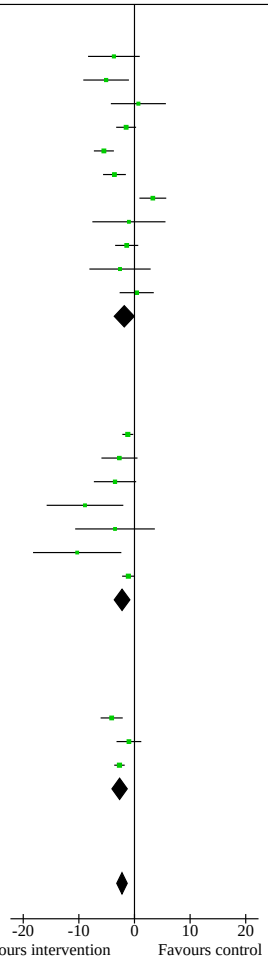


Comparison 5. Subgrouped by duration of follow-up (months)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
5.1 Change in body weight	21	1751	Mean Difference (IV, Random, 95% CI)	-2.25 [-3.19, -1.30]
5.1.1 ≤6 months	11	438	Mean Difference (IV, Random, 95% CI)	-1.84 [-3.64, -0.04]
5.1.2 > 6 months, ≤12 months	7	535	Mean Difference (IV, Random, 95% CI)	-2.23 [-3.64, -0.83]
5.1.3 >12 months, ≤36 months	3	778	Mean Difference (IV, Random, 95% CI)	-2.68 [-4.05, -1.30]
5.2 Change in body mass index [kg/m^2]	17	1353	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.61, -0.56]
5.2.1 ≤6 months	9	370	Mean Difference (IV, Random, 95% CI)	-1.27 [-2.33, -0.20]
5.2.2 > 6 months, ≤12 months	6	343	Mean Difference (IV, Random, 95% CI)	-1.04 [-1.85, -0.23]
5.2.3 >12 months, ≤36 months	2	640	Mean Difference (IV, Random, 95% CI)	-0.33 [-1.50, 0.85]
5.3 Change in waist circumference	13	1193	Mean Difference (IV, Random, 95% CI)	-1.73 [-3.17, -0.29]
5.3.1 ≤6 months	8	363	Mean Difference (IV, Random, 95% CI)	-1.88 [-3.84, 0.07]
5.3.2 > 6 months, ≤12 months	3	246	Mean Difference (IV, Random, 95% CI)	-2.86 [-6.48, 0.77]
5.3.3 >12 months, ≤36 months	2	584	Mean Difference (IV, Random, 95% CI)	0.21 [-5.26, 5.69]

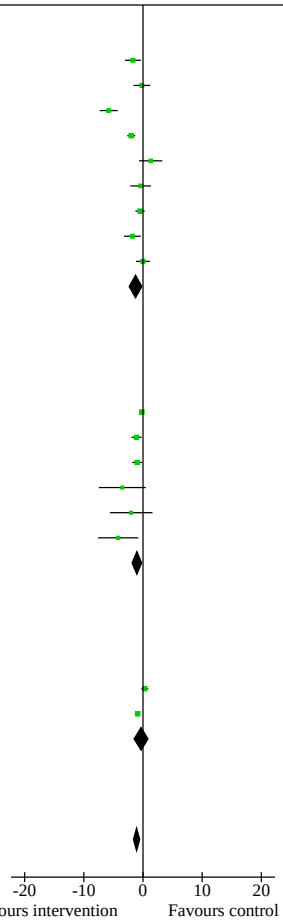
Analysis 5.1. Comparison 5: Subgrouped by duration of follow-up (months), Outcome 1: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [kg]
5.1.1 ≤6 months								
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	2.8%	-3.70 [-8.35 , 0.95]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	3.4%	-5.10 [-9.20 , -1.00]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	2.6%	0.70 [-4.25 , 5.65]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.9%	-1.50 [-3.29 , 0.29]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	6.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	6.4%	-3.60 [-5.65 , -1.55]
Shaw 2007	3.3	2.6	11	0	3	10	5.8%	3.30 [0.89 , 5.71]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	1.7%	-1.00 [-7.57 , 5.57]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	6.4%	-1.40 [-3.48 , 0.68]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	2.2%	-2.60 [-8.11 , 2.91]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	4.7%	0.40 [-2.67 , 3.47]
Subtotal (95% CI)			**237**			**201**	**49.9%**	**-1.84 [-3.64 , -0.04]**
Heterogeneity: Tau² = 6.25; Chi² = 42.37, df = 10 (P < 0.00001); I² = 76%								
Test for overall effect: Z = 2.00 (P = 0.05)								
5.1.2 > 6 months, ≤12 months								
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	8.4%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	4.4%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	3.7%	-3.50 [-7.30 , 0.30]
Djuric 2002a	-8	5.5	9	0.9	6	4	1.6%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	1.5%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	1.2%	-10.30 [-18.24 , -2.36]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	8.2%	-1.10 [-2.22 , 0.02]
Subtotal (95% CI)			**283**			**252**	**29.0%**	**-2.23 [-3.64 , -0.83]**
Heterogeneity: Tau² = 1.26; Chi² = 11.89, df = 6 (P = 0.06); I² = 50%								
Test for overall effect: Z = 3.11 (P = 0.002)								
5.1.3 >12 months, ≤36 months								
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	6.6%	-4.10 [-6.09 , -2.11]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	6.1%	-1.00 [-3.23 , 1.23]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	8.5%	-2.70 [-3.64 , -1.76]
Subtotal (95% CI)			**400**			**378**	**21.2%**	**-2.68 [-4.05 , -1.30]**
Heterogeneity: Tau² = 0.78; Chi² = 4.15, df = 2 (P = 0.13); I² = 52%								
Test for overall effect: Z = 3.81 (P = 0.0001)								
Total (95% CI)			**920**			**831**	**100.0%**	**-2.25 [-3.19 , -1.30]**
Heterogeneity: Tau² = 2.49; Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%								
Test for overall effect: Z = 4.67 (P < 0.00001)								
Test for subgroup differences: Chi² = 0.55, df = 2 (P = 0.76), I² = 0%								

