Exercise for overweight or obesity (Review)

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ABSTRACT

Background
Clinical trials have shown that exercise in adults with overweight or obesity can reduce bodyweight. There has been no quantitative systematic review of this in The Cochrane Library.

Objectives
To assess exercise as a means of achieving weight loss in people with overweight or obesity, using randomised controlled clinical trials.

Search strategy
Studies were obtained from computerised searches of multiple electronic bibliographic databases. The last search was conducted in January 2006.

Selection criteria
Studies were included if they were randomised controlled trials that examined body weight change using one or more physical activity intervention in adults with overweight or obesity at baseline and loss to follow-up of participants of less than 15%.

Data collection and analysis
Two authors independently assessed trial quality and extracted data.

Main results
The 43 studies included 3476 participants. Although significant heterogeneity in some of the main effects’ analyses limited ability to pool effect sizes across some studies, a number of pooled effect sizes were calculated. When compared with no treatment, exercise resulted in small weight losses across studies. Exercise combined with diet resulted in a greater weight reduction than diet alone (WMD - 1.1 kg; 95% confidence interval (CI) -1.5 to -0.6). Increasing exercise intensity increased the magnitude of weight loss (WMD - 1.5 kg; 95% CI -2.3 to -0.7). There were significant differences in other outcome measures such as serum lipids, blood pressure and fasting plasma glucose. Exercise as a sole weight loss intervention resulted in significant reductions in diastolic blood pressure (WMD - 2 mmHg; 95% CI -4 to -1), triglycerides (WMD - 0.2 mmol/L; 95% CI -0.3 to -0.1) and fasting glucose (WMD - 0.2 mmol/L; 95% CI -0.3 to -0.1). Higher intensity exercise resulted in greater reduction in fasting serum glucose than lower intensity exercise (WMD - 0.3 mmol/L; 95% CI -0.5 to -0.2). No data were identified on adverse events, quality of life, morbidity, costs or on mortality.

Authors’ conclusions
The results of this review support the use of exercise as a weight loss intervention, particularly when combined with dietary change. Exercise is associated with improved cardiovascular disease risk factors even if no weight is lost.

PLAIN LANGUAGE SUMMARY

Exercise and diet produce weight loss in people with overweight or obesity

Overweight and obesity are important public health problems and are associated with many serious health conditions. The risk of developing overweight and obesity depends on lifestyle factors such as food intake and physical activity levels. Treatment for overweight
and obesity therefore commonly involves diet and exercise. We found that exercise has a positive effect on body weight and cardiovascular disease risk factors in people with overweight or obesity, particularly when combined with diet, and that exercise improves health even if no weight is lost. No data were identified on adverse events, quality of life, morbidity, costs or mortality.

BACKGROUND

Description of the condition
Overweight and obesity are conditions of excess body fat (NHMRC 1997). The World Health Organisation (WHO) defines weight status according to body mass index (BMI), the ratio of weight (in kilograms) divided by height (in metres squared). A BMI of 20 to 25.9 defines normal weight, 25 to 29.9 defines overweight and equal to or greater than 30 defines obesity (WHO 2003). Overweight and obesity are a major public health problem with more than one billion adults overweight globally, 300 million of which have obesity (WHO 2006). Increased consumption of more energy-dense, nutrient-poor foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to the increase in prevalence (WHO 2003). Overweight and obesity pose a major risk for serious chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer. Effective weight management for individuals and groups with overweight and obesity involves a range of strategies including reducing energy intake through dietary change and increasing energy expenditure by increasing physical activity levels (WHO 2003).

Description of the intervention
Although evidence supporting the efficacy of exercise to achieve weight loss is disappointing, studies do support the efficacy of exercise to prevent weight gain. A number of large studies, including the Reno diet-heart study, the “First National Health Nutrition and Examination Survey” (NHANES-I) and the Canada Fitness survey have found a negative association between physical activity and weight gain (Foreyt 1995; Williamson 1993; Tremblay 1986; Tremblay 1990). These studies were large-scale cross-sectional and longitudinal studies. The impact of a number of vigorous and non-vigorous leisure activities on weight was examined. People who were habitually more active were found to be less obese. Therefore increasing physical activity, both exercise and habitual activity, may have a role in preventing obesity, preventing worsening of already established obesity, and reducing body mass in obese people.

How the intervention might work
Even if exercise does not result in weight loss, it confers significant health benefits to people with overweight and obesity. Blood lipid profiles associated with increased risk of coronary heart disease are a common metabolic feature of obesity. Since the early 1980s there has been increasing evidence that central fat accumulation has an adverse action on lipids, resulting in elevated triglycerides and very-low-density lipoproteins and low levels of high-density lipoproteins (Despres 1994). Exercise, with or without weight loss, improves plasma lipoprotein status, in particular, increasing high-density lipoproteins therefore may be of particular benefit to people who are abdominally obese even if no weight is lost by exercising. Similarly, large cross-sectional studies demonstrate reduction in blood pressure in those who regularly exercise, compared with sedentary persons, irrespective of weight (Montoye 1972; Sandvik 1993). The large cohort Harvard alumni study, showed that those who engaged in regular vigorous leisure activities had a 33 percent lower risk (relative risk reduction) of developing hypertension and 41 percent reduction (relative risk reduction) in mortality from coronary heart disease over 20 years (Paffenbarger 1983).

Exercise interventions ideally should be used in the context of a multi-component weight loss program to gain their maximum benefit. Diet and exercise combined with psychological interventions comprise an intuitively powerful weight loss program (NHLBI 1998). However, in spite of the increased comprehensiveness of weight loss programs and improvements in patient education, understanding of the role of diet and exercise in weight loss, psychological interventions, and improved pharmacotherapies for weight reduction, results of weight loss trials have continued to remain disappointing (Liao 2000). There are still major gaps in our understanding of the roles of diet, exercise, and psychological therapies in weight reduction. Also, achieving long-term modification of food intake and food type by the obese individual without creating decreases in energy expenditure associated with dieting, and dealing with relapse to pre-intervention diet and exercise behaviours are ongoing challenges (Brownell 1986).

Studies examining the magnitude of weight loss achievable with exercise have shown disappointing results. Garrow and Summerbell, in a meta-analysis of 28 studies of exercise and weight loss, concluded that weight lost in exercise programs without caloric restriction is small and usually ranges from 2 to 7 kg (Garrow 1995). Ballor and Keesey, in an earlier meta-analysis, also found that weight loss associated with exercise was modest (Ballor 1991). However, considerable research has been performed in the area since these meta-analyses were performed. This review aimed to clarify the effect of exercise on body weight and health in people with overweight and obesity, using high quality criteria to assess and summarise the evidence.

OBJECTIVES

To assess the efficacy of exercise as a means of achieving weight loss in people with overweight and obesity.
CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies
All randomised controlled clinical trials of exercise in people with overweight or obesity, with a duration of at least three months and loss to follow-up of less than 15%, were considered for inclusion.

Types of participants
Studies were limited to adult participants (aged over 18 years). Studies included adults with overweight or obesity according to body mass index, waist circumference or waist-to-hip ratio, irrespective of health status.

Types of intervention
The studies included had an exercise prescription. Exercise is defined as any form of physical activity performed on a repeated basis for an defined period of time (exercise training). Exercise prescriptions include specific recommendations for the type, intensity, frequency and duration of any physical activity with a specific objective (e.g. increase fitness, lose weight) (Bouchard 1994). Studies stating that they simply recommended increasing physical activity were not included within the analyses unless it was possible to quantify the exercise stimulus by some means. Studies that combined exercise and medication associated with weight loss as an intervention were excluded.

Types of outcome measures
Primary outcomes
1. Weight or another indicator of body mass (e.g. body mass index, waist measurement, waist-to-hip ratio);
2. Morbidity and mortality;

Secondary outcomes
1. Serum lipids;
2. Serum glucose;
3. Systolic and diastolic blood pressure;
4. Adverse effects.

We planned on examining the following effect modifiers if there were sufficient data: sex, age, adherence to treatment, initial weight and co-morbidities.

Timing of outcome assessment
Studies with a duration including follow-up period of three months or greater were included in this review.

SEARCH METHODS FOR IDENTIFICATION OF STUDIES
See: Cochrane Metabolic and Endocrine Disorders Group methods used in reviews.

METHODS OF THE REVIEW

Selection of studies
Assessment of quality and results data was undertaken by two reviewers (KS and HCG). Full articles were retrieved for further assessment if the information given in the abstract obtained from the searches suggested that the study: 1. included people who were overweight or obese, 2. compared exercise with placebo or another non-pharmacological weight loss intervention, 3. assessed one or more relevant clinical outcome measures, 4. used random allocation to the comparison groups. When a title or abstract could not be rejected with certainty, the full text of the article was obtained for further evaluation. Interrater agreement for study selection was measured using the kappa statistic (Cohen 1960). Where differences in opinion existed, these were resolved by a third party (POR). Where duplicate publications and companion papers were located, information was maximised by using all versions of the study.

Data extraction and management
Data extracted included the following:
(1) General information: Published/unpublished, title, authors, source, contact address, country, language of publication, year of publication, duplicate publications.
(2) Trial characteristics: Design, duration, randomisation (and method), allocation concealment (and method), blinding (outcome assessors), check of blinding.
(3) Intervention: Exercise prescription, comparison interventions (method, timing).
(4) Patients: Sampling (random/convenience), exclusion criteria, total number and number in comparison groups, gender, age, diagnostic criteria of overweight or obesity, similarity of groups at baseline, assessment of compliance or relapse, withdrawals or losses to follow-up (reasons or description), subgroups.
Outcomes: Outcomes specified above, what was the main outcome assessed in the study, other events, length of follow-up.

Results: For outcomes and times of assessment, intention-to-treatment analysis.

A template data extraction form was developed and sent to the Metabolic and Endocrine Disorders Group Editorial Base for approval. Study authors were not contacted for further information.

Assessment of methodological quality of included studies
The quality of reporting each trial was assessed based largely on the quality criteria specified by Schulz and Jadad (Schulz 1995; Jadad 1996). In particular, the following factors were studied:
1. Minimisation of selection bias - a) was the randomisation procedure adequate? b) was the allocation concealment adequate?
2. Minimisation of attrition bias - a) were withdrawals and dropouts completely described? b) was analysis by intention-to-treat?
3. Minimisation of detection bias - were outcome assessors blind to the intervention?

Based on these criteria, studies were subdivided into the following three categories (see Cochrane Handbook):
A - all quality criteria met: low risk of bias.
B - one or more of the quality criteria only partly met: moderate risk of bias.
C - one or more criteria not met: high risk of bias.

This classification was planned to be used as the basis of a sensitivity analysis.

Each trial was assessed for quality assessment independently by two reviewers (KS, HCG). Interrater agreement was calculated using the kappa statistic (Cohen 1960).

Data synthesis (meta-analysis)
Where data were available which were sufficiently similar with respect to interventions and outcomes, pooled estimates of effect were obtained using Review Manager (RevMan) 4.2. Data were entered into RevMan and analysed using RevMan Analyses, the statistical component of RevMan. Fixed-effect models were used to pool data where appropriate.

Assessment of heterogeneity
Where heterogeneity existed a random effects model was used to explore results. Effect sizes are presented as weighted mean differences with 95% confidence intervals. The chi-square method was used to assess heterogeneity with the significance set at p<0.1. Heterogeneity was also examined with I^2. Where I^2 values of greater than 50% were present, meta-analytic pooling was not performed (Higgins 2003).

Subgroup analyses and investigation of heterogeneity
Should the quantity of data have permitted, we planned to examine subgroups based on the following factors:
1. Type, intensity and duration of the exercise intervention;
2. Age;
3. Gender;
4. Smoking status;
5. Different comparison interventions;

Sensitivity analyses
We compared the results of fixed- and random-effects models. We also planned to perform sensitivity analyses in order to explore the influence of the following factors on effect size:
1. Repeating the analysis excluding unpublished studies (if there were any);
2. Repeating the analysis taking account of study quality, as specified above;
3. Repeating the analysis excluding any very long or large studies to establish how much they dominate the results;
4. Repeating the analysis excluding studies using the following filters: diagnostic criteria, language of publication, source of funding (industry versus other), country.

Funnel plots were performed for assessment of small study bias.

Description of studies
Trials identified
The search strategy, last performed in January 2006, identified 4040 abstracts for perusal. On review of the abstracts, 271 articles were retrieved for perusal. Of these, 89 potentially relevant studies were located.

QUOROM (quality of reporting of meta-analyses) statement
(Moher 1999)
- potentially relevant abstracts identified and screened for retrieval (n= 4040);
- abstracts excluded (n=3769);
- studies retrieved for more detailed evaluation (n=271);
- studies excluded (n=182);
- potentially appropriate studies to be included in the systematic review (n=89);
- studies excluded from the systematic review, with reasons in 'Table of Excluded Studies' (n=46);
- studies included in the systematic review (n=43);
- duplicate publications (n=2);
- RCTs included in the systematic review (n=41).

Excluded studies
Following an evaluation of the methods and results section of the trials, 46 were excluded from the review. These studies and their reasons for exclusion are presented in the table: 'Characteristics of Excluded Studies'.
Included studies
A total of 43 studies, reporting the results from 41 trials, met the inclusion criteria and were included in the review. The kappa statistic for trial selection was 0.73; 95% confidence interval (CI) 0.64 to 0.82. The details of these studies are described in the table: ‘Characteristics of Included Studies’. Two studies were duplicate publications of other studies included in the review. Data from these studies were included and were used to maximise available information about the primary studies (Pritchard 1997; Svendsen 1993). Two studies compared exercise and behaviour therapy with behaviour therapy alone (Jeffery 1998; Jeffery 2003). A number of trials did not present results in a manner that enabled variance data for change in outcome measures to be extracted. These studies, identified in the 'Notes' section of the 'Characteristics of Included Studies' table, are included in the results but are reported narratively (Aggel-Leijssen 2001b; Aggel-Leijssen 2002; Balkestein 1999; Gillett 1987; Manning 1991; Raz 1994; Stensel 1994; Utter 2000; Wing 1988; Wirth 1985). The data from these studies are not included in the analyses.

Studies
All included trials were randomised controlled clinical trials. Eight trials were factorial in design (Aggel-Leijssen 2001; Anderssen 1996; Cox 2004; Jeffery 1998; Neumark 1995; Nieman 1998; Stefanick 1998; Wood 1991). The remaining 33 were parallel in design.

Participants and settings
There were a total of 3476 participants in the 41 trials. All trials were conducted in adults. The weighted mean age of participants was 42.4 years for the 32 trials that reported age as a mean value. The remaining nine trials, which reported age as a range, included participants aged between 20 and 75 years. Of the 39 trials that reported gender distribution of participants, 17 included men only, 15 included women only, and 10 included both men and women. The duration of the included studies ranged from 3 to 12 months, including follow-up.

Twenty-four trials were conducted in the United States of America, four were conducted in The Netherlands (Aggel-Leijssen 2001; Aggel-Leijssen 2001b; Aggel-Leijssen 2002; Balkestein 1999), three in Canada (Jansen 2002; Ross 1996; Thong 2000) and Australia (Cox 2004; Cox 1996; Pritchard 1997), two in Israel (Raz 1994; Neumark 1995) and one in Norway (Anderssen 1996), the United Kingdom (Stensel 1994), Denmark (Svendsen 1993) and Germany (Wirth 1985), respectively. All trials were outpatient community studies. None were inpatient hospital studies. The range of outpatient settings in which trials were conducted included general medical clinics, hospital obesity outpatient clinics, primary care, university campuses and workplace settings. Most participants were recruited by local news media (e.g. local newspaper, radio announcements, bulletin boards). One study recruited their participants from a database of participants of a cohort study (Anderssen 1996), one from a group of people newly registered to participate in a concurrent lifestyle intervention trial (Hellenius 1993), one from a database of respondents to a community survey questionnaire (Svendsen 1993), and one from the staff of a national business corporation (Pritchard 1997).

The exercise interventions that were evaluated are listed below. Eighteen trials evaluated multiple exercise interventions within their design, and 23 trials evaluated a single exercise intervention. Twenty-one trials evaluated a walking intervention, 10 evaluated cycle ergometry (exercise bicycle), eight evaluated jogging, eight evaluated weights training, five evaluated commercial aerobics, five evaluated treadmill exercise, two evaluated stair stepping, and one evaluated each of dancing, ball games, calisthenics, rowing, and aqua jogging, respectively. No trials evaluated swimming or water aerobics as weight loss interventions.

Thirteen trials contained groups that compared exercise with no treatment as a weight loss intervention in people with overweight or obesity. Eight trials evaluated walking / jogging, three evaluated cycle ergometry (Aggel-Leijssen 2001b; Cox 2004; Irwin 2003), two evaluated weights training (Irwin 2003; Manning 1991), and one each evaluated aerobics (Pritchard 1997) and ball games / calisthenics (Wirth 1985). The exercise intensity was high (greater than 60% maximal oxygen uptake (VO2 max / maximum heart rate) for nine trials, low (less than 60% VO2 max / maximum heart rate) for one trial (Aggel-Leijssen 2001b), and not specified for two trials (Stensel 1994; Wing 1998). The exercise frequency was greater than five days a week for one trial (Thong 2000) and 3 to 5 days a week for 12 trials. Exercise duration ranged from 15 to 60 minutes with the median exercise duration per session of 45 minutes.

Eleven trials contained groups that compared exercise to diet as weight loss interventions in people with overweight or obesity. Seven trials evaluated walking or jogging, two evaluated aerobic exercise of the participants choice equivalent to brisk walking or jogging (Stefanick 1998; Pritchard 1997), one evaluated cycle ergometry (Cox 2004) and one evaluated aerobic exercise consisting of either walking, jogging, aerobics or circuit training (Anderssen 1996). The exercise intensity was high (greater than 60% VO2 max / maximum heart rate) for ten trials and not specified for one trial (Wing 1998). The exercise frequency was greater than five days a week for one trial (Thong 2000), 3 to 5 days a week for nine trials and 2 to 3 days a week for one trial (Hellenius 1993). Exercise duration ranged from 30 to 60 minutes with the median exercise duration per session of 40 minutes. Four studies compared exercise with a low calorie diet (Cox 2004; Schwartz 1987; Schwartz 1990; Thong 2000), three compared exercise with a low fat diet (Stefanick 1998; Anderssen 1996; Pritchard 1997), and four compared exercise with a low fat or low calorie diet (Gordon 1997; Hellenius 1993; Wing 1998; Wood 1988).

Sixteen trials contained groups that compared exercise in combination with diet to diet alone as weight loss interventions in people with overweight or obesity. Seven trials evaluated walking or
jogging, two evaluated cycle ergometry (Cox 2004; Hays 2004), one evaluated step aerobics (Wadden 1997), one cycling/walking/stair stepping (Ross 1996), one cycling or walking or aqua jogging (Janssen 2002), one treadmill exercise or cycling or stair stepping (Aggel-Leijssen 2001), one walking in combination with weights training (Whatley 1994), one walking or jogging or aerobics (Neumark 1995), one aerobic exercise in combination with weights training (Svendsen 1993) and one of exercise of the participants choice equivalent to brisk walking or jogging (Stefanick 1998).

The exercise intensity was high (greater than 60% VO2 max / maximum heart rate) for 12 trials, low (lower than 60% VO2 max / maximum heart rate) for one trial (Janssen 2002) and not specified for three trials (Wing 1998; Wood 1991; Stefanick 1998). The exercise frequency was greater than five days a week for one trial (Neumark 1995) and 3 to 5 days a week for 15 trials. Exercise duration ranged from 30 to 90 minutes with the median exercise duration per session of 50 minutes. A low calorie diet was used for 10 trials, a low fat diet for three trials (Hays 2004; Kiernan 2001; Stefanick 1998) and a low fat or low calorie diet for three trials (Gordon 1997; Wood 1991; Wing 1998).

Eight trials contained groups that compared high with low intensity exercise stimuli as weight loss interventions in people with overweight or obesity. In seven of the eight trials subgroups of participants were also on low fat or low calorie diets. Exercise stimuli investigated included high versus low intensity walking (Jakicic 2003; Leutholtz 1995), step aerobics versus increasing incidental physical activity (Anderson 1999), cycling plus treadmill exercise plus weights training versus cycling plus treadmill exercise alone (Wallace 1997), high versus low intensity walking plus weights training (Whatley 1994), and treadmill exercise plus cycling plus stair stepping versus weights training (Janssen 2002; Ross 1996). The exercise frequency was 3 to 5 days a week for all trials. Exercise duration ranged from 20 to 60 minutes in the high intensity group and 10 to 60 minutes in the low intensity group.