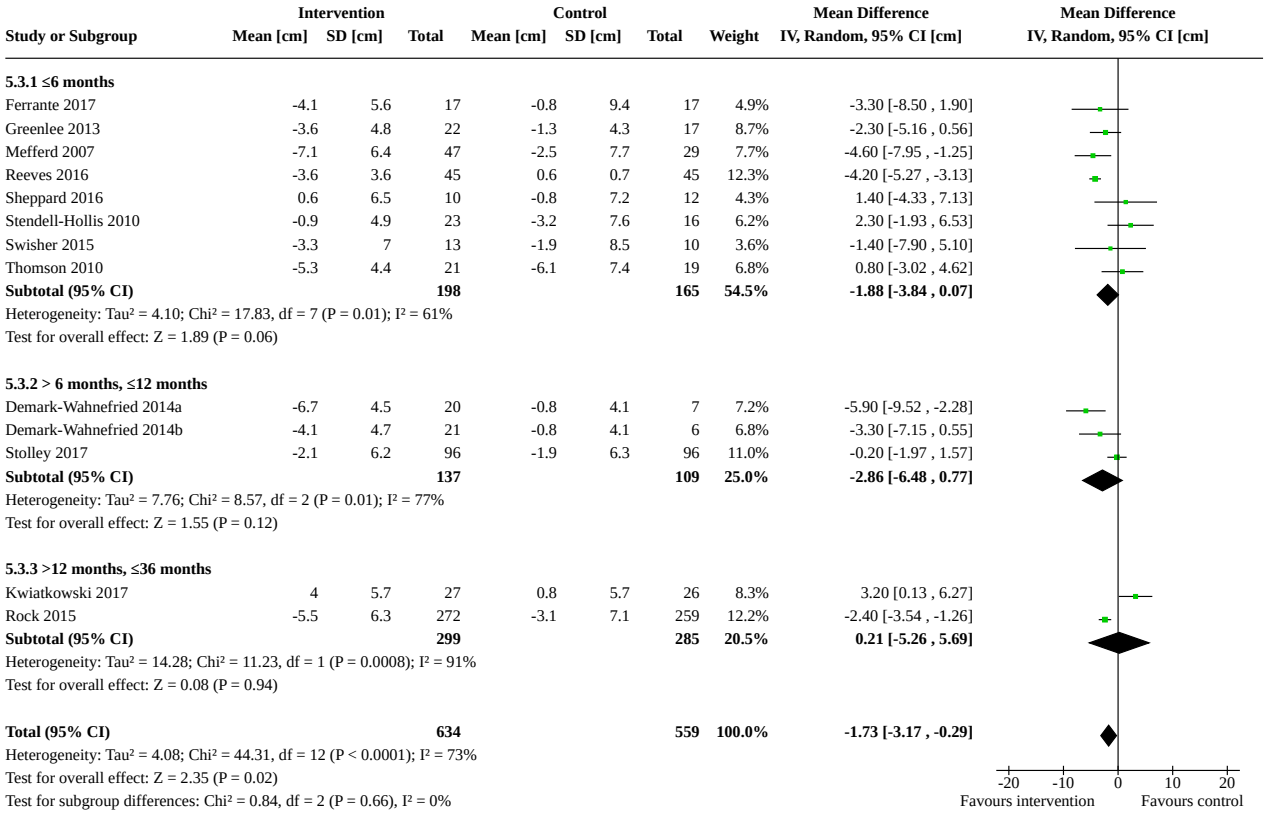


Analysis 5.2. Comparison 5: Subgrouped by duration of follow-up (months), Outcome 2: Change in body mass index [kg/m^2]

Study or Subgroup	Intervention Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
5.2.1 ≤6 months								
Dittus 2018	-2	2.2	18	-0.3	1.8	17	5.9%	-1.70 [-3.03 , -0.37]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	5.6%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	5.3%	-5.80 [-7.31 , -4.29]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	8.1%	-2.00 [-2.66 , -1.34]
Shaw 2007	1.3	1.1	11	0	3	10	4.1%	1.30 [-0.67 , 3.27]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	4.6%	-0.40 [-2.14 , 1.34]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	7.7%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	5.6%	-1.80 [-3.21 , -0.39]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	6.4%	0.00 [-1.17 , 1.17]
Subtotal (95% CI)			**200**			**170**	**53.3%**	**-1.27 [-2.33 , -0.20]**
Heterogeneity: Tau² = 2.19; Chi² = 57.89, df = 8 (P < 0.00001); I² = 86%								
Test for overall effect: Z = 2.32 (P = 0.02)								
5.2.2 > 6 months, ≤12 months								
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	9.1%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	7.5%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	7.6%	-1.00 [-1.84 , -0.16]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	1.5%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	1.7%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	1.9%	-4.20 [-7.61 , -0.79]
Subtotal (95% CI)			**187**			**156**	**29.3%**	**-1.04 [-1.85 , -0.23]**
Heterogeneity: Tau² = 0.47; Chi² = 14.51, df = 5 (P = 0.01); I² = 66%								
Test for overall effect: Z = 2.52 (P = 0.01)								
5.2.3 >12 months, ≤36 months								
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	8.3%	0.30 [-0.29 , 0.89]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	9.0%	-0.90 [-1.20 , -0.60]
Subtotal (95% CI)			**327**			**313**	**17.4%**	**-0.33 [-1.50 , 0.85]**
Heterogeneity: Tau² = 0.66; Chi² = 12.45, df = 1 (P = 0.0004); I² = 92%								
Test for overall effect: Z = 0.55 (P = 0.58)								
Total (95% CI)			**714**			**639**	**100.0%**	**-1.08 [-1.61 , -0.56]**
Heterogeneity: Tau² = 0.78; Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%								
Test for overall effect: Z = 4.03 (P < 0.0001)								
Test for subgroup differences: Chi² = 1.46, df = 2 (P = 0.48), I² = 0%								



Analysis 5.3. Comparison 5: Subgrouped by duration of follow-up (months), Outcome 3: Change in waist circumference



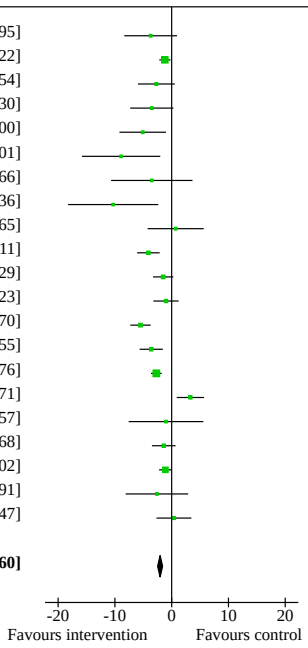
Comparison 6. Sensitivity analyses - analyses 1.1, 1.2, 1.3 repeated but with fixed effect approach

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6.1 Change in body weight	21	1751	Mean Difference (IV, Fixed, 95% CI)	-2.04 [-2.48, -1.60]
6.2 Change in body mass index [kg/m^2]	17	1353	Mean Difference (IV, Fixed, 95% CI)	-0.67 [-0.83, -0.50]
6.3 Change in waist circumference	13	1193	Mean Difference (IV, Fixed, 95% CI)	-2.47 [-3.09, -1.86]

Analysis 6.1. Comparison 6: Sensitivity analyses - analyses 1.1, 1.2, 1.3 repeated but with fixed effect approach, Outcome 1: Change in body weight

Study or Subgroup	Intervention Mean [kg]	Intervention SD [kg]	Intervention Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Fixed, 95% CI [kg]
Arikawa 2017	-8.8	5.3	10	-5.1	5.3	10	0.9%	-3.70 [-8.35 , 0.95]
Demark-Wahnefried 2012a	-2.7	3.7	119	-1.5	4.2	131	19.9%	-1.20 [-2.18 , -0.22]
Demark-Wahnefried 2014a	-3.7	4.2	20	-1	3.6	7	1.8%	-2.70 [-5.94 , 0.54]
Demark-Wahnefried 2014b	-4.5	5.8	21	-1	3.6	6	1.3%	-3.50 [-7.30 , 0.30]
Dittus 2018	-6.1	6.4	18	-1	5.8	16	1.1%	-5.10 [-9.20 , -1.00]
Djuric 2002a	-8	5.5	9	0.9	6	4	0.4%	-8.90 [-15.79 , -2.01]
Djuric 2002b	-2.6	5.9	8	0.9	6	4	0.4%	-3.50 [-10.66 , 3.66]
Djuric 2002c	-9.4	8.6	10	0.9	6	4	0.3%	-10.30 [-18.24 , -2.36]
Ferrante 2017	-1.8	6	17	-2.5	8.5	17	0.8%	0.70 [-4.25 , 5.65]
Goodwin 2014	-4.3	6	73	-0.2	5.9	65	4.8%	-4.10 [-6.09 , -2.11]
Greenlee 2013	-2.9	3.2	22	-1.4	2.5	17	6.0%	-1.50 [-3.29 , 0.29]
Kwiatkowski 2017	0	4.7	27	1	3.5	26	3.9%	-1.00 [-3.23 , 1.23]
Mefferd 2007	-5.7	3.5	47	-0.2	4.1	29	5.9%	-5.50 [-7.30 , -3.70]
Reeves 2016	-4.7	4.7	45	-1.1	5.2	45	4.6%	-3.60 [-5.65 , -1.55]
Rock 2015	-3.6	5.9	300	-0.9	5.7	287	21.7%	-2.70 [-3.64 , -1.76]
Shaw 2007	3.3	2.6	11	0	3	10	3.3%	3.30 [0.89 , 5.71]
Sheppard 2016	-0.8	7.6	10	0.2	8.1	12	0.4%	-1.00 [-7.57 , 5.57]
Stendell-Hollis 2010	-1.2	4.1	23	0.2	2.5	16	4.4%	-1.40 [-3.48 , 0.68]
Stolley 2017	-2.7	3.9	96	-1.6	4	96	15.3%	-1.10 [-2.22 , 0.02]
Swisher 2015	-3	3.9	13	-0.4	8.2	10	0.6%	-2.60 [-8.11 , 2.91]
Thomson 2010	-5.9	4.1	21	-6.3	5.6	19	2.0%	0.40 [-2.67 , 3.47]
Total (95% CI)			**920**			**831**	**100.0%**	**-2.04 [-2.48 , -1.60]**