Overall, trials did not differ markedly in the degree of overweight in the patient groups. Most reported weight change as kilograms lost. Only two trials reported weight change as change in BMI alone (Andersen 1996; Hellenius 1993). Weight entry criteria for most trials included participants with overweight as well as participants with obesity. Twenty-two trials specified weight entry criteria according to BMI (in excess of 25 for all studies except Andersen 1996 and Irwin 2003 which specified BMI equal or greater than 24 for inclusion). Eight trials specified weight entry criteria according to percentage overweight (all between 110% to 200% according to Metropolitan Life Insurance Tables) and five trials according to percentage body fat (all in excess of 24%). The remainder specified weight entry criteria according to waist-to-hip ratio (Stefanick 1998; Wallace 1997) and kilograms overweight (Anderson 1999; Jeffery 1998; Jeffery 2003).

Eight trials specified weight entry criteria according to BMI (in excess of 25 for all studies except Andersen 1996 and Irwin 2003 which specified BMI equal or greater than 24 for inclusion). Eight trials specified weight entry criteria according to percentage overweight (all between 110% to 200% according to Metropolitan Life Insurance Tables) and five trials according to percentage body fat (all in excess of 24%). The remainder specified weight entry criteria according to waist-to-hip ratio (Stefanick 1998; Wallace 1997) and kilograms overweight (Anderson 1999; Jeffery 1998; Jeffery 2003).

**RESULTS**

A summary table 'Summary of main findings from comparisons for each outcome', outlining the changes in outcome measures within each of the comparison groups, is provided in Table 02, original data for all outcomes in Table 02 in the additional tables section.

**Primary outcomes**

No data were identified on mortality, morbidity, adverse events or quality of life among the trials included in this review.

**Weight**

The effects of interventions on between-group change in weight and body mass index (BMI) are shown in 'Comparisons 02'. Due to heterogeneity of interventions and comparisons, we believed it appropriate to obtain pooled estimates for only two groups of trials assessing weight: exercise and diet versus diet alone, and high versus low intensity exercise without dietary change; and
one group of trials assessing BMI: exercise and diet versus diet alone.

In the group exercise plus diet versus diet alone fourteen trials involving 1049 participants included data regarding weight loss that were suitable for meta-analysis. Participants in both groups lost weight across trials. The pooled effect for interventions with a follow-up between 3 and 12 months was a reduction in weight of 1.1 kg (95% confidence interval (CI), 0.6 to 1.5) in the exercise and diet group compared with the diet alone group. Five trials involving 452 participants included data regarding change in BMI that were suitable for meta-analysis. Participants in both groups reduced BMI. The pooled effect for interventions was a reduction in BMI of 0.4 kg/m$^2$ (95% CI, 0.1 to 0.7) in the exercise and diet group compared with the diet alone group.

In the high versus low intensity exercise without dietary change group weight loss data from four trials involving 317 participants were pooled. All trials favoured high intensity exercise for weight loss. The pooled effect for interventions with a follow-up between 3.5 and 12 months was a reduction in weight of 1.5 kg (95% CI, 0.7 to 2.3) in the high intensity exercise group compared with the low intensity exercise group.

**Secondary outcomes**

**Systolic blood pressure**

Pooled estimates of between-group changes in systolic blood pressure could be estimated for two groups of trials: exercise versus diet and exercise and diet versus diet alone (Comparisons 02.03 and 03.03). Four trials involving 361 participants compared change in systolic blood pressure with exercise versus diet. All trials favoured diet over exercise for reduction in systolic blood pressure. Participants who dieted reduced systolic blood pressure 2 mmHg (95% CI, 0.3 to 4) more than participants who exercised (p=0.02). Six trials involving 615 participants compared change in systolic blood pressure with exercise and diet versus diet alone. Both groups reduced systolic blood pressure and no statistically significant difference between groups was demonstrated (p=0.87).

**Diastolic blood pressure**

Pooled estimates of between-group changes in diastolic blood pressure could be estimated for two groups of trials: exercise versus no treatment, and exercise versus diet (Comparisons 01.04 and 02.04). In the two trials that involved 259 participants and compared change in diastolic blood pressure with exercise versus no treatment, participants who exercised reduced diastolic blood pressure 2 mmHg (95% CI, 1 to 4) more than no treatment (p=0.01). In the four trials that involved 361 participants and compared diet and exercise for reducing diastolic blood pressure, there was no significant difference between interventions (p=0.19). Both interventions resulted in clinically significant reductions in diastolic blood pressure.

**Serum cholesterol**

There was one group of trials where pooled estimates of between-group changes in serum cholesterol could be estimated: exercise versus no treatment (Comparison 01.05). Participants who exercised did not reduce their serum cholesterol significantly more than those with no treatment in the three trials, involving 348 participants, that compared the two groups (p=0.65).

**Serum triglycerides**

There were three groups of trials where pooled estimates of between-group changes in triglycerides could be estimated: exercise and diet versus diet alone, high versus low intensity exercise with dietary change, and exercise versus no treatment (Comparisons 01.06, 03.06 and 04.06). No statistically significant difference between interventions was observed for exercise and diet versus diet alone (six trials, 619 participants) (p=0.12) or high versus low intensity exercise with dietary change (two trials, 65 participants) (p=0.98). Serum triglycerides were reduced by each intervention and across trials. In the third group of three trials involving 348 participants, people who exercised reduced serum triglycerides by 0.2 mmol/L (95% CI, 0.1 to 0.3) more than those with no treatment (p=0.01).

**Serum high-density lipoprotein (HDL)**

There was one group of trials where pooled estimates of between-group changes in serum HDL were able to be estimated: high versus low intensity exercise with dietary change (Comparison 4.7: Comparisons and Data). Rather than increasing HDL, both high and low intensity exercise were associated with reduced HDL across trials. Low intensity exercise was associated with a greater reduction than high intensity exercise however this difference was not statistically significant (two trials, 65 participants) (p=0.48).

**Fasting serum glucose**

There were four groups of trials where pooled estimates of between-group changes in fasting serum glucose could be estimated: exercise and diet versus diet alone, high versus low intensity exercise without dietary change, exercise versus no treatment, and exercise versus diet (Comparisons 01.08, 02.08, 03.08 and 05.06). Exercise reduced fasting serum glucose by 0.2 mmol/L (95% CI, 0.1 to 0.3) compared with no treatment (two trials, 273 participants) (p=0.006). High intensity exercise reduced fasting serum glucose by 0.3 mmol/L (95% CI, 0.2 to 0.5) more than low intensity exercise (two trials, 46 participants) (p<0.01). When diet and exercise were compared, diet resulted in an 0.1 mmol/L (95% CI, 0.0 to 0.2) greater reduction in fasting serum glucose than exercise (three trials, 354 participants). However, there was no statistically significant difference between diet and exercise versus diet in reducing fasting serum glucose (p=0.82). Both interventions resulted in reduced fasting serum glucose.

**Small study bias**

Publication bias was examined with the use of a funnel plot. The funnel plot for weight change (14 studies) did not suggest the presence of small study bias (Funnel plot).
Subgroup analyses
The number of trials available for subgroup analysis was limited for most outcomes except for weight loss in the exercise and diet versus diet only group of trials. The pooled results from this group of trials demonstrated a small but statistically significant effect when the results of a large number of trials were pooled. Subgroup analysis by sex and age could performed. Analysis by sex did no show relevant changes in pooled estimates. Analysis by age demonstrated that the pooled effect for studies with a mean age of participants of less than 45 years was a reduction in weight of 1.6 kg (95% CI, 0.6 to 2.6) in the exercise and diet group compared with the diet alone group, and the pooled effect for studies with a mean age of participants of greater than 45 years was a reduction in weight of 1.0 kg (95%CI, 1.3 to 0.7) in the exercise and diet group compared with the diet alone group.

Sensitivity analyses
Because most trials reported similar components of quality that were assessed (method of randomisation, allocation concealment, and blinding of the assessor), we could not examine the effects of these variables on outcomes.

DISCUSSION

Summary of findings
The findings of this study demonstrate that exercise has a positive effect on body weight in people with overweight and obesity. Although exercise alone improved weight loss only marginally compared with no treatment in this study, when combined with dietary interventions, the amount of weight loss achieved with exercise increased substantially. These findings are consistent with previous reviews (Miller 1997; McTigue 2003; Douketis 2005) that demonstrate only modest (less than five kg) weight loss with exercise alone as a weight loss intervention, and improved weight loss with diet and exercise compared with exercise alone.

An assessment of the effect of exercise intensity on weight loss was an important part of this study. Numerous trials have shown that an inverse association between body weight and physical activity exists (Coakley 1998; DiPietro 1998; King 2001; Swinburn 2004). However, most of these trials have assessed the effect of vigorous activity on body weight. The benefits of moderate and light intensity activity on body weight have been less extensively evaluated (Stewart 1997; Westerterp 2001; Dionne 2003). There is some evidence that moderate exercise such as walking, is no more effective than light exercise, such as calisthenics and stretching, as part of a weight loss programme (Jakicic 1995; Ross 1996). The results of this study support the hypothesis that vigorous activity is more effective than moderate or light intensity exercise in inducing weight loss. In this study high and low intensity exercise were associated with weight loss, both when combined with dietary weight loss methods and when undertaken without dietary change.

However, high intensity exercise was only significantly better than low intensity exercise at inducing weight loss when undertaken without dietary change. When diet was also modified, exercise intensity did not significantly affect the degree of weight loss. It is possible that this occurred because when exercise is combined with diet, the effect of exercise intensity on the magnitude of weight loss is outweighed by the effects of the dietary intervention.

Diet was demonstrated to be significantly more effective at facilitating weight loss than exercise in this meta-analysis. Both low calorie and low fat diets were used as comparison dietary interventions across clinical trials. Each was more effective at facilitating weight loss than exercise alone. This is consistent with the findings of other studies that also demonstrate dietary modification is superior to exercise in attaining weight loss in overweight and obese adults (Curioni 2005; Hansen 2005). It thus appears that dietary interventions are a more potent method for creating an energy imbalance than physical activity interventions.

A strength of this study compared with other systematic reviews and meta-analyses of exercise and weight loss is the inclusion of cardiovascular disease (CVD) risk factors as outcome measures for analyses (Miller 1997; McTigue 2003; Douketis 2005). Positive effects on CVD risk factors were demonstrated with exercise interventions in overweight and obese adults in this study. Those who participated in exercise interventions alone reduced systolic and diastolic blood pressure, cholesterol, triglycerides and fasting serum glucose. They also increased HDL levels. The changes that were statistically significant compared with no treatment were changes in diastolic blood pressure, triglycerides, HDL and glucose.

These changes were independent of significant weight loss. Weight loss does not appear to uniformly improve cardiovascular risk factors, particularly if 5% or less body weight reduction (Douketis 2005). However, RCTs have demonstrated that exercise improves risk factors for CVD in adult populations (Campbell 1997; Hu 1999; Hu 2000). The findings of this study indicate that the benefit of exercise on cardiovascular risk factors extends to adults with overweight and obesity.

Exercise combined with diet also has a positive effect on cardiovascular risk factors. Consistent with previous research, participants in this study who combined exercise with diet reduced systolic and diastolic blood pressure, serum cholesterol and triglycerides, and fasting serum glucose. However, when directly compared, exercise combined with diet was no more effective in reducing the above cardiovascular risk factors than diet alone.

The reason for this finding is uncertain. Both diet and physical activity are known to improve risk factors for CVD in adults (Rosen 2001; Schubert 2006). It was therefore hypothesized that the effects of each on CVD risk would be additive and that a combination of both interventions would have greater efficacy than diet alone. It is possible that participants in the diet only group also increased physical activity levels as a result of study participa-
tion. Alternatively, the study may have had insufficient power to
demonstrate an additive effect. The effect of diet was greater than
the effect of exercise on numerous CVD risk factors. Diet may
have therefore masked the effect of exercise on CVD risk factors
between comparison groups.

Both high and low intensity exercise resulted in reduced systolic
blood pressure and serum triglycerides. However, high intensity
exercise had a greater positive effect on fasting serum glucose than
low intensity exercise, suggesting that exercise intensity affects the
magnitude of the health benefit of the exercise undertaken. It
has previously been proposed that a threshold of vigorous activity
volume exists which has to be reached to affect CVD risk in adults
(Cox 2003). Results of this study support this hypothesis and
suggest that this threshold may also exist in overweight and obese
adults.

Limitations of the review
A limitation of this systematic review is the paucity of long-term
trials available for inclusion in the analyses. Most people lose
weight initially and then regain it over time (Egger 1997). Thus,
without longer term trials, the true effect of exercise on body
weight is difficult to determine. Also, without long-term trials,
the effects of exercise on mortality are difficult to determine. The
results of this study demonstrated that exercise was associated with
improvement in CVD risk factors. However, the effect of exer-
cise on disease endpoints such as myocardial infarction, cerebro-
vascular accident and type 2 diabetes could not be demonstrated.
Without long-term trials it is assumed, but not definite, that ex-
ercise will also have positive impacts on these end-points.

Also, a large number of studies were excluded from analysis due
to the relatively large losses to follow-up. This was done because if
studies with large losses to follow-up were included in the analyses,
valid conclusions about the relative efficacy of exercise interven-
tions could not be drawn. Although this is a valid justification to
exclude studies with large losses to follow-up, the negative effect
of doing so is to reduce the power of meta-analyses.

**Authors’ Conclusions**

Implications for practice

This review suggests that exercise is an effective weight loss inter-
vention, particularly when combined with dietary interventions.
Exercise is also an effective intervention for improving a range of
secondary outcomes even when weight loss does not occur. While
this review did not show any long-term morbidity and mortality
benefits associated with exercise, exercise was shown to positively
impact the intermediate outcomes that are commonly associated
with cardiovascular disease.

Implications for research

A large amount of research has been undertaken to assess the ef-
fects of exercise on weight loss in people who are overweight or
obese. Exercise stimuli that have been studied include walking,
jogging, weights training, stationary cycling, aerobics, ball games,
calisthenics and stair stepping. Further studies could assess alter-
native exercise stimuli such as increased incidental physical activity
and water based activities. Every effort should be made to maintain
high retention rates in trials, and reasons for withdrawal should
be ascertained so that factors affecting exercise adherence can be
further explored. Studies with longer duration of follow-up would
provide further information regarding the long-term health effects
of regular physical activity in people who are overweight or obese.

**Notes**

CHANGES TO PUBLISHED PROTOCOL

OBJECTIVE: Changed from ‘regular physical activity’ to ‘exer-
cise’; add ‘overweight’ to ‘obesity’

TYPES OF STUDIES: Add ‘loss to follow-up of less than 15%’;
delete ‘quasi-randomised trials’

TYPES OF OUTCOME MEASURES: Delete from additional
outcome measures ‘VO2max’ and ‘cost’; delete ‘relapse’; timing of
outcome assessment changed to ‘duration including follow-up of
three months or more were included’

METHODS OF THE REVIEW: Change second reviewer from
CDM to HCG for quality assessment of trials, data extraction,
data entry; change third reviewer from FT to POR for resolving
differences of opinion

DATA ANALYSIS: Dichotomous data not identified therefore
relative risk omitted; heterogeneity explored using I-squared in
addition to chi-squared

**Potential Conflict of Interest**

None known.

**Acknowledgements**

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able assistance in preparation of the protocol of this review. We
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results.
Sources of Support

External sources of support
- National Health and Medical Research Council AUSTRALIA

Internal sources of support
- Royal Australian College of General Practitioners AUSTRALIA

References to studies included in this review

Aggel-Leijssen 2001  [published data only]

Aggel-Leijssen 2001b  [published data only]

Aggel-Leijssen 2002  [published data only]

Anderson 1999  [published data only]

Anderssen 1996  [published data only]

Balkestein 1999  [published data only]

Cox 1996  [published data only]

Cox 2004  [published data only]

Gillett 1987  [published data only]

Gordon 1997  [published data only]

Hays 2004  [published data only]

Hellenius 1993  [published data only]

Irwin 2003  [published data only]

Jakicic 1995  [published data only]

Jakicic 2003  [published data only]

Janssen 2002  [published data only]
Schwartz 1987 (published data only)

Schwartz 1990 (published data only)

Stefanick 1998 (published data only)

Stensel 1994 (published data only)

Svensden 1993 (published data only)


Thong 2000 (published data only)

Utter 2000 (published data only)

Wadden 1997 (published data only)

Wallace 1997 (published data only)

Whatley 1994 (published data only)

Wing 1988 (published data only)
Cox 2003


Cuff 2003


Donnelly 2003


Dunn 1999


Dzator 2004


Esposito K


Esposito K


Figueroa A


Fogelholm 2001


Grant 2004


Hartwell 1986


Hinderliter 2002


Houmard 2003


**Nicklas 2004**


**Okura 2003**


**Potteiger 2003**


**Probart 1991**


**Proper 2003**


**Racette 1995**


**Ribeiro 1984**


**Samaras 2004**


**Schmitz 2003**


**Schuler 1991**


**Slentz 2004**


**Stahle 2000**

Stahle A, Lindquist I, Mattsson E. Important factors for physical activity among elderly patients one year after an acute myocardial

Teixeira 2003

Watkins 2003

Weinstock 1998

Yamanouchi 1995

Additional references

Ballor 1991

Bouchard 1994

Brownell 1986

Campbell 1997

Coakley 1998

Cohen 1960

Cox 2003

Curioni 2005

Despres 1994

Dionne 2003

DiPietro 1998

Douketis 2005

Egger 1997

Foreyt 1995

Garrow 1995

Hansen 2005

Higgins 2003

Hu 1999

Hu 2000

Jadad 1996

King 2001
King G, Fitzhugh E, Basset D, McLaughlin J, Strath S, Swartz A. Relationship of leisure-time physical activity and occupational activity...

**Liao 2000**

**McTigue 2003**

**Miller 1997**

**Moher 1999**

**Montoye 1972**

**NHLBI 1998**

**NHMRC 1997**

**Paffenbarger 1983**

**Rossner 2001**
Rossner S. Obesity in the elderly - a future matter of concern?. *Obesity Reviews* 2001;2:183–188.

**Sandvik 1993**

**Schubert 2006**

**Schulz 1995**

**Stewart 1997**

**Swinburn 2004**

**Tremblay 1986**

**Tremblay 1990**

**Westerterp 2001**

**WHO 2003**

**WHO 2006**

**Williamson 1993**

* Indicates the major publication for the study
### Characteristics of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Aggel-Leijssen 2001</th>
</tr>
</thead>
</table>
| **Methods** | DESIGN: Factorial; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 7.5%  
Analysis by treatment received |
| **Participants** | COUNTRY: Netherlands  
n: 40  
AGE: N=38.9 years  
MALES=all  
WEIGHT ENTRY CRITERIA: BMI > 27  
EXCLUSION CRITERIA: >2 hrs a week spent in sports activities, subjects with physically demanding jobs |
| **Interventions** | INTERVENTION 1 (n=17): modifast very low calorie diet for 6 weeks then low calorie diet  
INTERVENTION 2 (n=20): modifast for 6 weeks then low calorie diet + exercise (cycle ergometer, walking or aqua jogging) 4 times a week for 60 minutes a session at 40% VO2 max intensity  
FOLLOW-UP: 12 weeks |
| **Outcomes** | BODY MEASURES: weight loss (kg), BMI, body density  
OTHER: VO2 max, physical activity questionnaire |
| **Notes** | Allocation concealment B – Unclear |