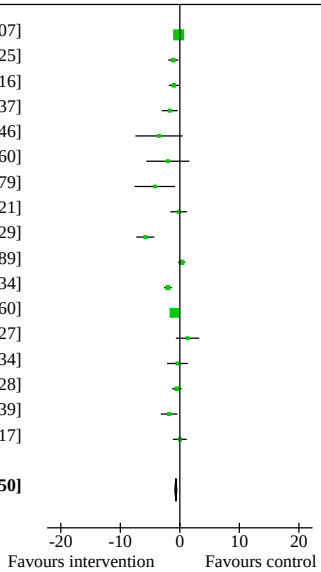
Heterogeneity: Chi² = 63.65, df = 20 (P < 0.00001); I² = 69%
Test for overall effect: Z = 9.13 (P < 0.00001)
Test for subgroup differences: Not applicable



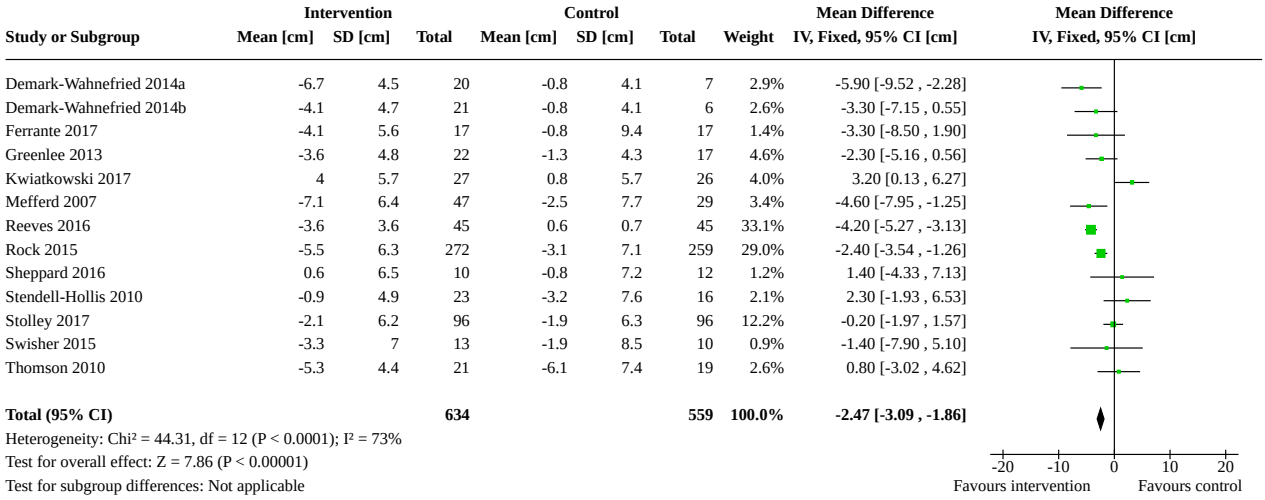
Analysis 6.2. Comparison 6: Sensitivity analyses - analyses 1.1, 1.2, 1.3 repeated but with fixed effect approach, Outcome 2: Change in body mass index [kg/m^2]

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Demark-Wahnefried 2012a	-0.9	1	119	-0.7	1.2	131	35.9%	-0.20 [-0.47 , 0.07]
Demark-Wahnefried 2014a	-1.5	1.2	20	-0.4	0.9	7	3.7%	-1.10 [-1.95 , -0.25]
Demark-Wahnefried 2014b	-1.4	1	21	-0.4	0.9	6	3.8%	-1.00 [-1.84 , -0.16]
Dittus 2018	-2	2.2	18	-0.3	1.8	17	1.5%	-1.70 [-3.03 , -0.37]
Djuric 2002a	-3	3.9	9	0.5	3.1	4	0.2%	-3.50 [-7.46 , 0.46]
Djuric 2002b	-1.5	2.8	8	0.5	3.1	4	0.2%	-2.00 [-5.60 , 1.60]
Djuric 2002c	-3.7	2.5	10	0.5	3.1	4	0.2%	-4.20 [-7.61 , -0.79]
Ferrante 2017	-1.1	2.1	17	-0.9	2.1	17	1.3%	-0.20 [-1.61 , 1.21]
Ghavami 2017	-4.3	0.9	40	1.5	4.8	40	1.2%	-5.80 [-7.31 , -4.29]
Kwiatkowski 2017	0.5	1.2	27	0.2	1	26	7.6%	0.30 [-0.29 , 0.89]
Mefferd 2007	-2.1	1.3	47	-0.1	1.5	29	6.1%	-2.00 [-2.66 , -1.34]
Rock 2015	-1.3	1.6	300	-0.4	2.1	287	29.1%	-0.90 [-1.20 , -0.60]
Shaw 2007	1.3	1.1	11	0	3	10	0.7%	1.30 [-0.67 , 3.27]
Sheppard 2016	-0.3	1.5	10	0.1	2.6	12	0.9%	-0.40 [-2.14 , 1.34]
Stendell-Hollis 2010	-0.5	1.5	23	0	1	16	4.3%	-0.50 [-1.28 , 0.28]
Swisher 2015	-1.6	1	13	0.2	2.1	10	1.3%	-1.80 [-3.21 , -0.39]
Thomson 2010	-2.3	1.6	21	-2.3	2.1	19	2.0%	0.00 [-1.17 , 1.17]
Total (95% CI)			**714**			**639**	**100.0%**	**-0.67 [-0.83 , -0.50]**