<table>
<thead>
<tr>
<th>Study</th>
<th>Aggel-Leijssen 2001b</th>
</tr>
</thead>
</table>
| **Methods** | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: none  
Analysis by treatment received |
| **Participants** | COUNTRY: Netherlands  
n: 13  
AGE: N=40.7 years  
MALES=none  
WEIGHT ENTRY CRITERIA: BMI > 29  
EXCLUSION CRITERIA: abnormal menstrual cycle, poor health as assessed by medical history and physical examination, > 3 kg weight change in the previous 2 months, taking medication known to affect the variables measured, < 2 hours a week in sports activities, physically demanding employment |
| **Interventions** | INTERVENTION 1 (n=7): cycle ergometry 3 days a week for 57 minutes at 40% VO2max  
INTERVENTION 2 (n=6): no exercise FOLLOW-UP: 12 weeks |
### Characteristics of included studies (Continued)

| Outcomes | BODY MEASURES: weight loss (kg), hydrostatic weighing, WHR, waist circumference  
OTHER: VO2 max, indirect calorimetry, U-13C palmitate infusion, 1,2-13C acetate infusion, free fatty acids, glucose, glycerol, triglycerides, insulin, catecholamines |
| Notes | All upper body obese. Lower body obese participants were not part of a randomised controlled trial. Variance for change in weight with interventions not reported therefore results reported narratively only.  
Allocation concealment | B – Unclear |

| Study | Aggel-Leijssen 2002 |
| Methods | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 10%  
Analysis by treatment received |
| Participants | COUNTRY: Netherlands  
n: 24  
AGE: N=43.4 years  
MALES=all  
WEIGHT ENTRY CRITERIA: BMI ≥ 27  
EXCLUSION CRITERIA: poor physical health, use of medication known to influence the variables measured, > 3 kg body weight change during 2 months before selection, > 2 hours a week in sports activities, physically demanding job |
| Interventions | INTERVENTION 1 (n=8): cycle ergometry 3 days a week for 33 minutes at 70% VO2max  
INTERVENTION 2 (n=8): cycle ergometry 3 days a week for 57 minutes at 40% VO2max  
CONTROL (n=8): no intervention  
FOLLOW-UP: 12 weeks |
| Outcomes | BODY MEASURES: weight loss (kg), BMI, hydrostatic weighing  
OTHER: VO2 max, U-13C palmitate infusion, 1,2-13C acetate infusion, free fatty acids, glucose, glycerol, triglycerides |
| Notes | Variance for change in weight with interventions not reported therefore results reported narratively only.  
Allocation concealment | B – Unclear |

| Study | Anderson 1999 |
| Methods | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - yes  
DURATION OF INTERVENTION: 16 weeks  
DROPOUTS: 2%  
Analysis by treatment received |
| Participants | COUNTRY: USA  
n: 40  
AGE: N=42.9 years  
MALES=none  
WEIGHT ENTRY CRITERIA: minimum of 15 kg overweight (Metropolitan Life Insurance tables)  
EXCLUSION CRITERIA: subjects with bulimia nervosa, binge eating disorder, significant depression, and other psychiatric disturbances, identified contra indications to diet, exercise or both, including recent |

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*Exercise for overweight or obesity (Review)*  
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### Characteristics of included studies (Continued)

myocardial infarction, a history of cerebrovascular, kidney, or liver disease, cancer type 1 diabetes mellitus, pregnancy or use of medications known to affect weight or energy expenditure

| Interventions | INTERVENTION 1 (n=20): low fat, low calorie diet of 1200 kcal a day + structured aerobic exercise by step aerobics 3 days a week for 45 minutes a session at intensity of 7 - 8.5 METS with bursts to 10.5 - 11 METS  
INTERVENTION 2 (n=20): low fat, low calorie diet as above + instruction to increase levels of moderate intensity physical activity in their daily life by 30 minutes per day most days of the week FOLLOW-UP: 16 weeks |
| Outcomes | BODY MEASURES: weight loss (kg), DXA body composition  
OTHER: treadmill testing, lipids, lipoproteins, mood |
| Notes | Allocation concealment: B – Unclear |

#### Study: Anderssen 1996

**Methods**  
DESIGN: Factorial; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 52 weeks  
DROPOUTS: 1%  
Analysis by treatment received

**Participants**  
COUNTRY: Norway  
n: 219  
AGE: all over 40 years  
MALES: not stated  
WEIGHT ENTRY CRITERIA: BMI > 24  
EXCLUSION CRITERIA: >1 workout per week, diastolic blood pressure outside 86-99 mm Hg, cholesterol outside 5.2-7.74 mmol / L, HDL > 1.2, fasting triglycerides <1.4

**Interventions**  
INTERVENTION 1 (n=54): walk/jog, aerobics or circuit training for 3 days a week at 60-80% maximum heart rate  
INTERVENTION 2 (n=55): low fat diet  
INTERVENTION 3 (n=67): low fat diet + exercise regimen as outlined above  
CONTROL (n=43): no intervention  
FOLLOW-UP: 52 weeks

**Outcomes**  
BODY MEASURES: BMI  
OTHER: BP, cholesterol, triglycerides, insulin, glucose, VO2 max, factor VII, total energy intake

**Notes**  
No raw scores for weight loss in kilograms provided.

**Allocation concealment**  
B – Unclear

#### Study: Balkestein 1999

**Methods**  
DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 11%  
Analysis by treatment received
Characteristics of included studies (Continued)

Participants
COUNTRY: The Netherlands
n: 37
AGE: N=37 years
MALES=all
WEIGHT ENTRY CRITERIA: BMI between 27 and 40
EXCLUSION CRITERIA: levels of physical activity more than 2 hours a week in sports or physically demanding labour, diabetes, respiratory disease, cardiovascular disorders other than mild hypertension, medication use, diet, psychiatric disorders and impairment of ability to exert physical activity

Interventions
INTERVENTION 1 (n=18): low calorie liquid formula diet
INTERVENTION 2 (n=19): low calorie liquid formula diet + exercise 4 days a week for 60 minutes a session at 40% of maximum heart rate
FOLLOW-UP: 12 weeks

Outcomes
BODY MEASURES: weight loss (kg), BMI
OTHER: blood pressure, resting heart rate, vascular compliance

Notes
Variance for change in weight with interventions not reported therefore results reported narratively only.

Allocation concealment
B – Unclear

Study
Cox 1996

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 16 weeks
DROPOUTS: 15%
Analysis by treatment received

Participants
COUNTRY: Australia
n: 60
AGE: 20-50 years
MALES=all
WEIGHT ENTRY CRITERIA: 120 - 160 % of ideal body weight
EXCLUSION CRITERIA: cigarette smoking, alcohol consumption > 210 ml/week, weight loss of > 10 kg in the preceding 12 months, hypertension, history of myocardial infarction, stroke, coronary bypass surgery, renal or hepatic disease, diabetes mellitus, asthma, musculoskeletal exercise that precludes exercise

Interventions
INTERVENTION 1 (n=13): vigorous intensity stationary cycling exercise 3 days a week for 30 minutes at 60-70% maximum heart rate
INTERVENTION 2 (n=17): light exercise by flexibility stretching once a week and stationary cycling against zero resistance twice a week or slow walking (<2 km in 30 minutes)
FOLLOW-UP: 16 weeks

Outcomes
BODY MEASURES: weight loss (kg)
OTHER: dietary compliance, physical fitness assessment, BP, alcohol, biochemistry

Notes

Allocation concealment
B – Unclear

Study
Cox 2004

Methods
DESIGN: Factorial; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated

Exercise for overweight or obesity (Review)
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Characteristics of included studies (Continued)

DURATION OF INTERVENTION: 16 weeks
DROPOUTS: 15%
Analysis by treatment received

Participants
COUNTRY: Australia
n: 51
AGE: 20-50 years
MALES=all
WEIGHT ENTRY CRITERIA: 120-160% of ideal weight for height
EXCLUSION CRITERIA: Weight loss of > 10 kg in the preceding 12 months, greater than two 30-minute sessions of vigorous exercise per week in the previous 6 months, musculoskeletal injury that precluded exercise, non-steroidal anti-inflammatory drugs, history of diabetes, asthma or heart, renal or hepatic disease, blood pressure not 130 - 160 systolic and 80 - 100 diastolic, taking antihypertensive medication, alcohol consumption > 210 mL/wk.

Interventions
INTERVENTION 1 (n=17): normal energy intake + light exercise (flexibility exercises once a week and stationary cycling against zero resistance twice a week for 30 mins. Every second week subjects substituted one cycling session for a slow walking session of <=2km in 30 mins) INTERVENTION 2 (n=13): normal energy intake + vigorous exercise (stationary cycling for 30 mins at 60-70% maximum workload 3 times a week)
INTERVENTION 3 (n=14): low energy intake + light exercise (reduced daily intake by 1000 - 1500 kcal/d)
INTERVENTION 4 (n=15): low energy intake + vigorous exercise
FOLLOW-UP: 16 weeks

Outcomes
BODY MEASURES: weight loss (kg), WHR, BMI
OTHER: HbA1c, insulin, glucose, VO2 max, total energy intake, dietary components

Notes
Allocation concealment B – Unclear

Study
Gillett 1987

Methods
DESIGN: Parallel; Randomisation method by random number table
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 16 weeks
DROPOUTS: 6%
Analysis by treatment received

Participants
COUNTRY: USA
n: 38
AGE: N=49 years
MALES=none
WEIGHT ENTRY CRITERIA: mean % body fat 42.5 +/- 7.1%
EXCLUSION CRITERIA: smokers, hypertension, pregnancy, non-sedentary for 6 months prior to the study, known coronary heart disease

Interventions
INTERVENTION 1 (n=20): dance exercise up to 53 minutes a session at 60-80 % of maximum heart rate
INTERVENTION 2 (n=18): commercial aerobics for up to 53 minutes a session at 70-80 % of maximum heart rate
FOLLOW-UP: 16 weeks

Outcomes
BODY MEASURES: weight loss (lb), body fat %
OTHER: muscular endurance, flexibility, VO2 max, cholesterol, triglyceride, glucose, HDL, blood pressure, resting heart rate

Notes
Variance for change in weight with interventions not reported therefore results reported narratively only.
### Characteristics of included studies (Continued)

**Study** | **Methods** |
---|---|
**Gordon 1997** | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 13%  
Analysis by treatment received|

**Participants** | COUNTRY: USA  
n: 55  
AGE: N=48 years  
MALES= 31%  
WEIGHT ENTRY CRITERIA: percentage body fat >27%  
EXCLUSION CRITERIA: known cardiovascular disease apart from hypertension, > 15 minutes of continuous aerobic exercise > 2 days a week during the previous 3 months, contraindications to maximal exercise testing, participation in dietary program aimed at weight reduction, consumption of > 3 alcoholic drinks a day, pregnancy, lactation, current use of antihypertensive medication |

**Interventions** | INTERVENTION 1 (n=15): low fat, low calorie diet  
INTERVENTION 2 (n=14): aerobic exercise (predominantly walking) 3 to 5 days a week for 30 to 45 minutes at 60-85% of maximum heart rate  
INTERVENTION 3 (n=19): diet and exercise as described above  
FOLLOW-UP: 12 weeks |

**Outcomes** | BODY MEASURES: weight loss (kg), skinfold thickness  
OTHER: food diary, heart rate monitoring, BP, treadmill testing, maximal oxygen uptake |

**Notes** | All subjects had hypertension. |

**Allocation concealment** | B – Unclear |

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**Study** | **Methods** |
---|---|
**Hays 2004** | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 5%  
Analysis by treatment received |

**Participants** | COUNTRY: USA  
n: 34  
AGE: N=66 years  
MALES:N = 14  
WEIGHT ENTRY CRITERIA: participants stated as overweight (method not stated but BMI, % body fat and body weight reported)  
EXCLUSION CRITERIA: current smoker, > 2 d/wk of structured physical activity, weight unstable in past 6 months (+/- >5 kg), normal OGTT, taking medication known to affect glucose metabolism |

**Interventions** | INTERVENTION 1 (n=11): low fat, high carbohydrate diet (providing 150% of predicted energy requirements) + exercise training 4 days a week on cycle ergometer at 80% to 85% of maximal heart rate for 45 mins |
### Characteristics of included studies (Continued)

<table>
<thead>
<tr>
<th>Intervention 2 (n=11)</th>
<th>low fat, high carbohydrate diet</th>
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</thead>
<tbody>
<tr>
<td>Intervention 3 (n=12)</td>
<td>control</td>
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<td>Follow-up</td>
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### Outcomes

<table>
<thead>
<tr>
<th>BODY MEASURES:</th>
<th>weight loss (kg), BMI, % body fat (BOD POD)</th>
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</thead>
<tbody>
<tr>
<td>OTHER:</td>
<td>macronutrient intake, reported physical activity, maximal aerobic capacity, resting energy expenditure, resting respiratory exchange ratio, change in fat and lean tissue cross-sectional area of the thigh</td>
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### Notes

- Allocation concealment: B – Unclear

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</table>
Characteristics of included studies (Continued)

WEIGHT ENTRY CRITERIA: BMI $\geq 24$ and $\geq 33\%$ body fat
EXCLUSION CRITERIA: non- postmenopausal, non-sedentary ($\geq 60$ mins / wk of moderate and vigorous intensity recreational activity and maximal oxygen consumption $> 25$ mL/kg/min, taking hormone replacement therapy, diabetes, smokers

| Interventions | INTERVENTION (n=87): 45 mins of moderate intensity exercise 5 d/wk for 12 months (aim 60 - 75% MHR for 45 mins per session).
CONTROL (n=86): weekly 45-minute stretching sessions for 1 year
FOLLOW-UP: 52 weeks |

| Outcomes | BODY MEASURES: weight, height, waist and hip circumference, DXA total body fat and body fat %, CT intra- abdominal and subcutaneous fat
OTHER: food frequency questionnaire, Minnesota Physical Activity Questionnaire, VO2 max |

Notes
Allocation concealment B – Unclear

Study  Jakicic 1995

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 20 weeks
DROPOUTS: 15%
Analysis by treatment received

Participants
COUNTRY: USA
n: 38
AGE: N=40.6 years
MALES=none
WEIGHT ENTRY CRITERIA: 120- 175% of ideal body weight (Metropolitan Life Insurance tables)
EXCLUSION CRITERIA: medical problems that prevent participation in regular exercise & / or calorie restricted diet, medication which affects heart rate response to exercise

Interventions
INTERVENTION 1 (n=25): low fat, low calorie diet (1200 - 1500 kcal / day) + discussion of behavioral strategies to modify diet and exercise + short bout exercise (multiple 10 minute bouts of exercise to a total of 20-40 minutes) 5 days a week at 70% maximum heart rate
INTERVENTION 2 (n=27): low fat, low calorie diet (1200 - 1500 kcal / day) + discussion of behavioral strategies to modify diet and exercise + long bout exercise (single 20-40 minute bout of exercise) 5 days a week at 70% maximum heart rate FOLLOW-UP: 20 weeks

Outcomes
BODY MEASURES: weight loss (kg), BMI
OTHER: exercise participation, food frequency questionnaires, accelerometer data, cardiorespiratory fitness, resting heart rate, BP

Notes
Allocation concealment B – Unclear

Study  Jakicic 2003

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 52 weeks
Characteristics of included studies (Continued)

DROPOUTS: 6%
Analysis by intention to treat

<table>
<thead>
<tr>
<th>Participants</th>
<th>COUNTRY: USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>n: 201</td>
<td>AGE: N=37 years</td>
</tr>
<tr>
<td>MALES=none</td>
<td>WEIGHT ENTRY CRITERIA: BMI 27 to 40</td>
</tr>
<tr>
<td>EXCLUSION CRITERIA: exercise &gt; 3 days per week for &gt; 20 mins / d in the previous 6 months, history of myocardial infarction, taking medication that would alter heart rate response during exercise or affect metabolism or weight loss, treatment for psychological conditions, currently pregnant, pregnant within the previous 6 months, planning to become pregnant during the intervention period, any medical condition that could affect metabolism or body weight or limit exercise participation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions</th>
<th>INTERVENTION 1 (n=50): vigorous intensity high duration exercise (5 days a week of brisk walking to expend 2000 kcal / week)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INTERVENTION 2 (n=50): moderate intensity high duration exercise (5 days a week of slower walking to expend 2000 kcal / week)</td>
</tr>
<tr>
<td></td>
<td>INTERVENTION 3 (n=50): moderate intensity moderate duration exercise (5 days a week of slower walking to expend 1000 kcal / week)</td>
</tr>
<tr>
<td></td>
<td>INTERVENTION 4 (n=51): vigorous intensity moderate duration exercise (5 days a week of brisk walking to expend 1000 kcal / week)</td>
</tr>
<tr>
<td>FOLLOW-UP:</td>
<td>52 weeks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>BODY MEASURES: weight loss (kg), BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER:</td>
<td>exercise participation, food frequency questionnaires, cardiorespiratory fitness, heart rate per exercise session, exercise duration, time to achieve 85% of maximal heart rate</td>
</tr>
</tbody>
</table>

Notes
Allocation concealment B – Unclear

Study Janssen 2002

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 16 weeks
DROPOUTS: none
Analysis by treatment received

<table>
<thead>
<tr>
<th>Participants</th>
<th>COUNTRY: Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>n: 38</td>
<td>AGE: N=40.1 years</td>
</tr>
<tr>
<td>MALES=none</td>
<td>WEIGHT ENTRY CRITERIA: BMI &gt; 27 and WHR &gt; 0.85</td>
</tr>
<tr>
<td>EXCLUSION CRITERIA: unstable weight in the 6 months prior to the study, taking medications, consuming greater than 2 standard alcoholic drinks a day, not premenopausal, irregular menstrual cycle</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions</th>
<th>INTERVENTION 1 (n=11): low calorie diet + aerobic exercise (treadmill walking, exercise bicycle or stair stepper) 5 days a week for 60 minutes to 50-85% of maximum heart rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INTERVENTION 2 (n=14): low calorie diet + resistance training (weights machine 3 days a week for 30 minutes a session until 120 kcal expended)</td>
</tr>
<tr>
<td></td>
<td>INTERVENTION 3 (n=13): low calorie diet only</td>
</tr>
<tr>
<td>FOLLOW-UP:</td>
<td>16 weeks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>BODY MEASURES: weight loss (kg), % body fat, MRI body fat, WHR, waist circumference</th>
</tr>
</thead>
</table>
Characteristics of included studies *(Continued)*

<table>
<thead>
<tr>
<th>Notes</th>
<th>Allocation concealment</th>
<th>B – Unclear</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Jeffery 1998</th>
</tr>
</thead>
</table>
| Methods | DESIGN; Factorial; Randomisation method not stated  
BLINDING;  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 26 weeks  
DROPOUTS: 13%  
Analysis by treatment received |
| Participants | COUNTRY: USA  
n: 193  
AGE: N=41 years  
MALES=15%  
WEIGHT ENTRY CRITERIA: between 14 and 32 kg overweight according to actuarial norms  
EXCLUSION CRITERIA: serious medical complaints, unable to walk for exercise, unwilling to be randomized to treatment conditions |
| Interventions | INTERVENTION 1 (n=40): standard behaviour therapy  
INTERVENTION 2 (n=41): standard behaviour therapy + supervised walks 3 days a week  
INTERVENTION 3 (n=42): standard behaviour therapy + supervised walks 3 days a week with personal trainer + reminders from personal trainer  
INTERVENTION 4 (n=37): standard behaviour therapy + supervised walks with a personal trainer + money  
INTERVENTION 5 (n=36): standard behaviour therapy + supervised walks with a personal trainer + reminders + money  
FOLLOW-UP: 26 weeks |
| Outcomes | BODY MEASURES: weight loss (kg)  
OTHER: physical activity questionnaire, food frequency questionnaire, Beck depression inventory, binge eating questionnaire, barriers to adherence questionnaire |
| Notes | |
| Allocation concealment | B – Unclear |

<table>
<thead>
<tr>
<th>Study</th>
<th>Jeffery 2003</th>
</tr>
</thead>
</table>
| Methods | DESIGN; Parallel; Randomisation method not stated  
BLINDING;  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 78 weeks  
DROPOUTS: 13% at 6 months  
Analysis by treatment received |
| Participants | COUNTRY: USA  
n: 202  
AGE: N=42.2 years  
MALES=42%  
WEIGHT ENTRY CRITERIA: between 14 and 32 kg overweight according to actuarial norms  
EXCLUSION CRITERIA: serious medical or psychological problems thought to interfere with treatment, not aged between 25 - 50 years |
Characteristics of included studies (Continued)

Interventions
INTERVENTION 1 (n=82): standard behaviour therapy
INTERVENTION 2 (n=100): standard behaviour therapy + physical activity (energy expenditure equivalent of 2500 kcal/wk)
FOLLOW-UP: 26 weeks (dropout rate > 15% at 52 and 78 weeks)

Outcomes
BODY MEASURES: weight loss (kg), BMI
OTHER: Paffenbarger Physical Activity Questionnaire, Block diet questionnaire

Notes
Allocation concealment B – Unclear

Study Kiernan 2001

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 52 weeks
DROPOUTS: 13%
Analysis by treatment received

Participants
COUNTRY: USA
n: 119
AGE: N=38.5 years
MALES=50%
WEIGHT ENTRY CRITERIA: BMI of 28 to 34 (males) and 24 to 30 (females)
EXCLUSION CRITERIA: smokers, non sedentary, poor health, use of blood pressure or lipid lowering medication, postmenopausal women

Interventions
INTERVENTION 1 (n=81): low fat diet + exercise by brisk walking / jogging 3 days a week for 45 minutes a session to intensity of 60- 80% of maximum heart rate
INTERVENTION 2 (n=71): low fat diet only
CONTROL (n=79): waiting list control
FOLLOW-UP: 52 weeks

Outcomes
BODY MEASURES: weight loss (kg), BMI
OTHER: VO2 max, eating inventory, depression inventory, aerobic capacity

Notes
Allocation concealment B – Unclear

Study Leutholtz 1995

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 12 weeks
DROPOUTS: 0%
Analysis by treatment received

Participants
COUNTRY: USA
n: 40
AGE: N=41 years
MALES=18%
WEIGHT ENTRY CRITERIA: body fat % œ 25% for men and œ 30% for women
Characteristics of included studies *(Continued)*

EXCLUSION CRITERIA: coronary or peripheral atherosclerosis, ketosis prone diabetes mellitus, chronic use of steroids, bleeding peptic ulcer, history of suicide attempts, active thrombophlebitis, alcohol abuse, pregnancy, lactation, inability to exercise, use of beta blockers or other exercise limiting medications

| Interventions | INTERVENTION 1 (n=20): liquid formula Optifast diet (420 kcal / day) + exercise by walking at a target heart rate of 60% of maximum heart rate to a distance that expended 300 kcal of energy |
| INTERVENTION 2 (n=20): liquid formula Optifast diet (420 kcal / day) + exercise by walking at a target heart rate of 40% of maximum heart rate to a distance that expended 300 kcal of energy |

**FOLLOW-UP:** 12 weeks

| Outcomes | BODY MEASURES: weight loss (kg), lean body mass, fat mass |
| OTHER: resting heart rate, BP, VO2 max |

Notes

Allocation concealment  B – Unclear

### Study

**Manning 1991**

**Methods**

DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 12 weeks
DROPOUTS: 9%
Analysis by treatment received

**Participants**

COUNTRY: USA
n: 24
AGE: 22-57 years
MALES=None
WEIGHT ENTRY CRITERIA: BMI > 30
EXCLUSION CRITERIA: physical activity in the previous 6 months, unstable weight in the previous 6 months

**Interventions**

INTERVENTION (n=40): strength training with weights 3 days a week for 12 weeks to 60-70% of maximum heart rate
CONTROL (n=6): no intervention
FOLLOW-UP: 12 weeks

**Outcomes**

BODY MEASURES: weight loss (kg), BMI
OTHER: dietary record, LDL, HDL, cholesterol, triglycerides, apolipoproteins

Notes

Variance for change in weight with interventions not reported therefore results reported narratively only.

Allocation concealment  B – Unclear

### Study

**Neumark 1995**

**Methods**

DESIGN: Factorial; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 12 weeks
DROPOUTS: 5%
Analysis by treatment received

**Participants**

COUNTRY: Israel
n: 42

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### Characteristics of included studies (Continued)

**AGE:** 25-50 years  
**MALES=none**

**WEIGHT ENTRY CRITERIA:** BMI > 27  
**EXCLUSION CRITERIA:** health problems, lack of interest in participation

#### Interventions

<table>
<thead>
<tr>
<th>Intervention (n=19)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERVENTION 1</td>
<td>low calorie diet (&lt;1000 kcal) + self monitoring</td>
</tr>
<tr>
<td>INTERVENTION 2</td>
<td>diet + self monitoring as above + supervised aerobic exercise for 1 hour per week + 15 minutes of walking / jogging 5 days a week + 10 minutes of other unspecified exercise 6 days a week</td>
</tr>
</tbody>
</table>

**FOLLOW-UP:** 12 weeks

#### Outcomes

**BODY MEASURES:** weight loss (kg), skinfold thicknesses, WHR, waist circumference, BMI  
**OTHER:** exercise compliance, physical fitness

#### Notes

- **Allocation concealment:** B – Unclear

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#### Study

**Nieman 1998**

**Methods**

- **DESIGN:** Factorial; Randomisation method not stated  
- **BLINDING:**  
  - patients - not stated  
  - caregivers - not stated  
  - outcome assessors - not stated  
- **DURATION OF INTERVENTION:** 12 weeks  
- **DROPOUTS:** 11%

**Participants**

- **COUNTRY:** USA  
- **n:** 91  
- **AGE:** N=45.6 years  
- **MALES=none**  
- **WEIGHT ENTRY CRITERIA:** BMI between 25 and 65  
- **EXCLUSION CRITERIA:** serious medical complaints, unable to walk for exercise, unwilling to be randomised to treatment conditions

**Interventions**

<table>
<thead>
<tr>
<th>Intervention 1 (n=21)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45 minutes of walking 5 days a week at 60-75% maximum heart rate</td>
</tr>
<tr>
<td>INTERVENTION 2 (n=26)</td>
<td>1200 - 1300 kcal a day diet</td>
</tr>
<tr>
<td>INTERVENTION 3 (n=22)</td>
<td>low calorie diet and exercise as outlined above</td>
</tr>
<tr>
<td>INTERVENTION 4 (n=22)</td>
<td>no treatment control</td>
</tr>
</tbody>
</table>

**FOLLOW-UP:** 12 weeks

**Outcomes**

**BODY MEASURES:** weight loss (kg), body composition, body fat %  
**OTHER:** adaptive immunity, natural killer cell activity, phagocytosis and oxidative burst, aerobic power, VO2 max, glucose, triglycerides, cholesterol, maximum heart rate

**Notes**

- Variance for change in weight with exercise only and control interventions not reported therefore results reported narratively only.

**Allocation concealment:** B – Unclear

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#### Study

**Pritchard 1997**

**Methods**

- **DESIGN:** Parallel; Randomisation method not stated  
- **BLINDING:**  
  - patients - not stated  
  - caregivers - not stated  
  - outcome assessors - not stated  
- **DURATION OF INTERVENTION:** 52 weeks

**Participants**

- **COUNTRY:** USA
- **n:** 91  
- **AGE:** N=45.6 years  
- **MALES=none**  
- **WEIGHT ENTRY CRITERIA:** BMI between 25 and 65  
- **EXCLUSION CRITERIA:** serious medical complaints, unable to walk for exercise, unwilling to be randomised to treatment conditions

**Interventions**

<table>
<thead>
<tr>
<th>Intervention 1 (n=21)</th>
<th>Description</th>
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<tbody>
<tr>
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<td>45 minutes of walking 5 days a week at 60-75% maximum heart rate</td>
</tr>
<tr>
<td>INTERVENTION 2 (n=26)</td>
<td>1200 - 1300 kcal a day diet</td>
</tr>
<tr>
<td>INTERVENTION 3 (n=22)</td>
<td>low calorie diet and exercise as outlined above</td>
</tr>
<tr>
<td>INTERVENTION 4 (n=22)</td>
<td>no treatment control</td>
</tr>
</tbody>
</table>

**FOLLOW-UP:** 12 weeks

**Outcomes**

**BODY MEASURES:** weight loss (kg), body composition, body fat %  
**OTHER:** adaptive immunity, natural killer cell activity, phagocytosis and oxidative burst, aerobic power, VO2 max, glucose, triglycerides, cholesterol, maximum heart rate

**Notes**

- Variance for change in weight with exercise only and control interventions not reported therefore results reported narratively only.
### Characteristics of included studies (Continued)

**DROPOUTS:** 12%

Analysis by treatment received

| Participants | COUNTRY: Australia  
| | n: 39  
| | AGE: N=43.4 years  
| | MALES=all  
| | WEIGHT ENTRY CRITERIA: mean BMI 29 +/- 2.6  
| | EXCLUSION CRITERIA: inability to satisfactorily complete standardized fitness test |

| Interventions | INTERVENTION 1 (n=21): 3 sessions of 30 minutes a week of aerobic exercise of the participants choice to an intensity of 65-75% of maximum heart rate  
| | INTERVENTION 2 (n=18): low fat diet  
| | FOLLOW-UP: 52 weeks |

| Outcomes | MEASURES: weight loss (kg), waist circumference, WHR, body composition (DXA)  
| | OTHER: 24 hour food recall, 3 day food diary, activity log |

| Notes |
| Allocation concealment | B – Unclear |

| Study | Raz 1994 |
|Methods | DESIGN: Parallel; Randomisation method not stated  
| | BLINDING:  
| | patients - not stated  
| | caregivers - not stated  
| | outcome assessors - not stated  
| | DURATION OF INTERVENTION: 12 weeks  
| | DROPOUTS: none  
| | Analysis by treatment received |

| Participants | COUNTRY: Israel  
| | n: 40  
| | AGE: N=56.6 years  
| | MALES=35%  
| | WEIGHT ENTRY CRITERIA: BMI > 25  
| | EXCLUSION CRITERIA: Ischaemic heart disease, systolic hypertension, inability to use a bicycle ergometer, unwillingness to accept control group treatment assignment |

| Interventions | INTERVENTION (n=19): 45 mins of cycle ergometry, treadmill and or rowing machine to 65% of VO2 max for 3 days a week  
| | CONTROL (n=19): no change to lifestyle  
| | FOLLOW-UP: 12 weeks |

| Outcomes | BODY MEASURES: weight loss (kg)  
| | OTHER: glucose, fructosamine, HbA1c, cholesterol, HDL, triglycerides, resting heart rate, maximal work capacity |

| Notes | Variance for change in weight with interventions not reported therefore results reported narratively only.  
| Allocation concealment | B – Unclear |

| Study | Ross 1996 |
|Methods | DESIGN: Parallel; Randomisation method not stated  
| | BLINDING:  
| | patients - not stated  
| | caregivers - not stated  
| | outcome assessors - not stated |
Characteristics of included studies (Continued)

DURATION OF INTERVENTION: 16 weeks
DROPOUTS: none
Analysis by treatment received

Participants
COUNTRY: Canada
n: 33
AGE: N=44.5 years
MALES=all
WEIGHT ENTRY CRITERIA: BMI > 27
EXCLUSION CRITERIA: change in weight of more than 2 kg in the previous 6 months, taking medication known to affect the study variables, consumption of > 2 alcoholic beverages daily

Interventions
INTERVENTION 1 (n=11): low calorie diet (1000 kcal / d)
INTERVENTION 2 (n=11): low calorie diet as above + aerobic exercise by bicycling / walking / stair stepping 5 days a week for 60 minutes a session
INTERVENTION 3 (n=11): low calorie diet as outlined above + resistance exercise using a weights machine 3 days a week with 8-12 repetitions per session to a calculated energy expenditure of 120 kcal per session
FOLLOW-UP: 16 weeks

Outcomes
BODY MEASURES: weight loss (kg), waist circumference, WHR, regional adipose tissue distribution (MRI)
OTHER: VO2 max, strength-training performance, dietary records

Notes
All subjects had upper body obesity

Allocation concealment
B – Unclear

Study
Schwartz 1987

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 12 weeks
DROPOUTS: none
Analysis by treatment received

Participants
COUNTRY: USA
n: 26
AGE: N=31.4 years
MALES=all
WEIGHT ENTRY CRITERIA: 110-185% of ideal body weight (Metropolitan Life Insurance tables)
EXCLUSION CRITERIA: poor health, unstable weight, cigarette smoking, use of prescription or over the counter medications, participation in regular exercise

Interventions
INTERVENTION 1 (n=12): low calorie diet (1200 kcal / d)
INTERVENTION 2 (n=14): brisk walking / jogging 3 days a week for 40 minutes a session at 70-85% maximum heart rate
FOLLOW-UP: 12 weeks

Outcomes
BODY MEASURES: weight loss (kg), body fat %
OTHER: lipoproteins, total and fractionated cholesterol, VO2 max

Notes

Allocation concealment
B – Unclear

Study
Schwartz 1990

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING;

Participants
COUNTRY: USA
n: 26
AGE: N=31.4 years
MALES=all
WEIGHT ENTRY CRITERIA: 110-185% of ideal body weight (Metropolitan Life Insurance tables)
EXCLUSION CRITERIA: poor health, unstable weight, cigarette smoking, use of prescription or over the counter medications, participation in regular exercise

Interventions
INTERVENTION 1 (n=12): low calorie diet (1200 kcal / d)
INTERVENTION 2 (n=14): brisk walking / jogging 3 days a week for 40 minutes a session at 70-85% maximum heart rate
FOLLOW-UP: 12 weeks

Outcomes
BODY MEASURES: weight loss (kg), body fat %
OTHER: lipoproteins, total and fractionated cholesterol, VO2 max

Notes

Allocation concealment
B – Unclear
### Characteristics of included studies (Continued)

| Participants | COUNTRY: USA  
n: 31  
AGE: N=30.9 years  
MALES=all  
WEIGHT ENTRY CRITERIA: mean body fat % of groups was 28.4% for the diet group and 30.1% for the exercise group  
EXCLUSION CRITERIA: poor health, unstable weight, cigarette smoking, participation in a regular exercise program, use of prescribed or over the counter medications |
| Interventions | INTERVENTION 1 (n=13): low calorie diet (1200 kcal / d)  
INTERVENTION 2 (n=18): brisk walking / jogging 3 days a week for 40 minutes a session at 70-85% of maximum heart rate |
| Follow-Up | FOLLOW-UP: 12 weeks |
| Outcomes | BODY MEASURES: weight loss (kg), body fat mass, % body fat  
OTHER: food diary, plasma epinephrine and norepinephrine clearance, baseline pulse rate |
| Notes | Allocation concealment: B – Unclear |

**Study** Stefanick 1998

**Methods** DESIGN: Factorial; Randomisation by computer - the Efron method  
BLINDING:  
patients - no  
caregivers - no  
outcome assessors - not stated  
DURATION OF INTERVENTION: 52 weeks  
DROPOUTS: 3%  
Analysis by treatment received

| Participants | COUNTRY: USA  
n: 377  
AGE: 30-64 years  
MALES=52%  
WEIGHT ENTRY CRITERIA: not stated - WHR for men œ 0.94 and women œ 0.82  
EXCLUSION CRITERIA: elevated HDL levels, history of heart disease, stroke, diabetes, recent cancer, other life-threatening illnesses or any condition limiting their ability to engage in moderate exercise, taking insulin or heart medications, blood pressure or high serum cholesterol, smoking more than 9 cigarettes daily, consuming more than 4 alcoholic drinks a day |
| Interventions | INTERVENTION 1 (n= 43): supervised aerobic exercise equivalent to brisk walking or jogging 3 days per week for 60 minutes per session  
INTERVENTION 2 (n=46): low fat diet  
INTERVENTION 3 (n=43): diet and exercise as outlined above  
CONTROL (n= 45): no change to diet or exercise |
| Follow-Up | FOLLOW-UP: 52 weeks |
| Outcomes | BODY MEASURES: weight loss (kg), WHR  
OTHER: cholesterol, triglycerides, HDL, LDL, glucose, BP, VO2max |
| Notes | |
### Characteristics of included studies (Continued)

#### Study 1: Stensel 1994

**Methods**
- **DESIGN:** Parallel; Randomisation method not stated
- **BLINDING:**
  - patients - no
  - caregivers - no
  - outcome assessors - not stated
- **DURATION OF INTERVENTION:** 52 weeks
- **DROPOUTS:** 10%
- Analysis by treatment received

**Participants**
- **COUNTRY:** UK
- **n:** 72
- **AGE:** 42-59 years
- **MALES:** all
- **WEIGHT ENTRY CRITERIA:** not stated - BMI was > 25.2 for participants
- **EXCLUSION CRITERIA:** non-sedentary, employed in a strenuous job

**Interventions**
- **INTERVENTION 1 (n= 48):** walking up to 40-45 minutes a day a minimum of 3 days a week
- **CONTROL (n= 24):** no change to diet or exercise
- **FOLLOW-UP:** 52 weeks

**Outcomes**
- **BODY MEASURES:** weight loss (kg), BMI, WHR, body density, % body fat
- **OTHER:** VO2 max, blood lactate, dietary intake

**Notes**
- Variance for change in weight with interventions not reported therefore results reported narratively only

#### Study 2: Svendsen 1993

**Methods**
- **DESIGN:** Parallel; Randomisation method not stated
- **BLINDING:**
  - patients - not stated
  - caregivers - not stated
  - outcome assessors - not stated
- **DURATION OF INTERVENTION:** 12 weeks
- **DROPOUTS:** 3%
- Analysis by treatment received

**Participants**
- **COUNTRY:** Denmark
- **n:** 121
- **AGE:** N=53.8 years
- **MALES:** none
- **WEIGHT ENTRY CRITERIA:** BMI > 25
- **EXCLUSION CRITERIA:** menstrual bleeding in the preceding 6 months, hysterectomy, weight loss in the preceding 3 months, lack of motivation or ability to participate, psychiatric illness, cardiovascular, pulmonary, catabolic, renal or hepatic disease, medication known to influence body composition, hormones, antihistamines and catabolic drugs

**Interventions**
- **INTERVENTION 1 (n=51):** diet only (formula diet providing 1.6 MJ daily) **INTERVENTION 2 (n=49):** supervised aerobic exercise and resistance weights training 3 days a week for 60 - 90 minutes per session at 70% VO2 max intensity + diet as outlined above
- **CONTROL (n= 21):** no change to diet or exercise
- **FOLLOW-UP:** 12 weeks

**Outcomes**
- **BODY MEASURES:** weight loss (kg), body composition, bone mineral density, fat tissue and lean tissue mass, skinfold thicknesses, WHR
### Characteristics of included studies (Continued)

<table>
<thead>
<tr>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER: blood pressure, pulse, food diaries, HDL, cholesterol, triglycerides, alkaline phosphatase</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment B – Unclear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Method Details</th>
</tr>
</thead>
</table>
| **Thong 2000** | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: none  
Analysis by treatment received |
| Participants   | COUNTRY: Canada  
n: 52  
AGE: N=44.4 years  
MALES=all  
WEIGHT ENTRY CRITERIA: BMI > 30  
EXCLUSION CRITERIA: none stated |
| Interventions  | INTERVENTION 1 (n=14): low calorie diet  
INTERVENTION 2 (n=14): brisk walking or jogging on a motorized treadmill daily for 12 weeks at intensity up to but not exceeding 75% of maximum heart rate  
CONTROL (n= 8): no change to diet or exercise  
FOLLOW-UP: 12 weeks |
| Outcomes       | BODY MEASURES: weight loss (kg), BMI, waist circumference, WHR, MRI fat stores  
OTHER: VO2 max, leptin levels |
| Notes          | Allocation concealment B – Unclear |

<table>
<thead>
<tr>
<th>Study</th>
<th>Method Details</th>
</tr>
</thead>
</table>
| **Utter 2000** | DESIGN: Parallel; Randomisation method not stated  
BLINDING:  
patients - not stated  
caregivers - not stated  
outcome assessors - not stated  
DURATION OF INTERVENTION: 12 weeks  
DROPOUTS: 4%  
Analysis by treatment received |
| Participants   | COUNTRY: USA  
n: 27  
AGE: N=42.3 years  
MALES=None  
WEIGHT ENTRY CRITERIA: BMI between 25-34  
EXCLUSION CRITERIA: physically active > 3 moderate to vigorous aerobic sessions of greater than 20 mins duration per week, poor health, diabetes, cancer, heart disease, cigarette smoking, history of gastrointestinal disease, gallstones, gallbladder sludge or other pathology of the gallbladder, currently on weight reduction diet, weight loss of > 5% in the previous 3 months |
| Interventions  | INTERVENTION 1 (n=16): walking 5 days a week, 45 mins a session to intensity of 60-80 % of maximum heart rate  
CONTROL (n= 11): no change to diet or exercise |
### Characteristics of included studies *(Continued)*

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Notes</th>
</tr>
</thead>
</table>
| **Wadden 1997**        | DESIGN: Parallel; Randomisation method not stated | COUNTRY: USA          | INTERVENTION 1 (n=29): low calorie diet (900 kcal / d including liquid formula diet)  
INTERVENTION 2 (n=31): diet as above + step aerobics 3 days a week for 50-55 minutes a session at intensity of 11-15 on Borgs Rating of Perceived Exertion Scale  
INTERVENTION 3 (n=31): diet as above + strength training using fixed weights 3 days a week for 10-14 repetitions up to 40 minutes duration  
INTERVENTION 4 (n=29): diet as above + aerobic training as above + strength training as above  | BODY MEASURES: weight loss (kg), BMI, body fat %  
OTHER: gallbladder emptying, VO2 max, energy intake, treadmill time, BP, VO2 max | Allocation concealment B – Unclear |

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Notes</th>
</tr>
</thead>
</table>
| **Wallace 1997**       | DESIGN: Parallel; Randomisation method not stated | COUNTRY: USA          | Analysis by treatment received                                                                                              | BODY MEASURES: weight loss (kg), body densitometry, % body fat, fat free mass  
OTHER: indirect calorimetry, food cravings/ hunger/ satiety/ preoccupation measures, Beck Depression Inventory and mood questionnaire, resting energy expenditure | Allocation concealment B – Unclear |
### Characteristics of included studies (Continued)

<table>
<thead>
<tr>
<th>Interventions</th>
<th>INTERVENTION 1 (n=8): 60 mins of aerobic exercise (30 minutes each of cycle ergometry and treadmill walking) at 60-70 % maximum heart rate for 3 days a week</th>
<th>INTERVENTION 2 (n=8): endurance training as above + resistance weights for 8-12 sets at intensity of 75% 1RM</th>
<th>FOLLOW-UP: 14 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcomes</td>
<td>BODY MEASURES: weight loss (kg), % body fat, WHR, body composition</td>
<td>OTHER: electrolytes strength testing</td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td>Allocation concealment: B – Unclear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Study: Whatley 1994

<table>
<thead>
<tr>
<th>Methods</th>
<th>DESIGN: Parallel; Randomisation method not stated</th>
<th>BLINDING:</th>
<th>patients - not stated</th>
<th>caregivers - not stated</th>
<th>outcome assessors - not stated</th>
<th>DURATION OF INTERVENTION: 12 weeks</th>
<th>DROPOUTS: none</th>
<th>Analysis by treatment received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>COUNTRY: USA</td>
<td>n: 23</td>
<td>AGE: 38.5 years</td>
<td>MALES: none</td>
<td>WEIGHT ENTRY CRITERIA: BMI between 30 and 42</td>
<td>EXCLUSION CRITERIA: significant medical illness, unstable weight or participation in weight loss activities in the previous 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interventions</td>
<td>INTERVENTION 1 (n=7): very low energy liquid formula diet</td>
<td>INTERVENTION 2 (n=8): very low energy liquid formula diet + walking and weights training 3 days a week at 50-65% of maximum heart rate</td>
<td>INTERVENTION 3 (n=8): very low energy liquid formula diet + walking 5 days a week and weights training 3 days a week at 50-65% of maximum heart rate FOLLOW-UP: 12 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcomes</td>
<td>BODY MEASURES: weight loss (kg), % body fat, WHR</td>
<td>OTHER: VO2 max, resting metabolic rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td>Allocation concealment: B – Unclear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Study: Wing 1988

<table>
<thead>
<tr>
<th>Methods</th>
<th>DESIGN: Parallel; Randomisation method not stated</th>
<th>BLINDING:</th>
<th>patients - no</th>
<th>caregivers - no</th>
<th>outcome assessors - yes</th>
<th>DURATION OF INTERVENTION: 52 weeks</th>
<th>DROPOUTS: 7%</th>
<th>Analysis by treatment received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>COUNTRY: USA</td>
<td>n: 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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*Exercise for overweight or obesity (Review)*

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Characteristics of included studies (Continued)

AGE: N=55.6 years
MALES=not stated
WEIGHT ENTRY CRITERIA: >120% of ideal body weight
EXCLUSION CRITERIA: non-diabetic, not aged between 30 and 65 years, history of coronary heart disease, taking medications which could interfere with weight loss or heart rate during exercise, orthopaedic problems that would limit walking

Interventions
INTERVENTION 1 (n=15): walking 3 miles four days a week + low calorie diet calculated to produce 1 kg / wk weight loss
INTERVENTION 2 (n=15): low calorie diet only
FOLLOW-UP: 52 weeks

Outcomes
BODY MEASURES: weight loss (kg), BMI
OTHER: HbA1c, cholesterol, triglycerides, BP, glucose, insulin

Notes
All type 2 diabetes. Variance for change in weight with interventions not reported therefore results reported narratively only.