Heterogeneity: Chi² = 102.33, df = 16 (P < 0.00001); I² = 84%
Test for overall effect: Z = 8.01 (P < 0.00001)
Test for subgroup differences: Not applicable



Analysis 6.3. Comparison 6: Sensitivity analyses - analyses 1.1, 1.2, 1.3 repeated but with fixed effect approach, Outcome 3: Change in waist circumference



ADDITIONAL TABLES

Table 1. Number of studies, intervention-comparisons, patients randomised and patients analysed by outcome

	Included in meta-analysis					
Outcome	**Studies reporting outcome N**	**Studies N**	**Intervention-comparisons N**	**Total patients analysed/ randomised (%)**	**Intervention patients analysed/ randomised (%)**	**Control patients analysed/ randomised (%)**
Overall	**20**	**20**	**23**	2013/2360 (85.3%)	1056/1209 (87.3%)	957/1151 (83.1%)
Overall survival	**1**	0	0	0	0	0
Breast Cancer recurrence	4	4	4	281/281 (100.0%)	155/155 (100.0%)	126/126 (100.0%)
Change in body weight	19	18	21	1751/2190 (80.0%)	920/1122 (82.0%)	831/1068 (77.8%)
Change in body mass index	15	14	17	1353/1682 (80.4%)	714/862 (82.8%)	639/820 (77.9%)
Change in waist circumference	12	12	13	1193/1541 (77.4%)	634/800 (79.3%)	559/741 (75.4%)
Disease-free survival	0	0	0	0	0	0
Adverse events	5	3	4	394/446 (88.3%)	205/229 (89.5%)	189/217 (87.1%)
Change in quality of life - overall	8	8	10	867/1148 (75.5%)	447/578 (77.3%)	420/570 (73.7%)

Table 1. Number of studies, intervention-comparisons, patients randomised and patients analysed by outcome *(Continued)*

Change in quality of life - physical subscales	7	7	10	1024/1351 (75.8%)	530/679 (78.1%)	494/672 (73.5%)
Change in quality of life - social subscales	4	4	6	389/464 (83.8%)	196/228 (86.0%)	193/236 (81.8%)
Change in quality of life - emotional subscales	5	5	8	498/633 (78.7%)	264/321 (82.2%)	234/312 (75.0%)
Change in quality of life - mental health subscales	3	3	3	355/400 (88.8%)	173/200 (86.5%)	182/200 (91.0%)
Change in quality of life - anxiety depression subscales	3	3	3	669/910 (73.5%)	340/457 (74.4%)	329/453 (72.6%)
Change in insulin	4	4	6	134/192 (69.8%)	79/95 (83.2%)	55/97 (56.7%)
Change in glucose	4	4	6	133/192 (69.3%)	78/95 (82.1%)	55/97 (56.7%)
Change in total cholesterol	5	4	6	189/256 (73.8%)	116/141 (82.3%)	73/115 (63.5%)
Change in HDL cholesterol	5	4	6	189/256 (73.8%)	116/141 (82.3%)	73/115 (63.5%)
Change in LDL cholesterol	4	4	6	189/256 (73.8%)	116/141 (82.3%)	73/115 (63.5%)
Change in triglycerides	4	4	6	189/256 (73.8%)	116/141 (82.3%)	73/115 (63.5%)
Change in leptin	3	1	3	39/74 (52.7%)	27/35 (77.1%)	12/39 (30.8%)

HDL: high-density lipoprotein
LDL: low-density lipoprotein

APPENDICES

Appendix 1. CENTRAL

#1 MeSH descriptor: [Breast Neoplasms] explode all trees
#2 breast near neoplasm*
#3 breast near carcinom*
#4 breast near cancer*
#5 breast near tumour*
#6 breast near tumor*
#7 breast near malignan*
#8 #1 or #2 or #3 or #4 or #5 or #6 or #7
#9 MeSH descriptor: [Weight Reduction Programs] explode all trees
#10 weight reduction program* or weight near reduction near program*
#11 MeSH descriptor: [Weight Loss] explode all trees
#12 weight loss or weight near loss
#13 MeSH descriptor: [Body Weight Changes] explode all trees
#14 body weight chang* or body near weight near chang*
#15 MeSH descriptor: [Exercise] explode all trees
#16 MeSH descriptor: [Exercise Therapy] explode all trees