Allocation concealment B – Unclear

Study Wing 1998

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 26 weeks
DROPOUTS: 15%
Analysis by treatment received

Participants
COUNTRY: USA
n: 154
AGE: N=45.7 years
MALES=21%
WEIGHT ENTRY CRITERIA: 130-200% of ideal body weight
EXCLUSION CRITERIA: diabetics, no family history of diabetes

Interventions
INTERVENTION 1 (n=37): walking for 50-60 minutes up to 5 days a week to expend 1500 kcal a week
INTERVENTION 2 (n=37): low calorie, low fat diet
INTERVENTION 3 (n=40): low fat, low calorie diet + aerobic exercise as outlined above
CONTROL (n=40): given self-help behavioral manual with information on healthy eating, exercise and behavioral strategies for weight control
FOLLOW-UP: 26 weeks

Outcomes
BODY MEASURES: weight loss (kg), waist circumference, WHR
OTHER: glucose tolerance test, insulin, fasting glucose, HbA1c, cholesterol and triglycerides, HDL, blood pressure, physical activity assessment, food frequency measures

Notes
All subjects had a family history of non-insulin dependent diabetes mellitus.

Allocation concealment B – Unclear

Study Wirth 1985

Methods
DESIGN: Parallel; Randomisation method not stated
BLINDING:
patients - not stated
caregivers - not stated
outcome assessors - not stated

Participants
COUNTRY: USA
n: 154
AGE: N=45.7 years
MALES=21%
WEIGHT ENTRY CRITERIA: 130-200% of ideal body weight
EXCLUSION CRITERIA: diabetics, no family history of diabetes

Interventions
INTERVENTION 1 (n=37): walking for 50-60 minutes up to 5 days a week to expend 1500 kcal a week
INTERVENTION 2 (n=37): low calorie, low fat diet
INTERVENTION 3 (n=40): low fat, low calorie diet + aerobic exercise as outlined above
CONTROL (n=40): given self-help behavioral manual with information on healthy eating, exercise and behavioral strategies for weight control
FOLLOW-UP: 26 weeks

Outcomes
BODY MEASURES: weight loss (kg), waist circumference, WHR
OTHER: glucose tolerance test, insulin, fasting glucose, HbA1c, cholesterol and triglycerides, HDL, blood pressure, physical activity assessment, food frequency measures

Notes
All subjects had a family history of non-insulin dependent diabetes mellitus.

Allocation concealment B – Unclear
**Characteristics of included studies (Continued)**

| DURATION OF INTERVENTION: 16 weeks | DROPOUTS: 7% |
| Analysis by treatment received |

**Participants**
- COUNTRY: Germany
- n: 21
- AGE: N=43 years
- MALES=all
- WEIGHT ENTRY CRITERIA: not stated - mean body fat % = 24
- EXCLUSION CRITERIA: no hyper triglyceridaemia

**Interventions**
- INTERVENTION 1 (n=10): jogging, ball games and calisthenics 3 times a week for 1 hour to achieve a pulse between 120 and 150 beats per minute
- CONTROL (n=11): no treatment
- FOLLOW-UP: 16 weeks

**Outcomes**
- BODY MEASURES: weight loss (kg)
- OTHER: cholesterol, LDL, HDL, apo lipoprotein A1, insulin, blood pressure, body fat %, energy expenditure, glycerol release

**Notes**
- All patients had hyper triglyceridaemia. Variance for change in weight with interventions not reported therefore results reported narratively only.

**Allocation concealment**
- B – Unclear

---

**Study**

**Wood 1988**

**Methods**
- DESIGN: Parallel; Randomisation method by envelopes
- BLINDING: patients - not stated
caregivers - not stated
outcome assessors - unclear
- DURATION OF INTERVENTION: 52 weeks
- DROPOUTS: 15%
- Analysis by treatment received

**Participants**
- COUNTRY: USA
- n: 131
- AGE: N=44.6 years
- MALES=all
- WEIGHT ENTRY CRITERIA: 120-160 % of ideal body weight
- EXCLUSION CRITERIA: smokers, consumed more than four alcoholic drinks per day, taking medications affecting blood pressure or lipids, were not expected to remain living in the local area for 12 months

**Interventions**
- EXERCISE INTERVENTION (n=47): jogging 60-80% of maximum heart rate for 40 to 50 minutes at least 3 days a week
- DIET INTERVENTION (n=42): low fat diet
- CONTROL (n=42): waiting list
- FOLLOW-UP: 52 weeks

**Outcomes**
- BODY MEASURES: weight loss (kg)
- OTHER: serum cholesterol and triglycerides, LDL and HDL

**Notes**

**Allocation concealment**
- B – Unclear

---

**Study**

**Wood 1991**

**Methods**
- DESIGN: Factorial; Randomisation method not stated
- BLINDING:

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*Exercise for overweight or obesity (Review)*

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patients - not stated
caregivers - not stated
outcome assessors - not stated
DURATION OF INTERVENTION: 52 weeks
DROPOUTS: 12.5%
Analysis by treatment received

Participants
COUNTRY: USA
n: 231
AGE: 25-49 years
MALES=50%
WEIGHT ENTRY CRITERIA: 120-150% of ideal body weight
EXCLUSION CRITERIA: smokers, non sedentary, consumed four or more alcoholic drinks per day, poor physical health, taking medications known to affect blood pressure or lipid metabolism, pregnancy, lactation, use of oral contraceptives, blood pressure over 160/95 at rest, plasma total cholesterol above 6.72 mmol per liter, plasma triglycerides above 5.65 mmol per liter

Interventions
INTERVENTION 1 (n=81): brisk walking / jogging for 40 to 50 minutes at least 3 days a week + low fat / low calorie diet
INTERVENTION 2 (n=71): low calorie, low fat diet
CONTROL (n=79): waiting list
FOLLOW-UP: 52 weeks

Outcomes
BODY MEASURES: weight loss (kg)
OTHER: serum cholesterol and triglycerides, LDL and HDL, blood pressure

Notes
Allocation concealment B – Unclear
n=number of subjects; N=mean; kg=kilograms; BMI=body mass index; HDL=high-density lipoprotein; LDL=low-density lipoprotein; BP=blood pressure; HbA1c=glycosylated haemoglobin; WHR=waist-to-hip ratio; RCT = randomised controlled trial.

Characteristics of excluded studies

Study | Reason for exclusion
--- | ---
Ades 2003 | Participants not overweight or obese
Aiello 2004 | No weight loss data for controls
Aldred 1995 | Participants not overweight or obese
Asikainen 2002 | Participants not overweight or obese
Blumenthal 2000 | Loss to follow-up of greater than 15%
Cox 2003 | Loss to follow-up of greater than 15%
Cuff 2003 | Initial sample size not specified - only the number who completed the study
Donnelly 2003 | Loss to follow-up of greater than 15%
Dunn 1999 | Loss to follow-up of greater than 15%
Dzator 2004 | Loss to follow-up of greater than 15%
Esposito 2003 | Loss to follow-up of greater than 15%
Esposito 2004 | Diet + exercise versus no treatment control
Figueroa 2003 | Participants not all overweight or obese
Fogelholm 2001 | Weight maintenance study
Grant 2004 | Loss to follow-up of greater than 15%
<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartwell 1986</td>
<td>Numbers in each intervention group not given</td>
</tr>
<tr>
<td>Hinderliter 2002</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Houmard 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Hurttunen 1979</td>
<td>Weight loss discouraged whilst dieting and exercising</td>
</tr>
<tr>
<td>Jakicic 1998</td>
<td>Unable to extract mean and standard deviation data for primary or secondary outcomes</td>
</tr>
<tr>
<td>Kirk 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Kraemer 1997</td>
<td>Unable to extract mean and standard deviation data for primary or secondary outcomes</td>
</tr>
<tr>
<td>Kraemer 1999</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Lehmann 1995</td>
<td>Not randomized controlled clinical trial</td>
</tr>
<tr>
<td>Lejeune 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Levesque 1997</td>
<td>Participants not overweight or obese</td>
</tr>
<tr>
<td>Lindstrom 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Loreto 2003</td>
<td>Participants not all overweight or obese</td>
</tr>
<tr>
<td>Mensink 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Messier 2000</td>
<td>Unable to extract mean and standard deviation data for primary or secondary outcomes</td>
</tr>
<tr>
<td>Nicklas 2004</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Okura 2003</td>
<td>Non-random allocation to groups</td>
</tr>
<tr>
<td>Potteiger 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Proper 1991</td>
<td>Participants not overweight or obese</td>
</tr>
<tr>
<td>Racette 1995</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Ribeiro 1984</td>
<td>Not randomized controlled clinical trial or pretest-intervention-post test design</td>
</tr>
<tr>
<td>Samaras 1997</td>
<td>No exercise prescription</td>
</tr>
<tr>
<td>Schmirz 2003</td>
<td>Participants not all overweight or obese</td>
</tr>
<tr>
<td>Schuler 1991</td>
<td>Participants not overweight or obese</td>
</tr>
<tr>
<td>Slentz 2004</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Stahle 2000</td>
<td>Participants not overweight or obese</td>
</tr>
<tr>
<td>Teixeira 2003</td>
<td>Participants not overweight or obese</td>
</tr>
<tr>
<td>Watkins 2003</td>
<td>Loss to follow-up of greater than 15%</td>
</tr>
<tr>
<td>Weinstock 1998</td>
<td>Unable to extract mean and standard deviation data for primary or secondary outcomes</td>
</tr>
<tr>
<td>Yamanouchi 1995</td>
<td>Intervention &lt; 12 weeks duration</td>
</tr>
</tbody>
</table>

**RCT** = randomized controlled trial
## Additional Tables

### Table 01. Search Strategy

**Search terms**

The following Medline search strategy was used and adapted for use with the other databases.

**NOTES:** unless stated otherwise, search terms are free text terms; MeSH: Medical subject heading (Medline medical index term); an asterisk (*) stands for 'any character(s)', a question mark stands for 'one or no character'.

**OBESITY OR WEIGHT LOSS**

1. Obesity/ [MeSH term, all sub trees and subheadings included]
2. Bulimia/ [MeSH term, all subheadings included]
3. Hyperphagia/ [MeSH term, all subheadings included]
4. Anti-Obesity-Agents/ [MeSH term, all subheadings included]
5. Pickwickian syndrome (and) Prader-Willi-syndrome/[MeSH term, all subheadings included]
6. (obes* or adipos* or overweight* or over weight*) [in abstract or title]
7. (overeat* or overfeed*) [in abstract or title]
8. (binge eating disorder* or fat overload syndrom*) [in abstract or title]
9. Weight-gain/ [MeSH term, all subheadings included]
10. Weight-loss/ [MeSH term, all subheadings included]
12. weight gain [in abstract or title]
13. weight cycling [in abstract or title]
14. (weight near (reduce* or loss losing or maint* or decreas* or watch* or diet* or control*)) [in abstract or title]
15. or/1-14

This was combined with the following search strategy:

**EXERCISE**

1. exercis* OR (physic* activ*) OR exert* OR (physic* fit*) OR sports (text words)
2. walk* or jog* or swim* (text words)
3. (weight lift*) OR (strength train*) OR (resistance train*) OR (circuit weight train*) OR (aerob* train*) (text words)
4. exercise/ [MeSH term, all subheadings and categories included]
5. exertion/ [MeSH term, all subheadings and categories included]
6. physical education/ [MeSH term, all subheadings and categories included]
7. training/ [MeSH term, all subheadings and categories included]
8. physical-fitness/ [MeSH term, all subheadings and categories included]
9. sports/ [MeSH term, all subheadings and categories included]
10. OR/ 1-9

This was combined with the following search strategy:

**RANDOMISED CONTROLLED TRIALS**

1. RANDOMISED-CONTROLLED-TRIAL in PT
2. "RANDOMISED-CONTROLLED-TRIAL"/ all subheadings
3. "RANDOM-ALLOCATION" in MIME, MJME
4. random* or alloc* or assign*
5. (#4 in TI) or (#4 in AB)
6. #1 or #2 or #3 or #5
7. CONTROLLED-CLINICAL-TRIAL in PT
8. CLINICAL-TRIAL in PT
9. explode "CLINICAL-TRIALS"/ all subheadings
10. (CLIN* near TRIAL*)
11. (#10 in TI) or (#10 in AB)
12. "CROSS-OVER-STUDIES" in MIME, MJME
13. cross-over near (stud* or trial* or design*)

*Exercise for overweight or obesity (Review)*

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Table 01. Search Strategy  (Continued)

Search terms

14 crossover near (stud* or trial* or design*)
15 #7 or #8 or #9 or #11 or #12 or #13 or 14
16 "DOUBLE-BLIND-METHOD" in MIME, MJME
17 "SINGLE-BLIND-METHOD" in MIME, MJME
18 (singl* or doubl* or trebl* or tripl*) near (blind* or mask*)
19 (#18 in TI) or (#18 in AB)
20 #16 or #17 or #19
21 "PLACEBOS"/ all subheadings
22 placebo* in TI
23 placebo* in AB
24 #21 or #22 or #23
25 explode "RESEARCH-DESIGN"/ all subheadings
26 TG=COMPARATIVE-STUDY
27 explode "EVALUATION-STUDIES"/ all subheadings
28 "FOLLOW-UP-STUDIES" in MIME, MJME
29 "PROSPECTIVE-STUDIES" in MIME, MJME
30 control* or prospectiv* or volunteer*
31 (#30 in TI) or (#30 in AB)
32 #25 or #26 or #27 or #28 or #29 or #31
33 #6 or #15 or #20 or #24 or #32
34 (TG=ANIMAL) not ((TG=HUMAN) and (TG=ANIMAL))
35 #33 not #34

This was combined with the following search strategy:
SYSTEMATIC REVIEWS AND META-ANALYSES
1 "META-ANALYSIS" in MIME,MJME
2 explode "REVIEW-LITERATURE"/ all subheadings
3 META-ANALYSIS in PT
4 REVIEW in PT
5 REVIEW-ACADEMIC in PT
6 REVIEW-LITERATURE in PT
7 REVIEW-TUTORIAL in PT
8 GUIDELINE in PT
9 PRACTICE-GUIDELINE in PT
10 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9
11 REVIEW-OF-REPORTED-CASES in PT
12 REVIEW-MULTICASE in PT
13 LETTER in PT
14 COMMENT in PT
15 EDITORIAL in PT
16 HISTORICAL-ARTICLE in PT
17 #11 or #12 or #13 or #14 or #15 or #16
18 #10 not #17
19 ((systematic* or quantitativ* or methodologic*) near (review* or overview*)) in TLAB
20 (meta anal* or metaanal*) in TLAB
21 (integrativ* research review* or research integration) in TLAB
22 (quantitativ* synthes*) in TLAB
23 (pooling* or (pooled analys*) or (mantel* haenszel*)) in TLAB
24 (peto* or der simonian* or dersimonian* or fixed effect* or random effect*) in TLAB
25 #19 or #20 or #21 or #22 or #23 or #24
Table 01. Search Strategy  (Continued)

Search terms

26 #18 or #25
27 (TG=ANIMAL) not ((TG=HUMAN) and (TG=ANIMAL))
28 #26 not #27
### Table 02. Original data for all outcomes

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
<th>Outcome 4</th>
<th>Outcome 5</th>
<th>Outcome 6</th>
<th>Outcome 7</th>
<th>Outcome 8</th>
<th>Outcome 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggel-Leijssen 2001</td>
<td>Weight change (kg) at 12 weeks (mean +/- SD): diet = -14.8 +/- 5.3 kg</td>
<td>Weight change (kg) at 12 weeks (mean +/- SD): exercise = -15.2 +/- 6.3 kg</td>
<td>Change in BMI at 12 weeks (mean +/- SD): exercise = 32.1 +/- 3.8 kg</td>
<td>Change in % body fat at 12 weeks (mean +/- SD): exercise = 42.6 +/- 2.4 kg</td>
<td>Change in WHR at 12 weeks (mean +/- SD): exercise = 0.89 +/- 0.04 kg</td>
<td>Change in VO2 max (ml/min) at 12 weeks (mean +/- SD): exercise = 2126 +/- 168 kg</td>
<td>Change in % body fat at 12 weeks (mean +/- SD): exercise = 31.3 +/- 4.3 kg</td>
<td>Change in % body fat at 12 weeks (mean +/- SD): exercise = 31.9 +/- 4.4 kg</td>
<td>Change in % body fat at 12 weeks (mean +/- SD): exercise = 31.5 +/- 2.2 kg</td>
</tr>
<tr>
<td>Aggel-Leijssen 2001b</td>
<td>Weight change (kg) at 12 weeks (mean +/- SD): vigorous exercise = 105.5 +/- 6.6 kg (pre) to 105.1 +/- 6.2 kg</td>
<td>Change in BMI at 12 weeks (mean +/- SE): vigorous exercise = 32.2 +/- 1.6 (pre) to 32.1 +/- 1.3 (post), control = 33.3 +/- 3.9 (pre) to 33.1 +/- 3.9 (post)</td>
<td>Change in % body fat at 12 weeks (mean +/- SE): vigorous exercise = 31.3 +/- 4.3 (pre) to 31.8 +/- 4.4 (post), moderate exercise = 31.6 +/- 3.1 (pre) to 31.7 +/- 3.1 (post)</td>
<td>Change in WHR at 12 weeks (mean +/- SE): vigorous exercise = 0.89 +/- 0.03 (pre) to 0.90 +/- 0.03 (post)</td>
<td>Change in VO2 max (ml/min) at 12 weeks (mean +/- SE): vigorous exercise = 2126 +/- 168 kg (pre) to 2188 +/- 291 kg post)</td>
<td>Change in % body fat at 12 weeks (mean +/- SE): vigorous exercise = 31.3 +/- 4.3 kg (pre) to 31.5 +/- 2.4 kg (post)</td>
<td>Change in % body fat at 12 weeks (mean +/- SE): vigorous exercise = 31.9 +/- 4.4 kg (pre) to 32.0 +/- 4.5 kg (post)</td>
<td>Change in % body fat at 12 weeks (mean +/- SE): vigorous exercise = 31.5 +/- 2.2 kg (pre) to 31.7 +/- 3.1 kg (post)</td>
<td>Change in % body fat at 12 weeks (mean +/- SE): vigorous exercise = 31.9 +/- 4.4 kg (pre) to 32.0 +/- 4.5 kg (post)</td>
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Exercise for overweight or obesity (Review)  
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<tbody>
<tr>
<td>Anderson 1999</td>
<td>Weight change (kg) at 16 weeks (mean +/- SD): diet + exercise = -8.3 +/- 3.8 kg</td>
<td>Triglyceride change (%) at 16 weeks (mean +/- SD): diet + exercise = -17.9 +/- 18.2 %</td>
<td>Cholesterol change (%) at 16 weeks (mean +/- SD): diet + exercise = -10.9 +/- 8.0 %</td>
<td>Systolic blood pressure change (%) at 16 weeks (mean +/- SD): diet + exercise = -7.0 +/- 7.1 %</td>
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<td>Anderssen 1996</td>
<td>BMI change at 12 months: exercise = -0.65 (SE=1.5), diet = -1.6 (SE=1.8), diet + exercise = -2.2 (SE=1.8), control = 0.4 (SE=0.8)</td>
<td>Fasting serum glucose change at 12 months: exercise = -0.09 (SE=0.4), diet = -0.2 (SE=0.5), diet + exercise = -0.3 (SE=0.3), control = 0.6 (SE=0.6)</td>
<td>VO2 max change at 12 months: exercise = 4.0, diet = 1.7, diet + exercise = 6.7</td>
<td>Change in total energy intake at 12 months: exercise = 92, diet = -1679, diet + exercise = 2091</td>
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<td>Balkestein 1999</td>
<td>Weight change (kg) at 12 weeks: diet + exercise = 102 +/- 3 (SEM), control = 87</td>
<td>Change in BMI at 12 weeks: diet + exercise = 33 +/- 1 (SEM), control = 28</td>
<td>Change in systolic blood pressure (mmHg) at 12 weeks: diet + exercise = 130</td>
<td>Change in diastolic blood pressure (mmHg) at 12 weeks: diet + exercise = 82</td>
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Table 02. Original data for all outcomes  
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<tr>
<td>Cox 1996</td>
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<td>+/- 2 (SEM) (post), diet = 103 +/- 3 (SEM) (pre) to 88 +/- 2 (SEM) (post)</td>
<td>+/- 1 (SEM) (post), diet = 32 +/- 1 (SEM) (pre) to 27 +/- 1 (SEM) (post)</td>
<td>+/- 2 (SEM) (post), diet = 127 +/- 3 (SEM) (pre) to 117 +/- 2 (SEM) (post)</td>
<td>+/- 2 (SEM) (post), diet = 80 +/- 2 (SEM) (pre) to 72 +/- 2 (SEM) (post)</td>
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Cox 1996
- Weight change (kg) at 16 weeks:
  - Vigorous exercise = -1.43 kg (SEM=0.3), light exercise = -0.35 kg (SEM=0.3)

Cox 2004
- Weight change (kg) at 16 weeks:
  - Exercise = -1.55 kg (95%CI, -0.25 to -2.84), diet = -10.88 kg (95%CI, -8.53 to -13.23), diet + exercise = -11.66 kg (95%CI, -8.32 to -15.01), control = -0.05

- Systolic blood pressure change (mmHg) at 16 weeks:
  - Vigorous exercise = -3.2 mmHg (95%CI, -5.6 to -1.6), light exercise = -3.6 mmHg (95%CI, -5.6 to -1.3)

- Diastolic blood pressure change (mmHg) at 16 weeks:
  - Vigorous exercise = -2.9 mmHg (95%CI, -4.2 to -1.6), light exercise = -3.1 mmHg (95%CI, -4.9 to -1.3)

- BMI change at 16 weeks:
  - Exercise = -0.1 (95% CI, -0.6 to 0.00), diet = -0.02 (95% CI, -0.04 to 0.02), diet + exercise = -0.03 (95% CI, -0.05 to -0.01), control = 0.1 (95% CI, -0.2 to 0.4)

- Fasting serum glucose change (mmol/L) at 16 weeks:
  - Exercise = 0.01 (95% CI, -0.67 to 0.51), diet = 0.01 (95% CI, -0.08 to 0.01), diet + exercise = 0.03 (95% CI, -0.19 to 0.20), control = -0.09 (95% CI, -0.26 to 0.20)

- Glycated haemoglobin change (%)
  - Exercise = 0.13 (95% CI, -0.08 to 0.26), diet = 0.26 (95% CI, 0.14 to 0.38), diet + exercise = -0.03 (95% CI, -0.26 to 0.20), control = 0.13 (95% CI, -0.26 to 0.20)

- VO2 max change (L/min) at 16 weeks:
  - Exercise = 0.59 (95% CI, 0.94 to 0.23), diet = 0.17 (95% CI, 0.49 to 0.79), diet + exercise = 0.65 (95% CI, 0.23 to 1.07), control = -0.03 (95% CI, -0.26 to 0.20)

- Change in energy intake (kJ/d) at 16 weeks:
  - Exercise = 787 (95% CI, 2330 to 2330), diet = -794 (95% CI, -1023 to -561), diet + exercise = -4804 (95% CI, -6402 to 0.79), control = 0.79 (95% CI, -0.26 to 0.20)
Table 02. Original data for all outcomes (Continued)

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<td></td>
<td>control = -0.44, kg (95% CI, 0.4 to -1.3)</td>
<td>0.01 (95% CI, 0.01 to 0.01)</td>
<td>0.19, control = 0.21, (95% CI, -0.1 to 0.01)</td>
<td>0.09 (95% CI, -0.01 to 0.20)</td>
<td>0.01 (95% CI, 0.00 to 0.98)</td>
<td>to -3205, control = -0.44, kg (95% CI, 0.4 to -1.3)</td>
<td>0.01 (95% CI, 0.01 to 0.01)</td>
<td>0.19, control = 0.21, (95% CI, -0.1 to 0.01)</td>
<td>0.09 (95% CI, -0.01 to 0.20)</td>
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<tr>
<td>Gillett 1987</td>
<td>Weight change (lb) at 16 weeks (mean +/- SD): exercise = 165.3 +/- 6.7 (pre) to 169.1 lb (pre)</td>
<td>Change in % body fat at 16 weeks (mean +/- SD): exercise = 42.3 +/- 6.9 (pre) to 45.6 (pre)</td>
<td>Change in total serum cholesterol (mg%) at 16 weeks (mean +/- SD): exercise = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post), control = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post)</td>
<td>Change in total serum glucose (mg%) at 16 weeks (mean +/- SD): exercise = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post), control = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post)</td>
<td>Change in systolic blood pressure (mmHg) at 16 weeks (mean +/- SD): exercise = 79.2 +/- 12.2 (pre) to 72.1 +/- 8.7 (post), control = 79.2 +/- 12.2 (pre) to 72.1 +/- 8.7 (post)</td>
<td>Change in diastolic blood pressure (mmHg) at 16 weeks (mean +/- SD): exercise = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post), control = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post)</td>
<td>Change in total serum triglycerides (mg%) at 16 weeks (mean +/- SD): exercise = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post), control = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post)</td>
<td>Change in total serum glucose (mg%) at 16 weeks (mean +/- SD): exercise = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post), control = 94.3 +/- 0.0 (pre) to 91.3 +/- 7.6 (post)</td>
<td>Change in systolic blood pressure (mmHg) at 16 weeks (mean +/- SD): exercise = 79.2 +/- 12.2 (pre) to 72.1 +/- 8.7 (post), control = 79.2 +/- 12.2 (pre) to 72.1 +/- 8.7 (post)</td>
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<td>Gordon 1997</td>
<td>Weight change (kg) at 12 weeks (mean +/- SD): exercise = -1.0 +/- 1.8 kg, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Body fat (%) change at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Maximal oxygen uptake change (ml/min) at 12 weeks (mean +/- SD): exercise = -10.0 +/- 6.4 mmHg, diet = -11.3 +/- 12.1 mmHg, diet + exercise = -12.5 +/- 6.3 mmHg</td>
<td>Systolic blood pressure change (mmHg) at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Diastolic blood pressure change (mmHg) at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Change in body fat (%) at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Change in maximal oxygen uptake (ml/min) at 12 weeks (mean +/- SD): exercise = -10.0 +/- 6.4 mmHg, diet = -11.3 +/- 12.1 mmHg, diet + exercise = -12.5 +/- 6.3 mmHg</td>
<td>Change in systolic blood pressure (mmHg) at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
<td>Change in diastolic blood pressure (mmHg) at 12 weeks (mean +/- SD): exercise = -0.5 +/- 1.0 %, diet = -1.6 +/- 1.3 %, diet + exercise = -2.4 +/- 1.7 %</td>
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<td>Hays 2004</td>
<td>Weight change % body fat</td>
<td>Physical</td>
<td>Maximal</td>
<td>Resting energy</td>
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<td>(kg) at 14 weeks (mean +/- SD): diet = -3.2 +/- 1.2 kg, diet + exercise = -4.8 +/- 0.9 kg, control = -0.1 +/- 0.6 kg</td>
<td>change at 14 weeks (mean +/- SD): diet = -2.2 +/- 1.2 %, diet + exercise = -3.5 +/- 0.7 %, control = 0.2 +/- 0.6 %</td>
<td>activity (kcal/wk) from baseline to week 14 (mean and SEM): diet = 3034 (SEM=411) and post = 4988 (SEM=477) kcal/wk, diet + exercise = 4549 (SEM=808) and post = 5157 (SEM=820) kcal/wk, control - pre = 4730 (SEM=679) and post = 5191 (SEM=682) kcal/wk</td>
<td>aerobic capacity (mL/kg/min) from baseline to week 14 (mean and SEM): diet - pre = 17.8 (SEM=1.0); diet + exercise - pre = 18.5 (SEM=1.3) and post = 23.1 (SEM=1.3), control - pre = 17.0 (SEM=1.0)</td>
<td>expenditure (kcal/d) from baseline to week 14 (mean and SEM): diet = 1356 (SEM=1343) kcal/d, diet + exercise = 1286 (SEM=53) and post = 1224 (SEM=52) kcal/d, control - pre = 1357 (SEM=92) and post = 1318 (SEM=81) kcal/d</td>
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<td>Hellenius 1993</td>
<td>BMI at 6 months: exercise = -0.3 (95% CI, -0.5 to -0.01), diet = -0.3 (95% CI, -0.6 to -0.03), diet + exercise = -0.6 (95% CI, diet + exercise)</td>
<td>Waist circumference (cm) at 6 months: exercise = -2.2 (95% CI, -3.2 to -1.3), diet = -1.3 (95% CI, -2.5 to -0.1), diet + exercise = -0.6 (95% CI, diet + exercise)</td>
<td>WHR at 6 months: exercise = -0.06 (95% CI, -0.08 to -0.05), diet = -0.05 (95% CI, -0.10 to -0.02), diet + exercise = -0.05 (95% CI, -0.10 to -0.03), diet + exercise = -0.07 (95% CI, -0.10 to -0.02), diet + exercise = -0.07 (95% CI, -0.10 to -0.02), diet + exercise = -0.09 (95% CI, -0.10 to -0.09), diet + exercise = -0.10 (95% CI, -0.10 to -0.09), diet + exercise = -0.12 (95% CI, -0.12 to -0.10)</td>
<td>Systolic blood pressure (mmHg) at 6 months: exercise = -5 (95% CI, -9 to -10), diet = -7 (95% CI, -9 to -10), diet + exercise = -7 (95% CI, -9 to -10), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -4 (95% CI, -6 to -4), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -4 (95% CI, -6 to -4), diet + exercise = -2 (95% CI, -4 to -2)</td>
<td>Total serum cholesterol (mmol/L) at 6 months: exercise = 8928 (SD=1522) kcal/d, diet = 8564 (SD=1494) kcal/d, diet + exercise = 8160 (SD=1751) kcal/d</td>
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<td>Systolic blood pressure (mmHg) at 6 months: exercise = -5 (95% CI, -9 to -10), diet = -7 (95% CI, -9 to -10), diet + exercise = -7 (95% CI, -9 to -10), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -4 (95% CI, -6 to -4), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -2 (95% CI, -4 to -2), diet + exercise = -4 (95% CI, -6 to -4), diet + exercise = -2 (95% CI, -4 to -2)</td>
<td>Total serum triglycerides (mmol/L) at 6 months: exercise = -1.2 (95% CI, -3.4 to -2.0), diet = -0.3 (95% CI, -1.1 to -0.0), diet + exercise = -0.9 (95% CI, -2.0 to -0.7), change in number of exercise sessions per month at 6 months: exercise = 5.1 (SD=7.3), diet = 11.7 (SD=6.7), diet + exercise = 5.1 (SD=7.3)</td>
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<tr>
<td>Irwin 2003</td>
<td>Weight change (kg) at 3 months:</td>
<td>BMI change at 3 months:</td>
<td>Waist circumference (cm) change at 3 months:</td>
<td>Hip circumference (cm) change at 3 months:</td>
<td>DXA total body fat change (kg) at 12 months:</td>
<td>DXA % fat change at 12 months:</td>
<td>Intra-abdominal fat change (CT - g / cm²) at 12 months:</td>
<td>Subcutaneous fat change (CT - g / cm²) at 12 months:</td>
<td>Maximal oxygen consumption, % change at 12 months:</td>
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<tr>
<td></td>
<td>Intervention = -0.5 kg (95%CI, -1 to 0.1), control = 0 kg (95%CI, -0.6 to 0.5); Weight change (kg) at 12 months:</td>
<td>Intervention = -0.2 (95%CI, -0.4 to 0), control = 0 (95%CI, -0.2 to 0.2); BMI change at 12 months:</td>
<td>Intervention = -0.5 cm (95%CI, -1.2 to 0.2), control = 0.1 cm (95%CI, -0.8 to 0.6); Waist circumference change at 12 months:</td>
<td>Intervention = -0.1 cm (95%CI, -0.6 to 0.9); Hip circumference change at 12 months:</td>
<td>Intervention = -1.4 kg (95%CI, -1.6 to -0.8), control = -0.2 % (-0.6 to 0.2); Body fat change at 12 months:</td>
<td>Intervention = -1.2 % (95%CI, -1.6 to -0.8), control = -0.2% (-0.6 to 0.2); Body fat change at 12 months:</td>
<td>Intervention = -8.5 (95%CI, -15.1 to -0.2), control = 0.1 (95%CI, -0.6 to 0.2); Intra-abdominal fat change (CT - g / cm²) at 12 months:</td>
<td>Intervention = -11.7 % (95%CI, -8.8 to 14.6), control = 0.7 % (95%CI, -2.2 to 3.6); Subcutaneous fat change (CT - g / cm²) at 12 months:</td>
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<tr>
<td>Jakicic 1995</td>
<td>Weight change (kg) at 20 weeks (mean VO2 max change by 20 weeks)</td>
<td>BMI change by 20 weeks (mean +/-)</td>
<td>Systolic blood pressure change by</td>
<td>Diastolic blood pressure change by</td>
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<td>Intervention = -1.3 kg (95%CI, -2 to -0.5), control = 0.1 kg (95%CI, -0.6 to 0.8)</td>
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<td>(+/- SD): Vigorous exercise = -6.4 +/- 4.5 kg, light exercise = -8.9 +/- 5.3 kg</td>
<td>(mean +/- SD): Vigorous exercise = 33.7 +/- 4.8</td>
<td>(-8.9 +/- 1944.9 ml/min pre to 37.3 ml/min post, light exercise = 2030.9 +/- 401.9 ml/min pre to 2132.2)</td>
<td>20 weeks</td>
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<td>Jakicic 2003 Weight change (kg) at 12 months (mean +/- SD): Vigorous intensity, high duration exercise = -8.2 +/- 7.6 kg, Moderate intensity, high duration exercise = 32.3 +/- 3.9 kg, Moderate intensity, moderate duration exercise = -6.3 +/- 5.6 kg, Vigorous moderate intensity</td>
<td>Change in leisure-time physical activity (min/week) from baseline to 12 months</td>
<td>Change in energy intake (kcal/day) from baseline to 12 months</td>
<td>Change in cardiorespiratory fitness (mL/kg) from baseline to 12 months</td>
<td>Change in cardiorespiratory fitness from baseline to 12 months</td>
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<td>intensity, moderate duration exercise = -7 +/- 6.4 kg</td>
<td>duration = 32.7 +/- 4.3 (pre) to 30.3 +/- 4.5 (post), Vigorous intensity, moderate duration exercise = 32.7 +/- 4.6 (pre) to 30.2 +/- 4.6 (post)</td>
<td>248.8 (pre) to 189.9 +/- 119.0 (post), Moderate intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
<td>intensity, moderate duration exercise = 2027 +/- 743 (pre) to 1350 +/- 422 (post), Vigorous intensity, moderate duration exercise = 2200 +/- 875 (pre) to 1449 +/- 502 (post)</td>
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Janssen 2002

Weight change (kg) at 16 weeks (mean +/- SD): diet = -10 +/- 3.9 kg, diet + aerobic exercise = -11.1 +/- 4.4 kg, diet + resistance exercise = -10 +/- 3 kg

BMI change at 16 weeks (mean +/- SD): diet = -4 +/- 1.4, diet + aerobic exercise = -4.2, diet + resistance exercise = 3.9

Fasting serum glucose change (mmol/L) at 16 weeks (mean +/- SD): diet = -0.1 +/- 0.4, diet + aerobic exercise = -0.1 +/- 0.5, diet + resistance exercise = -0.1 +/- 0.4

Serum triglyceride change (mmol/L) at 16 weeks (mean +/- SD): diet = -0.3 +/- 1.6, diet + aerobic exercise = -0.3 +/- 0.5, diet + resistance exercise = -0.3 +/- 0.4

Fasting serum cholesterol change (mmol/L) at 16 weeks (mean +/- SD): diet = -0.8 +/- 0.4, diet + aerobic exercise = -0.8 +/- 0.6, diet + resistance exercise = -0.8 +/- 0.4
<table>
<thead>
<tr>
<th>Study ID</th>
<th>Outcome 1</th>
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<tbody>
<tr>
<td>Jeffery 1998</td>
<td>Weight change (kg) at 12 months: exercise = -6.5 +/- 6.5 kg, control = -8.3 +/- 4.3 kg</td>
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<tr>
<td>Jeffery 2003</td>
<td>Weight change (kg) at 6 months (mean +/- SD): Diet = -8.1 +/- 7.4 kg, diet + exercise = -9 +/- 7.1 kg; Weight change (kg) at 12 months: Diet = -6.1 +/- 8.8 kg, Diet + exercise = -8.5 +/- 7.9 kg; Weight change (kg) at 18 months: Diet = -4.1 +/- 7.3 kg, Diet + exercise = -6.7 +/- 8.1 kg</td>
<td>Energy expenditure (kcal/wk) from baseline to 18 months (mean and SD): diet - pre = 2071 (SD=1058)</td>
<td>Energy intake (kcal/d) from baseline to 18 months (mean and SD): diet - pre = 2189 (SD=1066)</td>
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<tr>
<td>Kiernan 2001</td>
<td>Weight change (kg) at 12 months (mean +/- SD): diet + exercise = -6.9 +/- 5.5 kg, diet = -4.5 +/- 5.7 kg</td>
<td>BMI change at 12 months (mean +/- SD): diet + exercise = -2.3 +/- 1.8, diet = -1.6 +/- 1.8</td>
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</table>
Leutholtz 1995

Weight change (kg) at 12 weeks (mean +/- SD): vigorous exercise = -15.7 +/- 5.3 kg, light exercise = -15.0 +/- 8.4 kg

Body fat (% change) at 12 weeks: vigorous exercise = -3.2 %, light exercise = -2.9 %

Manning 1991

Weight change (kg) at 12 weeks (mean +/- SEM): exercise = 84.1 +/- 3.5 kg (pre) to 85.5 +/- 3.6 kg (post), control = 87.0 +/- 2.0 kg (post)

Change in BMI at 12 weeks (mean +/- SEM): exercise = 32.0 +/- 1.4 (pre) to 32.8 +/- 1.4 (post), control = 32.8 +/- 1.4 (pre) to 32.8 +/- 1.4 (post)

Change in energy intake (kcal/day) at 12 weeks (mean +/- SEM): exercise = 1618 +/- 135 kcal/day (pre) to 1675 +/- 96 kcal/day (post), control = 1658 +/- 144 kcal/day (pre) to 1728 +/- 102 kcal/day (post)

Change in total serum cholesterol (mg/dl) at 12 weeks (mean +/- SEM): exercise = 200 +/- 10 (pre) to 198 +/- 11 (post), control = 197 +/- 15 (pre) to 205 +/- 15 (post)