#17 exercis*
#18 exercise therap* or exercise near therap*
#19 MeSH descriptor: [Exercise Movement Techniques] explode all trees
#20 MeSH descriptor: [Physical Education and Training] explode all trees
#21 MeSH descriptor: [Physical Fitness] explode all trees
#22 MeSH descriptor: [Physical Exertion] explode all trees
#23 MeSH descriptor: [Sports] explode all trees
#24 MeSH descriptor: [Motor Activity] explode all trees
#25 MeSH descriptor: [Walking] explode all trees
#26 MeSH descriptor: [Jogging] explode all trees
#27 MeSH descriptor: [Swimming] explode all trees
#28 MeSH descriptor: [Bicycling] explode all trees
#29 MeSH descriptor: [Resistance Training] explode all trees
#30 (resistance or strength or weight) near train* or resistance train* or strength train* or weight train*
#31 MeSH descriptor: [Dancing] explode all trees
#32 MeSH descriptor: [Dance Therapy] explode all trees
#33 danc* near therap* or danc* therap* or danc*
#34 aerobic* near exercis* or aerobic exercis*
#35 MeSH descriptor: [Diet] explode all trees
#36 MeSH descriptor: [Diet Therapy] explode all trees
#37 diet therapy or diet* near therap*
#38 MeSH descriptor: [Diet, Reducing] explode all trees
#39 body weight management or body near weight near manag* or weight management or weight near manag*
#40 MeSH descriptor: [Bariatric Surgery] explode all trees
#41 bariatric surger* or bariatric near surger*
#42 MeSH descriptor: [Bariatrics] explode all trees
#43 MeSH descriptor: [Anti-Obesity Agents] explode all trees
#44 anti-obesity agent* or anti-obesity near agent* or anti-obesity drug* or anti-obesity near drug* or anti-obesity medic* or anti-obesity near medic*
#45 weight loss drug* or weight near loss near drug* or weight loss medic* or weight near loss near medic*
#46 orlistat
#47 sibutramine
#48 L-carnitine or carnitine
#49 metformin
#50 weight loss intervention or weight near loss near intervention*
#51 MeSH descriptor: [Behavior Therapy] explode all trees
#52 behavior therap* or behavior near therap* or behaviour therap* or behaviour near therap*
#53 MeSH descriptor: [Cognitive Therapy] explode all trees
#54 cogniti* therap* or cogniti* near therap*
#55 MeSH descriptor: [Psychotherapy] explode all trees
#56 psychotherap*
#57 lifestyle modification or lifestyle near modif*
#58 #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57
#59 #8 and #58
#60 MeSH descriptor: [Survivors] this term only
#61 survive* or survival or survivor*
#62 post treatment
#63 after treatment
#64 recover*
#65 treatment next finish*
#66 treatment next end*
#67 treatment next complete*
#68 treat* next (for or with)
#69 #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67 or #68
#70 #59 and #69

Appendix 2. MEDLINE (via OvidSP)

1	randomized controlled trial.pt.
2	controlled clinical trial.pt.
3	randomized.ab.
4	placebo.ab.
5	Clinical Trials as Topic/
6	randomly.ab.
7	trial.ti.
8	(crossover or cross-over).tw.
9	Pragmatic Clinical Trials as Topic/
10	pragmatic clinical trial.pt.
11	or/1-10
12	exp Breast Neoplasms/
13	(breast adj6 cancer$).tw.
14	(breast adj6 neoplasm$).tw.
15	(breast adj6 carcinoma$).tw.
16	(breast adj6 tumo?r$).tw.
17	or/12-16
18	exp Weight Reduction Programs/
19	weight reduc* program*.tw.
20	exp Weight Loss/
21	weight loss.tw.
22	exp body weight changes/
23	exp Exercise/
24	exercise.tw.
25	exp Exercise Movement Techniques/
26	exp Exercise Therapy/
27	exercise therap*.tw.
28	exp "Physical Education and Training"/

(Continued)

29	((physical adj6 education) and training).tw.
30	(physical and (education adj6 training)).tw.
31	((physical adj6 education) and training).tw.
32	(physical and (education adj6 training)).tw.
33	exp Physical Fitness/
34	physical fitness.tw.
35	(physical adj6 fitness).tw.
36	Physical Exertion/
37	exertion.tw.
38	exp Sports/
39	sport*.tw.
40	Motor Activity/
41	physical activit*.tw.
42	(physical adj6 activit*).tw.
43	exp Walking/
44	walk*.tw.
45	exp Jogging/
46	jog*.tw.
47	exp Swimming/
48	swim*.tw.
49	Bicycling/
50	bicycl*.tw.
51	weight training.tw.
52	(weight adj6 training).tw.
53	Dancing/
54	Dance Therapy/
55	danc*.tw.
56	(dance adj6 therap*).tw.

(Continued)

57	dance therap*.tw.
58	(aerobic adj6 exercis*).tw.
59	aerobic exercise.tw.
60	Resistance Training/
61	resistance train*.tw.
62	((resistance or strength) and train*).tw.
63	((resistance or strength) adj6 train*).tw.
64	strength train*.tw.
65	exp Diet Therapy/
66	exp Diet/
67	(diet adj6 therap*).tw.
68	diet therap*.tw.
69	diet*.tw.
70	Diet, Reducing/
71	body weight management.tw.
72	(weight adj6 manag*).tw.
73	exp bariatric surgery/
74	bariatric surger*.tw.
75	(bariatric adj6 surger*).tw.
76	exp Bariatrics/
77	exp Anti-Obesity Agents/
78	anti-obesity drug*.tw.
79	(anti-obesity adj6 drug).tw.
80	exp Appetite Depressants/
81	(obesity adj6 (drug* or medic*)).tw.
82	weight loss drug*.tw.
83	weight loss medic*.tw.
84	((weight and loss) adj6 (drug* or medic*)).tw.

(Continued)

85	((weight adj6 loss) and (drug* or medic*)).tw.
86	orlistat.mp.
87	sibutramine.mp.
88	L-carnitine.mp.
89	metformin.mp.
90	weight loss intervention.tw.
91	((weight and loss) adj6 intervention*).tw.
92	((weight adj6 loss) and intervention*).tw.
93	exp Behavior Therapy/
94	behaviour therap*.tw.
95	(behaviour adj6 therap*).tw.
96	exp Cognitive Therapy/
97	cogniti* therap*.tw.
98	(cogniti* adj6 therap*).tw.
99	exp Psychotherapy/
100	lifestyle modification.tw.
101	(lifestyle adj6 modif*).tw.
102	or/18-101
103	11 and 17 and 102
104	exp animals/ not humans/
105	103 not 104
106	survivors/
107	survivor$.tw.
108	post treatment.tw.
109	after treatment.tw.
110	(survival or survive$).tw.
111	recover$.tw.
112	(finish$ adj6 treatment).tw.