Change in triglycerides (mg/dl) at 12 weeks (mean +/- SEM): exercise = 111 +/- 10 (pre) to 126 +/- 12 (post), control = 106 +/- 20 (pre) to 114 +/- 30 (post)

Neumark 1995

Weight change (kg) at 3 months (mean +/- SD): exercise = -3.6 +/- 2.6 kg, control = -3.8 +/- 2.0 kg

Change in waist circumference (cm) at 3 months (mean +/- SD): exercise = -7.4 +/- 7.0 cm, control = -8.5 +/- 8.9 cm

Nieman 1998

Weight change (kg) at 3 months

Change in BMI at 3

Change in % body fat at 3

Change in VO2 max

Change in serum

Change in serum

Change in serum glucose
Table 02. Original data for all outcomes (Continued)

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<tbody>
<tr>
<td></td>
<td>months (mean +/- SEM):</td>
<td>exercise = 88.4 +/- 2.9 (pre) to 87.4 +/- 2.8 (post), diet = 90.6 +/- 3.8 (pre) to 90.5 +/- 2.4 (pre) to 89.7 +/- 2.5 (post)</td>
<td>82.8 +/- 1.6 (pre) to 81.8 +/- 1.4 (pre) to 81.7 +/- 1.5 (pre)</td>
<td>32.3 +/- 1.1 (pre) to 32.0 +/- 1.0 (pre) to 31.8 +/- 1.0 (pre)</td>
<td>43.1 +/- 1.4 (pre) to 42.1 +/- 1.1 (pre) to 42.3 +/- 0.9 (pre)</td>
<td>2303 +/- 73 (pre) to 2195 +/- 73 (pre) to 2057 +/- 69 (pre)</td>
<td>43.3 +/- 1.2 (pre) to 43.3 +/- 1.3 (pre) to 42.3 +/- 1.3 (pre)</td>
<td>5.3 +/- 1.4 (pre) to 5.3 +/- 1.4 (pre) to 5.1 +/- 1.0 (pre)</td>
<td>5.2 +/- 1.0 (pre) to 5.1 +/- 0.9 (pre) to 5.1 +/- 0.8 (pre)</td>
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Pritchard 1997

| Weight change (%) at 12 months (mean +/- SD): | exercise = -3 +/- 0.5%, diet = -7.2 +/- 0.9%, control = 1.0 +/- 0.5% |
| BMI change (%) at 12 months (mean +/- SD): | exercise = -4.4, diet = -8.2, control = 1.0 |

Raz 1994

| Change in BMI at 12 weeks (mean +/- SD): | exercise = 31.8 +/- 4.6 (pre) to 12 weeks (mean +/- SD): exercise = 11.4 |
| Change in serum glucose (mmol/l) at 12 weeks (mean +/- SD): | exercise = 11.4 |
| Change in serum cholesterol (mmol/l) at 12 weeks (mean +/- SD): | exercise = 5.1 |
| Change in serum triglycerides (mmol/L) at 12 weeks (mean +/- SD): | exercise = 2.0 |
Table 02. Original data for all outcomes (Continued)

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<tr>
<th>Study ID</th>
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<td>31.5 +/- 4.3</td>
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<td>exercise = 5.7</td>
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<td>+/- 2.3 (pre)</td>
<td>to 1.9 +/- 0.7</td>
<td>(post), control</td>
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<td>(post), control</td>
<td>10.2 +/- 3.3</td>
<td>+/- 1.0 (pre)</td>
<td>10.4 +/- 0.9</td>
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<td>= 30.2 +/- 4.7</td>
<td>(post), control</td>
<td>to 5.6 +/- 1.0</td>
<td>(post), control</td>
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<td>(pre) to 30.6</td>
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<td>Change in % body fat at 3</td>
<td>Change in calorie intake</td>
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<td>1990</td>
<td>(kg) at 3 months</td>
<td>months (mean +/- SD):</td>
<td>(kcal/day) at 3</td>
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<td>exercise = -2.3</td>
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<td>+/- 176 kcal/d, diet = - 247 +/- 275 kcal/d</td>
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<td>+/- 3.4 kg, diet</td>
<td>+/- 2.3 %, diet</td>
<td>+/- 5.9 +/- 3.5</td>
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<td>- 6.7 kg</td>
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<td>Stefanick 1998 Weight change (kg) at 12 months (mean +/- SD):</td>
<td>Change in serum cholesterol (mmol/L) at 12 months</td>
<td>Change in serum triglycerides (mmol/L) at 12 months</td>
<td>Change in serum glucose (mmol/L) at 12 months</td>
<td>Change in diastolic blood pressure (mmHg) at 12 months</td>
<td>Change in systolic blood pressure (mmHg) at 12 months</td>
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<td>+/- 2.8 kg, diet</td>
<td>+/- 2.8 +/- 4.7, diet</td>
<td>+/- 10.6 +/- 4.5, diet</td>
<td>+/- 7.8 +/- 3.1, diet + exercise</td>
<td>+/- 3.6, diet + exercise</td>
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<td>+/- 3.5 kg, diet</td>
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<td>+/- 3.5 kg, diet</td>
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<td>Stensel 1994 Weight change (kg) at 12 months:</td>
<td>Change in BMI (pre) to 25.4 (SEM)</td>
<td>Change in body fat % (pre) to 79.3 (SEM)</td>
<td>Change in VO2 max (pre) to 78.3 (SEM) (pre)</td>
<td>Change in WHR at 12 months:</td>
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<td>+/- 0.4 (SEM)</td>
<td>+/- 28.7</td>
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<td>+/- 1.5 (SEM) (pre)</td>
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<td>+/- 1.5 (SEM) (post)</td>
<td>+/- 0.7 (SEM)</td>
<td>+ / - 0.01</td>
<td>0.94 +/- 0.01</td>
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<td>24.8 +/- 2.5 (SEM)</td>
<td>29.5 +/- 1.5 (SEM)</td>
<td>0.95</td>
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<td>29.3 +/- 1.5 (SEM)</td>
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<td>78.3 +/- 2.7 (SEM)</td>
<td>25.0 +/- 0.7 (SEM)</td>
<td>29.3 +/- 1.5 (SEM)</td>
<td>0.94 +/- 0.01</td>
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<td>Svendsen 1993 Weight change (kg) at 12 weeks (mean +/- SD):</td>
<td>Change in serum cholesterol (mmol/L) at 12 weeks (mean)</td>
<td>Change in serum triglycerides (mmol/L) at 12 weeks (mean)</td>
<td>Change in energy intake (kj/d) at 12 weeks (mean)</td>
<td>Change in systolic blood pressure (mmHg) at 12 weeks (mean)</td>
<td>Change in diastolic blood pressure</td>
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<td>WHR change at 12 weeks</td>
<td>VO2 max change at 12 weeks</td>
<td>Change in energy intake (kj/d) at 12 weeks</td>
<td>Change in systolic blood pressure (mmHg) at 12 weeks</td>
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<td>+/- SD): diet</td>
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<td>BMI change at 3 months:</td>
<td>WHR change at 3 months:</td>
<td>VO2 max change at 3 months:</td>
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<td>Utter 2000</td>
<td>Weight change (kg) at 3 months (mean +/- SE):</td>
<td>Change in % body fat at 3 months (mean +/- SE):</td>
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<tr>
<td>Wallace 1997</td>
<td>Weight change (kg) at 14 weeks (mean +/- SD): vigorous exercise = -4.2 +/- 4.1 kg, moderate exercise = -1.9 +/- 5.1 kg</td>
<td>Change in % body fat at 14 weeks (mean +/- SD): vigorous exercise = -6.9 +/- 1.3 %, moderate exercise = -1.4 +/- 1.4 %</td>
<td>WHR change at 14 weeks (mean +/- SD): vigorous exercise = -0.06 +/- 0.01, moderate exercise = -0.04 +/- 0.01</td>
<td>Change in VO2 max (L/min) at 3 months (mean +/- SD): vigorous exercise = -0.05 +/- 0.02, moderate exercise = -0.08 +/- 0.18</td>
<td>Change in HbA1c at 12 months (mean +/- SD): diet + exercise = 37.5 +/- 1.9 (pre) to 34.6 +/- 2.1 (post), diet = 37.9 +/- 1.7 (pre) to 34.6 +/- 2.1 (post)</td>
<td>Change in serum triglycerides (mmol/l) at 14 weeks (mean +/- SD): diet + exercise = 10.6 +/- 0.5 (pre) to 9.2 +/- 0.5 (post), diet = 10.9 +/- 0.5</td>
<td>Change in serum triglycerides (mmol/l) at 12 months (mean +/- SD): diet + exercise = 4.9 +/- 0.3 (pre) to 5.2 +/- 0.3</td>
<td>Change in serum glucose (mmol/l) at 12 months (mean +/- SD): diet + exercise = 11.6 +/- 0.6 (pre) to 9.9 +/- 0.8</td>
<td>Change in serum glucose (mmol/l) at 12 months (mean +/- SD): diet = -11.1 +/- 2.9, moderate exercise = -5.9 +/- 2.6</td>
</tr>
</tbody>
</table>

Wing 1988 | Weight change (kg) at 12 months (mean +/- SD): diet + exercise = 104.1 +/- 6.0 kg to 96.2 +/- 6.5 kg (post), diet = 37.9 +/- 1.7 (pre) to 34.6 +/- 2.1 (post) | BMI change at 12 months (mean +/- SD): diet + exercise = 37.5 +/- 1.9 (pre) to 34.6 +/- 2.1 (post), diet = 37.9 +/- 1.7 (pre) to 34.6 +/- 2.1 (post) | Change in blood pressure (mmHg) at 14 weeks (mean +/- SD): vigorous exercise = -14.6 +/- 5.5, moderate exercise = -8.3 +/- 6.8 | Change in serum cholesterol (mmol/l) at 12 months (mean +/- SD): diet + exercise = 10.6 +/- 0.5 (pre) to 9.2 +/- 0.5 (post), diet = 10.9 +/- 0.5 | Change in serum cholesterol (mmol/l) at 12 months (mean +/- SD): diet + exercise = 4.9 +/- 0.3 (pre) to 5.2 +/- 0.3 | Change in serum cholesterol (mmol/l) at 12 months (mean +/- SD): diet + exercise = 4.9 +/- 0.3 (pre) to 5.2 +/- 0.3 | Change in HbA1c at 12 months (mean +/- SD): diet + exercise = 37.5 +/- 1.9 (pre) to 34.6 +/- 2.1 (post), diet = 37.9 +/- 1.7 (pre) to 34.6 +/- 2.1 (post) | Change in HbA1c at 12 months (mean +/- SD): diet + exercise = 37.5 +/- 1.9 (pre) to 34.6 +/- 2.1 (post), diet = 37.9 +/- 1.7 (pre) to 34.6 +/- 2.1 (post) | Change in HbA1c at 12 months (mean +/- SD): diet = -11.1 +/- 2.9, moderate exercise = -5.9 +/- 2.6 |
### Table 02. Original data for all outcomes (Continued)

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
<th>Outcome 4</th>
<th>Outcome 5</th>
<th>Outcome 6</th>
<th>Outcome 7</th>
<th>Outcome 8</th>
<th>Outcome 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 102.0 +/- 5.0 kg (pre) to 98.2 +/- 4.9 kg (post)</td>
<td>36.6 +/- 1.8 (pre) to 10.1 (post)</td>
<td>(pre) to 10.1</td>
<td>(pre) to 5.2 +/- 0.2 (post)</td>
<td>(post), diet = 1.8 +/- 0.3 (pre) to 1.9 +/- 0.2 (post)</td>
<td>12.6 +/- 0.7 (pre) to 11.8 +/- 1.0 (post)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Wing 1998

- **Weight change (kg) at 6 months:** exercise = -2.1 +/- 0.8 kg, diet + exercise = -0.2 +/- 0.4, control = -0.2 +/- 0.5
- **BMI at 6 months:** exercise = 6 months: 0.8, diet = 6 months: 0.7, diet + exercise = 6 months: 0.6, control = 6 months: 0.5
- **Change in fasting plasma glucose (mmol/l) at 6 months:** exercise = 6 months: 0.3, diet = 6 months: 0.2, diet + exercise = 6 months: 0.1, control = 6 months: 0.0
- **Change in fasting plasma cholesterol (mmol/l) at 6 months:** exercise = 6 months: 0.12, diet = 6 months: 0.1, diet + exercise = 6 months: 0.1, control = 6 months: 0.0
- **Change in fasting triglycerides (mmol/l) at 6 months:** exercise = 6 months: 0.0, diet = 6 months: 0.0, diet + exercise = 6 months: 0.0, control = 6 months: 0.0
- **Change in systolic blood pressure (mmHg) at 6 months:** exercise = 6 months: 18.9, diet = 6 months: 12.2, diet + exercise = 6 months: 6.2, control = 6 months: 6.9
- **Change in diastolic blood pressure (mmHg) at 6 months:** exercise = 6 months: 6.9, diet = 6 months: 12.3, diet + exercise = 6 months: 6.9, control = 6 months: 6.9

#### Wirth 1985

- **Weight change (kg) at 4 months (mean +/- SD):** exercise = 81.9 +/- 10.6 kg, diet = 82.1 +/- 3.1 kg, control = 82.7 +/- 3.1 kg
- **% body fat at 4 months (mean +/- SD):** exercise = 24.0%, diet = 31.5%, control = 31.3%
- **Change in resting systolic blood pressure (mmHg) at 4 months:** exercise = 137 +/- 51 (pre) to 123 +/- 51 (post), diet = 137 +/- 51 (pre) to 123 +/- 51 (post), control = 137 +/- 51 (pre) to 123 +/- 51 (post)
- **Total serum cholesterol (mg/dL) at 4 months:** exercise = 273 +/- 57 (pre) to 260 +/- 57 (post), diet = 273 +/- 57 (pre) to 260 +/- 57 (post), control = 273 +/- 57 (pre) to 260 +/- 57 (post)

#### Wood 1988

- **Weight change (kg) at 12 months (mean +/- SD):** exercise = -4.0 kg, diet = 12 months: 132 +/- 5.6 kg, control = 12 months: 132 +/- 5.6 kg
- **Change in energy intake (kJ/day) at 12 months:** exercise = 12 months: 132 +/- 5.6 kg, diet = 12 months: 132 +/- 5.6 kg, control = 12 months: 132 +/- 5.6 kg
- **Change in VO2 max (ml/kg/min) at 12 months:** exercise = 12 months: 132 +/- 5.6 kg, diet = 12 months: 132 +/- 5.6 kg, control = 12 months: 132 +/- 5.6 kg
Table 02. Original data for all outcomes  *(Continued)*

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
<th>Outcome 4</th>
<th>Outcome 5</th>
<th>Outcome 6</th>
<th>Outcome 7</th>
<th>Outcome 8</th>
<th>Outcome 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+/- 3.9 kg, diet</td>
<td>+/- 7.2 +/- 3.7</td>
<td>+/- 673 +/- 2558</td>
<td>+/- 0.9, diet</td>
<td>+/- 5.4, diet</td>
<td>+/- 3.2</td>
<td>+/- 2.4</td>
<td>+/- 2.4</td>
<td>+/- 3.2</td>
</tr>
<tr>
<td></td>
<td>kg, control =</td>
<td>kg, control =</td>
<td>kj/day, diet</td>
<td>control =</td>
<td>0.0 +/- 3.2,</td>
<td>+/ 3.2</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>0.6 +/- 3.7 kg</td>
<td>1887 kj/day,</td>
<td>control =</td>
<td>+/ 3.2</td>
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<tr>
<td></td>
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<td>-433 +/- 2071</td>
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<td></td>
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</tr>
<tr>
<td>Wood 1991</td>
<td>Weight change</td>
<td>Change in serum triglycerides</td>
<td>Change in serum cholesterol</td>
<td>Change in systolic blood pressure</td>
<td>Change in diastolic blood pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kg) at 12 months (mean +/- SD)</td>
<td>(mmol/L) at 12 months</td>
<td>(mmol/L) at 12 months</td>
<td>(mmHg) at 12 months (mean)</td>
<td>(mmHg) at 12 months (mean)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diet + exercise = -3.4</td>
<td>+/- 4.9 kg, diet</td>
<td>+/- 2.3 +/- 6.0</td>
<td>0.2 +/- 0.6</td>
<td>0.32 +/- 0.6</td>
<td>0.70, diet = - 4.1 +/- 7.3</td>
<td>0.4 +/- 0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diet = - 0.03</td>
<td>12 months</td>
<td>12 months</td>
<td>+/- 8, diet = -</td>
<td></td>
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<td></td>
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<tr>
<td>+/- 0.5</td>
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</tr>
</tbody>
</table>

SD=standard deviation; SE=standard error; SEM=standard error of the mean; CI=confidence interval; kg=kilograms; lb=pounds; BMI=body mass index; WHR=waist-hip ratio; DXA=dual-energy x-ray absorptiometry; mmHg=millimetres of mercury; kcal=kilocalories; VO2max=maximal oxygen uptake; HDL=high-density lipoprotein; LDL=low-density lipoprotein; mmol/L=millimoles per litre
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Body Weight</th>
<th>BMI</th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
<th>Cholesterol</th>
<th>Triglycerides</th>
<th>HDL</th>
<th>Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise versus No Treatment</td>
<td>Exercise increased weight loss compared with no treatment. Exercisers lost 0.5 to 7.6 kg. No treatment changed weight from 0.1 kg loss to 0.7 kg gain.</td>
<td>Exercise reduced BMI more than no treatment. Exercisers lost between 0.3 and 2.4 kg/m². No treatment changed BMI from 0.03 loss to 0.4 kg/m² gain.</td>
<td>Exercise did not reduce SBP significantly more than no treatment. Exercisers reduced SBP by 0.8 to 5.0 mmHg. No treatment reduced SBP by 1.0 mmHg.</td>
<td>Exercise reduced DBP 2.1 mmHg more than no treatment. Exercisers reduced DBP from 1.0 loss to 0.6 mmHg gain.</td>
<td>Exercise did not reduce cholesterol significantly more than no treatment. Exercisers reduced cholesterol 0.1 to 0.3 mmol/L. No treatment reduced cholesterol 0.1 to 0.2 mmol/L.</td>
<td>Exercise reduced TG 0.2 mmol/L more than no treatment. Exercisers reduced TG 0.1 to 0.2 mmol/L. No treatment changed TG from no change to 0.1 mmol/L gain.</td>
<td>Exercise increased HDL 0.01 to 0.1 mmol/L. No treatment changed HDL from 0.02 loss to 0.01 mmol/L gain.</td>
<td>Exercise reduced glucose 0.2 mmol/L more than no treatment. Exercisers reduced glucose 0.1 to 0.4 mmol/L. No treatment changed glucose from 0.2 lost to 0.1 mmol/L gain.</td>
</tr>
</tbody>
</table>

High versus Low Intensity Exercise

Increasing the intensity increased the weight loss if participants were not on a diet. High intensity exercisers lost 1.5 kg more than low intensity exercisers. Range of weight change for high intensity exercisers was from 1.3 kg to 8.9 kg loss. Range for low intensity exercisers was from 6.3 kg loss to 0.1 kg gain.

Insufficient data for analysis.

SBP was reduced with both high and low intensity exercise. Increased exercise intensity did not reduce SBP significantly more than low intensity.

No consistent effect of exercise on DBP was seen. Increased exercise intensity did not reduce DBP significantly more than low intensity.

Insufficient data for analysis.

TG was reduced by both high and low intensity exercise. Increased exercise intensity did not reduce TG significantly more than low intensity.

HDL was increased by both high and low intensity exercise. Increased exercise intensity increased HDL 0.1 mmol/L more than low intensity.