(Continued)

113	(end$ adj6 treatment).tw.
114	(complete$ adj6 treatment).tw.
115	(treated and (with or for)).tw.
116	or/106-115
117	105 and 116

Appendix 3. Embase (via OvidSP)

1	Randomized controlled trial/
2	Controlled clinical study/
3	Random$.ti,ab.
4	randomization/
5	intermethod comparison/
6	placebo.ti,ab.
7	(compare or compared or comparison).ti.
8	((evaluated or evaluate or evaluating or assessed or assess) and (compare or compared or comparing or comparison)).ab.
9	(open adj label).ti,ab.
10	((double or single or doubly or singly) adj (blind or blinded or blindly)).ti,ab.
11	double blind procedure/
12	parallel group$1.ti,ab.
13	(crossover or cross over).ti,ab.
14	((assign$ or match or matched or allocation) adj5 (alternate or group$1 or intervention$1 or patient$1 or subject$1 or participant$1)).ti,ab.
15	(assigned or allocated).ti,ab.
16	(controlled adj7 (study or design or trial)).ti,ab.
17	(volunteer or volunteers).ti,ab.
18	human experiment/
19	trial.ti.

(Continued)

20	or/1-19
21	exp breast/
22	exp breast disease/
23	(21 or 22) and exp neoplasm/
24	exp breast tumor/
25	exp breast cancer/
26	exp breast carcinoma/
27	(breast$ adj5 (neoplas$ or cancer$ or carcin$ or tumo$ or metasta$ or malig$)).ti,ab.
28	or/21-27
29	exp weight reduction/ or weight reduction*.tw. or (weight reduction adj6 program*).tw. or weight loss*.tw. or (weight loss adj6 program*).tw.
30	exp aerobic exercise/ or aerobic exercise*.tw. or (aerobic adj6 exercis*).tw.
31	exp exercise/ or exercis*.tw.
32	exp kinesiotherapy/ or exercise therap*.tw. or (exercise* adj6 therap*).tw.
33	exp movement therapy/ or movement therap*.tw. or (movement adj6 therap*).tw. or exercise movement*.tw. or (exercise adj6 movement*).tw.
34	exp physical education/ or physical education training*.tw. or (physical adj6 education*).tw.
35	exp fitness/ or physical fitness*.tw. or (physical adj6 fitness).tw.
36	(physical exertion or (physical adj6 exertion)).tw.
37	exp sport/ or sport*.tw.
38	exp physical activity/ or physical activit*.tw. or (physical adj6 activit*).tw.
39	exp motor activity/ or motor activit*.tw. or (motor adj6 activit*).tw.
40	exp walking/ or walk*.tw.
41	exp Jogging/ or jog*.tw.
42	exp swimming/ or swim*.tw.
43	exp cycling/ or cycl*.tw. or bicycl*.tw.
44	exp weight lifting/ or weight lift*.tw. or (weight adj6 lift*).tw. or weight train*.tw. or (weight adj6 train*).tw.
45	exp dance therapy/ or dance therap*.tw. or (danc* adj6 therap*).tw. or dance movement therap*.tw. or (dance and movement and therap*).tw.

(Continued)

46	exp resistance training/ or resistance train*.tw. or (resistance adj6 train*).tw. or strength train*.tw. or (strength adj6 train*).tw.
47	exp diet therapy/ or diet therap*.tw. or (diet adj6 therap*).tw.
48	exp diet/ or diet*.tw.
49	exp body weight/ or body weight.tw. or (bod* adj6 weight*).tw.
50	exp body weight management/ or (body weight adj6 manag*).tw. or (weight* adj6 manag*).tw.
51	exp bariatric surgery/ or bariatric surger*.tw. or (bariatric* adj6 surger*).tw.
52	exp bariatrics/ or bariatric*.tw.
53	exp antiobesity agent/ or anti-obesity agent*.tw. or (anti-obesity adj6 agent*).tw. or anti-obesity drug*.tw. or (anti-obesity adj6 drug*).tw. or anti-obesity medication*.tw. or (anti-obesity adj6 medic*).tw.
54	exp anorexigenic agent/ or anorexigenic agent*.tw. or (anorexigenic adj6 agent*).tw. or appetite suppressant*.tw. or (appetite adj6 suppressant*).tw.
55	(weight loss medication* or (weight loss adj6 (medic* or drug*)) or weight loss drug*).tw.
56	exp tetrahydrolipstatin/ or orlistat.tw.
57	exp sibutramine/ or sibutramine.tw.
58	exp carnitine/ or carnitine.tw. or l-carnitine.tw.
59	exp metformin/ or metformin.tw.
60	(weight loss intervention* or (weight loss adj6 intervention*)).tw.
61	exp behavior therapy/ or behavio?r therap*.tw. or (behavio?r adj6 therap*).tw.
62	exp cognitive therapy/ or cognitive therap*.tw. or (cognitive adj6 therap*).tw.
63	exp psychotherapy/ or psychotherap*.tw.
64	exp lifestyle modification/ or lifestyle modif*.tw. or (lifestyle* adj6 modif*).tw.
65	29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64
66	20 and 28 and 65
67	limit 66 to (human and embase)
68	cancer survivor/
69	survivor$.tw.
70	post treatment.tw.
71	after treatment.tw.

(Continued)

72	(survival or survive$).tw.
73	recover$.tw.
74	(finish$ adj6 treatment).tw.
75	(end$ adj6 treatment).tw.
76	(complete$ adj6 treatment).tw.
77	(treated adj6 (with or for)).tw.
78	or/68-77
79	67 and 78

Appendix 4. WHO ICTRP search portal

Basic searches:

1. breast cancer AND weight reduction AND obese
2. breast cancer AND weight reduction AND overweight

Advanced searches:

1. Title: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: exercise OR sport OR physical activity OR walk OR jog OR swim OR bicycle OR weight training OR dance OR resistance training OR strength training
Recruitment status: ALL

2. Title: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: weight management OR diet OR bariatric surgery OR weight loss surgery
Recruitment status: ALL

3. Title: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: weight loss drug OR weight loss medication OR weight loss agent OR anti-obesity drug OR anti-obesity medication OR anti-obesity agent
Recruitment status: ALL

4. Title: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: orlistat OR sibutramine OR L-carnitine OR carnitine OR metformin
Recruitment status: All

Appendix 5. Clinicaltrials.gov

Basic searches:

1. breast cancer AND weight reduction AND obese
2. breast cancer AND weight reduction AND overweight

Advanced searches:

1. Search terms: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: exercise OR sport OR physical activity OR walk OR jog OR swim OR bicycle OR weight training OR dance OR resistance training OR strength training

Recruitment status: All studies
Study results: All studies
Study type: All studies

2. Search terms: obese OR overweight OR weight
Conditions: breast cancer OR breast neoplasm
Interventions: weight management OR diet OR bariatric surgery OR weight loss surgery
Recruitment status: All studies
Study results: All studies
Study type: All studies

3. Search terms: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: weight loss drug OR weight loss medication OR weight loss agent OR anti-obesity drug OR anti-obesity medication OR anti-obesity agent
Recruitment status: All studies
Study Results: All studies
Study type: All studies

4. Search terms: obese OR overweight OR weight
Condition: breast cancer OR breast neoplasm
Intervention: orlistat OR sibutramine OR L-carnitine OR carnitine OR metformin
Recruitment status: All studies
Study Results: All studies
Study type: All studies

WHAT'S NEW

Date	Event	Description
14 December 2020	Amended	The Plain Language Summary has been reformatted.

HISTORY

Protocol first published: Issue 3, 2016
Review first published: Issue 12, 2020

CONTRIBUTIONS OF AUTHORS

1. Draft of protocol: JV, LXM, MKB, and SYT
2. Study selection: HS, PB, LXM, JV, SYT
3. Extract data from studies: HS, PB
4. Enter data into RevMan: SE
5. Carry out the analysis: SE
6. Interpret the analysis: HS, PB, JV, LXM, SYT and SE
7. Draft the final review: HS, PB, JV, LXM, SYT and SE
8. Disagreement resolution: HS, PB, JV, SYT
9. Update the review: HS, PB, JV, LXM, SYT and SE

DECLARATIONS OF INTEREST

HS: none known.
PB: none known.
LXM: none known.
SYT: none known.
JV: none known.
SE: none known.

SOURCES OF SUPPORT

Internal sources

- Concord Cancer Centre, University of Sydney, Concord Repatriation General Hospital, University of Sydney, Concord, Australia

  Salary
- Nutrition and Food Hygiene Department, Hebei University, Baoding, China

  The Hebei University Natural Science Foundation [2013-264], [2015-17]
- Institute for Health Research, The University of Notre Dame Australia, Fremantle, Australia

  Salary
- Nutrition and Dietetics Department, Concord Repatriation General Hospital, Concord, Australia

  Salary

External sources

- The Commonwealth of Australia, Australia

  Endeavour Award [Round 2014]

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The search strategies published in the protocol were retrieving many irrelevant results. The search strategies for the electronic databases (CENTRAL, Medline and Embase) and the clinical trial registries were thus amended to reflect the participant group more closely.

The protocol stated that ductal cancer in situ (DCIS) was excluded, but many studies included these patients. We therefore allowed cohorts that had < 10% of participants with DCIS included.

Some of the of outcomes in the protocol were ambiguously or incorrectly defined (e.g. overall survival); these definitions have since been modified. 'Change in BMI' was not listed as an outcome in the protocol, but was added after it became apparent that many studies were reporting this outcome. ‘Crude death rates’ were incorrectly listed as a secondary outcome in the protocol. However, this has been removed from the list above as ‘crude death rates’ are group summary statistics corresponding to the outcome of death (or time to death) which is already listed as primary outcome number 1.

According to the protocol the following outcomes were to be included in the 'Summary of findings' table(s).

1. Overall breast cancer survival.
2. Incidence of cancer recurrence after diagnosis.
3. Any potential adverse events.
4. Change in body weight.
5. Disease-free survival rate.
6. Mortality.
7. Change in skinfold thickness and waist circumference.

However due to very little data regarding breast cancer specific survival or disease-free survival, or skinfold thickness, change in BMI and quality of life (overall scales) were added to the tables.

INDEX TERMS

Medical Subject Headings (MeSH)

Body Mass Index; Breast Neoplasms [*complications] [epidemiology]; *Cancer Survivors; Combined Modality Therapy [methods]; Exercise; Neoplasm Recurrence, Local [epidemiology]; Obesity [*therapy]; Overweight [*therapy]; Psychotherapy; Quality of Life; Randomized Controlled Trials as Topic; Waist Circumference; *Weight Loss; Weight Reduction Programs

MeSH check words

Female; Humans