Glucose was reduced with both high and low intensity exercise. High intensity reduced glucose 0.3 mmol/L more than low intensity. Range was 0.01 to 0.6 reduction with high intensity and 0.3 reduction to 0.5 gain with low intensity.
Table 03. Summary of Main Findings from Comparisons for Each Outcome  
(Continued)

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Body Weight</th>
<th>BMI</th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
<th>Cholesterol</th>
<th>Triglycerides</th>
<th>HDL</th>
<th>Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>High versus Low Intensity Exercise</td>
<td>Increasing the intensity did not increase the weight loss if they were on a diet. Range of weight change was 6.4 kg to 19.6 kg loss across groups.</td>
<td>Insufficient data for analysis.</td>
<td>SBP was reduced with both high and low intensity exercise. Increased exercise intensity did not reduce SBP significantly more than low intensity.</td>
<td>No consistent effect of exercise on diastolic BP was seen. Increased exercise intensity did not reduce diastolic BP significantly more than low intensity.</td>
<td>No consistent effect of exercise on cholesterol was seen. Increased exercise intensity did not reduce cholesterol significantly more than low intensity.</td>
<td>TG was reduced by both high and low intensity exercise. Increased exercise intensity did not reduce TG significantly more than low intensity.</td>
<td>HDL was reduced by both high and low intensity exercise. Increased exercise intensity did not reduce HDL significantly more than low intensity.</td>
<td>Glucose was reduced by both high and low intensity exercise. Increased exercise intensity did not reduce glucose significantly more than low intensity.</td>
</tr>
<tr>
<td>Dietary Change</td>
<td></td>
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</tr>
<tr>
<td>Exercise versus Diet</td>
<td>Diet resulted in greater weight losses compared with exercise. Dieters lost 2.8 kg to 13.6 kg of weight. Exercisers lost 0.5 kg to 7.6 kg of weight.</td>
<td>Diet resulted in greater BMI reductions than exercise. Both lost 0.3 to 2.4 kg/m2.</td>
<td>Diet resulted in greater SBP reductions than exercise. Diet reduced SBP by 2.2 mmHg more than exercise. Range of SBP change with diet was 2.6 to 11.3 mmHg reduction. Range with exercise was 0.8 to 9.9 mmHg reduction.</td>
<td>There was no significant difference between diet and exercise for DBP reduction. Dieters reduced DBP from 1.1 to 7.5 mmHg. Exercisers reduced DBP from 1.2 to 5.9 mmHg.</td>
<td>Diet resulted in no significant difference between diet and exercise on cholesterol reductions than exercise. Range of cholesterol change with diet was 0.2 to 0.7 mmol/L reduction. Range with exercise was 0.2 to 0.3 mmol/L reduction.</td>
<td>There was no significant difference between diet and exercise on TG. Range of TG change with diet was 0.6 loss to 0.03 mmol/L gain. Range with exercise was 0.2 loss to 0.1 gain.</td>
<td>There was no significant difference between diet and exercise on HDL. Range of HDL change with diet was 0.01 loss to 0.1 mmol/L gain. Range with exercise was 0.01 to 0.1 mmol/L gain.</td>
<td>Diet resulted in greater glucose reductions than exercise. Diet reduced glucose by 0.1 mmol/L more than exercise. Range of glucose reduction with diet was 0.2 to 0.4 mmol/L. Range with exercise was 0.0 to 0.4 mmol/L reduction.</td>
</tr>
<tr>
<td>Diet versus Diet Alone</td>
<td>Diet + exercise resulted in greater weight loss than diet alone. Dieters +</td>
<td>Diet + exercise resulted in greater reductions in BMI than diet alone.</td>
<td>Adding exercise to diet did not improve SBP reduction. Range of SBP change was 2.6</td>
<td>Adding exercise to diet did not improve DBP reduction. Range of DBP change was 1.1</td>
<td>Adding exercise to diet did not improve cholesterol reduction. Range of Cholesterol change was 0.69</td>
<td>Adding exercise to diet did not improve TG reduction. Range of TG change was 0.1</td>
<td>Adding exercise to diet did not improve HDL levels. Range of HDL change was 0.1</td>
<td>Adding exercise to diet did not improve glucose levels. Range of glucose change was 0.1</td>
</tr>
<tr>
<td>Intervention</td>
<td>Body Weight</td>
<td>BMI</td>
<td>Systolic BP</td>
<td>Diastolic BP</td>
<td>Cholesterol</td>
<td>Triglycerides</td>
<td>HDL</td>
<td>Glucose</td>
</tr>
<tr>
<td>--------------</td>
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<td>--------------</td>
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</tr>
<tr>
<td>exercisers lost 1.1 kg more than dieters.</td>
<td>Dieters + exercisers lost 0.4 kg/m² more than dieters.</td>
<td>Range of weight change for dieters + exercisers was from 3.4 kg to 17.7 kg loss.</td>
<td>Range of BMI change for dieters + exercisers was from 0.6 to 4.0 kg/m² loss.</td>
<td>to 13 mmHg drop across groups.</td>
<td>to 9.0 mmHg drop across groups.</td>
<td>cholesterol change was 0.15 to 1.4 mmol/L drop across groups.</td>
<td>Triglycerides drop to 0.03 mmol/L gain across groups.</td>
<td>HDL drop to 0.1 mmol/L gain across groups.</td>
</tr>
</tbody>
</table>

kg=kilograms; BMI=body mass index; HDL=high-density lipoprotein; LDL=low-density lipoprotein; BP=blood pressure; HbA1c=glycosylated haemoglobin; WHR=waist–hip ratio

n=number of subjects; N=mean; kg=kilograms; m=metres; BMI=body mass index; BP=blood pressure; HDL=high-density lipoprotein; LDL=low-density lipoprotein; TG=triglycerides; HbA1c=glycosylated haemoglobin; mmHg=millimetres of mercury; mmol/L=millimoles per litre
## Analyses

### Comparison 01. Exercise versus no treatment control

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight change in kilograms</td>
<td>01</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in body mass index (BMI)</td>
<td>02</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mmHg)</td>
<td>03</td>
<td>2</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-2.09 [-3.68, -0.51]</td>
</tr>
<tr>
<td>Change in diastolic blood pressure (mmHg)</td>
<td>04</td>
<td>2 259</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.03 [-0.09, 0.15]</td>
</tr>
<tr>
<td>Change in total serum cholesterol (mmol/l)</td>
<td>05</td>
<td>3 348</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.18 [-0.31, -0.05]</td>
</tr>
<tr>
<td>Change in serum triglycerides (mmol/l)</td>
<td>06</td>
<td>3 348</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td></td>
</tr>
<tr>
<td>Change in serum HDL (mmol/l)</td>
<td>07</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in fasting serum glucose (mmol/l)</td>
<td>08</td>
<td>2 273</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.17 [-0.30, -0.05]</td>
</tr>
</tbody>
</table>

### Comparison 02. Exercise versus diet

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight change in kilograms</td>
<td>01</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in body mass index (BMI)</td>
<td>02</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mmHg)</td>
<td>03</td>
<td>4 361</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>2.24 [0.29, 4.20]</td>
</tr>
<tr>
<td>Change in diastolic blood pressure (mmHg)</td>
<td>04</td>
<td>4 361</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.87 [-0.44, 2.18]</td>
</tr>
<tr>
<td>Change in total serum cholesterol (mmol/l)</td>
<td>05</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in serum triglycerides (mmol/l)</td>
<td>06</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in serum HDL (mmol/l)</td>
<td>07</td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in fasting serum glucose (mmol/l)</td>
<td>08</td>
<td>3 354</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.10 [-0.00, 0.20]</td>
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</table>

### Comparison 03. Exercise + diet versus diet alone

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight change in kilograms</td>
<td>01</td>
<td>33 2157</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-1.02 [-1.32, -0.72]</td>
</tr>
<tr>
<td>Change in body mass index (BMI)</td>
<td>02</td>
<td>5 452</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.43 [-0.71, -0.14]</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mmHg)</td>
<td>03</td>
<td>6 615</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.11 [-1.48, 1.25]</td>
</tr>
<tr>
<td>Comparison 04. High versus low intensity exercise with dietary change</td>
<td></td>
<td></td>
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<tr>
<td>---------------------------------------------------------------</td>
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<tr>
<td><strong>Outcome title</strong></td>
<td><strong>No. of studies</strong></td>
<td><strong>No. of participants</strong></td>
<td><strong>Statistical method</strong></td>
<td><strong>Effect size</strong></td>
</tr>
<tr>
<td>Weight change in kilograms</td>
<td>7</td>
<td>224</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.08 [-1.20, 1.04]</td>
</tr>
<tr>
<td>Change in body mass index (BMI)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mmHg)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in diastolic blood pressure (mmHg)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in serum cholesterol (mmol/l)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in serum triglycerides (mmol/l)</td>
<td>6</td>
<td>619</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.08 [-0.18, 0.02]</td>
</tr>
<tr>
<td>Change in serum HDL (mmol/l)</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
<tr>
<td>Change in fasting serum glucose (mmol/l)</td>
<td>4</td>
<td>407</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.01 [-0.10, 0.08]</td>
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<table>
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<tr>
<th>Comparison 05. High versus low intensity exercise without dietary change</th>
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<tbody>
<tr>
<td><strong>Outcome title</strong></td>
</tr>
<tr>
<td>Weight change in kilograms</td>
</tr>
<tr>
<td>Change in systolic blood pressure (mmHg)</td>
</tr>
<tr>
<td>Change in diastolic blood pressure</td>
</tr>
<tr>
<td>Change in serum triglycerides (mmol/l)</td>
</tr>
<tr>
<td>Change in serum HDL (mmol/l)</td>
</tr>
<tr>
<td>Change in serum glucose (mmol/l)</td>
</tr>
</tbody>
</table>

**INDEX TERMS**

Medical Subject Headings (MeSH)

*Diet, Reducing; *Exercise; Obesity [*therapy]; Overweight; Randomized Controlled Trials; Weight Loss
Exercise for overweight or obesity

Authors
Shaw K, Gennat H, O’Rourke P, Del Mar C

Contribution of author(s)
KELLY SHAW: Protocol development, literature search, assessment of trials and data extraction. Was also the principal reviewer performing the analysis and interpretation of data, as well as the development of the final review.
HANNI GENNAT: Assessment of trials, data extraction, data entry, quality scoring of trials.
PETER O’ROURKE: Resolution of differences of opinion between reviewers, statistical analysis, assistance in interpretation of data and development of the final review.
CHRISTOPHER DEL MAR: Assessment of trials and data extraction, assistance in development of the final review.

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Information not supplied by author

Date new studies found but not yet included/excluded
Information not supplied by author

Date new studies found and included/excluded
Information not supplied by author

Date authors’ conclusions section amended
Information not supplied by author

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Editorial group
Cochrane Metabolic and Endocrine Disorders Group
Figure 01.

Review: Exercise for overweight or obesity
Comparison: 03 Exercise + diet versus diet alone
Outcome: 01 Weight change in kilograms

Graph showing weight change in kilograms (WMD) versus standard error (SE) for Exercise for overweight or obesity review.
Analysis 01.01. Comparison 01 Exercise versus no treatment control, Outcome 01 Weight change in kilograms

Review: Exercise for overweight or obesity
Comparison: 01 Exercise versus no treatment control
Outcome: 01 Weight change in kilograms

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
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<th>Weighted Mean Difference (Fixed)</th>
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</thead>
<tbody>
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<td>Mean(SD)</td>
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<td>Mean(SD)</td>
</tr>
<tr>
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<td>90</td>
<td>-0.50 (2.80)</td>
<td>91</td>
<td>0.65 (3.50)</td>
</tr>
<tr>
<td>Thong 2000</td>
<td>16</td>
<td>-7.60 (0.40)</td>
<td>8</td>
<td>-0.10 (0.80)</td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>-4.00 (3.90)</td>
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<td>0.60 (3.70)</td>
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</table>

-10.0 -5.0 0 5.0 10.0
Favours exercise Favours no treatment

Analysis 01.02. Comparison 01 Exercise versus no treatment control, Outcome 02 Change in body mass index (BMI)

Review: Exercise for overweight or obesity
Comparison: 01 Exercise versus no treatment control
Outcome: 02 Change in body mass index (BMI)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Anderssen 1996</td>
<td>49</td>
<td>-0.65 (1.50)</td>
<td>43</td>
<td>0.36 (0.80)</td>
</tr>
<tr>
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<td>39</td>
<td>0.30 (0.64)</td>
</tr>
<tr>
<td>Thong 2000</td>
<td>16</td>
<td>-2.40 (0.40)</td>
<td>8</td>
<td>-0.03 (0.30)</td>
</tr>
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</table>

-10.0 -5.0 0 5.0 10.0
Favours exercise Favours no treatment

Analysis 01.03. Comparison 01 Exercise versus no treatment control, Outcome 03 Change in systolic blood pressure (mmHg)

Review: Exercise for overweight or obesity
Comparison: 01 Exercise versus no treatment control
Outcome: 03 Change in systolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-5.00 (13.90)</td>
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<td>-1.00 (6.40)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.80 (8.10)</td>
<td>91</td>
<td>-1.00 (7.70)</td>
</tr>
</tbody>
</table>

-10.0 -5.0 0 5.0 10.0
Favours exercise Favours no treatment

Exercise for overweight or obesity (Review)
Copyright © 2007 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd
### Analysis 01.04. Comparison 01 Exercise versus no treatment control, Outcome 04 Change in diastolic blood pressure (mmHg)

**Review:** Exercise for overweight or obesity  
**Comparison:** 01 Exercise versus no treatment control  
**Outcome:** 04 Change in diastolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-4.00 (8.00)</td>
<td>24.3</td>
<td>-3.00 [ -6.22, 0.22 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-1.20 (6.50)</td>
<td>75.7</td>
<td>-1.80 [ -3.62, 0.02 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>129</td>
<td></td>
<td>100.0</td>
<td>-2.09 [ -3.68, -0.51 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.40 df=1 p=0.52 I² =0.0%

Test for overall effect z=2.59  p=0.01

### Analysis 01.05. Comparison 01 Exercise versus no treatment control, Outcome 05 Change in total serum cholesterol (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 01 Exercise versus no treatment control  
**Outcome:** 05 Change in total serum cholesterol (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.12 (0.73)</td>
<td>16.4</td>
<td>0.01 [ -0.29, 0.31 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.14 (0.56)</td>
<td>62.5</td>
<td>0.05 [ -0.11, 0.21 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>-0.25 (0.64)</td>
<td>21.1</td>
<td>-0.02 [ -0.29, 0.25 ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>176</td>
<td></td>
<td>100.0</td>
<td>0.03 [ -0.09, 0.15 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.21 df=2 p=0.90 I² =0.0%

Test for overall effect z=0.46  p=0.6
### Analysis 01.06. Comparison 01 Exercise versus no treatment control, Outcome 06 Change in serum triglycerides (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 01 Exercise versus no treatment control  
**Outcome:** 06 Change in serum triglycerides (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
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</thead>
<tbody>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.10 (0.75)</td>
<td>39</td>
<td>0.06 (0.45)</td>
<td>21.3 [-0.16 [-0.43, 0.11]]</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.14 (0.54)</td>
<td>91</td>
<td>0.06 (0.70)</td>
<td>48.5 [-0.20 [-0.38, -0.02]]</td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>-0.16 (0.50)</td>
<td>42</td>
<td>0.00 (0.60)</td>
<td>30.1 [-0.16 [-0.39, 0.07]]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>176</td>
<td></td>
<td>172</td>
<td></td>
<td>100.0 [-0.18 [-0.31, -0.05]]</td>
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</tbody>
</table>

Test for heterogeneity chi-square=0.10 df=2 p=0.95 I² =0.0%
Test for overall effect z=2.77 p=0.006

### Analysis 01.07. Comparison 01 Exercise versus no treatment control, Outcome 07 Change in serum HDL (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 01 Exercise versus no treatment control  
**Outcome:** 07 Change in serum HDL (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
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</thead>
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<tr>
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<td>39</td>
<td>0.01 (0.18)</td>
<td>39</td>
<td>-0.02 (0.21)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>0.04 (0.14)</td>
<td>91</td>
<td>0.01 (0.13)</td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>0.11 (0.15)</td>
<td>42</td>
<td>-0.02 (0.11)</td>
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</table>

Test for heterogeneity chi-square=0.10 df=2 p=0.95 I² =0.0%
**Analysis 01.08. Comparison 01 Exercise versus no treatment control, Outcome 08 Change in fasting serum glucose (mmol/l)**

**Review:** Exercise for overweight or obesity  
**Comparison:** 01 Exercise versus no treatment control  
**Outcome:** 08 Change in fasting serum glucose (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>No treatment</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
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<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI (%)</td>
</tr>
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<td>Andersen 1996</td>
<td>49</td>
<td>-0.09 (0.40)</td>
<td>43</td>
<td>0.07 (0.45)</td>
<td>51.2</td>
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<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.37 (0.49)</td>
<td>91</td>
<td>-0.18 (0.72)</td>
<td>48.8</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>139</td>
<td></td>
<td>134</td>
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<td>100.0</td>
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</table>

Test for heterogeneity chi-square=0.06 df=1 p=0.81 I² =0.0%
Test for overall effect z=2.73 p=0.006

---

**Analysis 02.01. Comparison 02 Exercise versus diet, Outcome 01 Weight change in kilograms**

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 01 Weight change in kilograms

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
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<tbody>
<tr>
<td></td>
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<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>95% CI</td>
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<tr>
<td>Gordon 1997</td>
<td>14</td>
<td>-1.00 (1.80)</td>
<td>15</td>
<td>-5.80 (3.90)</td>
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<td>Pritchard 1997</td>
<td>21</td>
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<tr>
<td>Schwartz 1987</td>
<td>14</td>
<td>-2.80 (3.60)</td>
<td>12</td>
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<tr>
<td>Schwartz 1990</td>
<td>18</td>
<td>-2.30 (3.40)</td>
<td>13</td>
<td>-13.60 (6.70)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.50 (2.80)</td>
<td>95</td>
<td>-2.80 (3.50)</td>
</tr>
<tr>
<td>Thong 2000</td>
<td>16</td>
<td>-7.60 (0.40)</td>
<td>14</td>
<td>-7.40 (0.80)</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>33</td>
<td>-2.10 (4.20)</td>
<td>35</td>
<td>-9.10 (6.40)</td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>-4.00 (3.90)</td>
<td>42</td>
<td>-7.20 (3.70)</td>
</tr>
</tbody>
</table>

---

Exercise for overweight or obesity (Review)  
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### Analysis 02.02. Comparison 02 Exercise versus diet, Outcome 02 Change in body mass index (BMI)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 02 Change in body mass index (BMI)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
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<td>40</td>
<td>-0.30 (1.02)</td>
</tr>
<tr>
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<td>14</td>
<td>-2.40 (0.80)</td>
</tr>
<tr>
<td>Wing 1988</td>
<td>33</td>
<td>-0.80 (1.50)</td>
<td>35</td>
<td>-3.30 (2.20)</td>
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</tbody>
</table>

### Analysis 02.03. Comparison 02 Exercise versus diet, Outcome 03 Change in systolic blood pressure (mmHg)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 03 Change in systolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
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<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
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<td>-9.90 (6.40)</td>
<td>15</td>
<td>-11.30 (12.10)</td>
</tr>
<tr>
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<td>39</td>
<td>-5.00 (13.90)</td>
<td>40</td>
<td>-7.00 (11.30)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.80 (8.10)</td>
<td>95</td>
<td>-2.60 (7.80)</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>33</td>
<td>-2.40 (18.90)</td>
<td>35</td>
<td>-10.20 (9.20)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>176</td>
<td>185</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square = 2.54 df = 3 p = 0.47 I² = 0.0%  
Test for overall effect z = 2.25 p = 0.02
### Analysis 02.04. Comparison 02 Exercise versus diet, Outcome 04 Change in diastolic blood pressure (mmHg)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 04 Change in diastolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gordon 1997</td>
<td>14</td>
<td>-5.90 (4.60)</td>
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<td>16.2</td>
<td>1.60 [-1.65, 4.85]</td>
<td></td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-4.00 (8.00)</td>
<td></td>
<td>16.5</td>
<td>2.00 [-1.22, 5.22]</td>
<td></td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-1.20 (6.50)</td>
<td></td>
<td>59.8</td>
<td>-0.10 [-1.79, 1.59]</td>
<td></td>
</tr>
<tr>
<td>Wing 1998</td>
<td>33</td>
<td>-1.70 (12.20)</td>
<td></td>
<td>7.6</td>
<td>4.50 [-0.25, 9.25]</td>
<td></td>
</tr>
</tbody>
</table>

**Total (95% CI):** 176 185  
Weighted Mean Difference (Fixed): 0.87 [-0.44, 2.18]  
Test for heterogeneity chi-square=4.18 df=3 p=0.24 I² =28.2%  
Test for overall effect z=1.30  p=0.2

---

### Analysis 02.05. Comparison 02 Exercise versus diet, Outcome 05 Change in total serum cholesterol (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 05 Change in total serum cholesterol (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.12 (0.73)</td>
<td></td>
<td>0.07</td>
<td>-0.31, 0.45</td>
</tr>
<tr>
<td>Schwartz 1987</td>
<td>14</td>
<td>0.18 (0.44)</td>
<td></td>
<td>0.92</td>
<td>0.46, 1.38</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>90</td>
<td>-0.14 (0.56)</td>
<td></td>
<td>0.13</td>
<td>-0.02, 0.28</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>33</td>
<td>0.12 (0.72)</td>
<td></td>
<td>0.61</td>
<td>0.27, 0.95</td>
</tr>
<tr>
<td>Wood 1988</td>
<td>47</td>
<td>-0.25 (0.60)</td>
<td></td>
<td>0.11</td>
<td>-0.13, 0.35</td>
</tr>
</tbody>
</table>

**Total (95% CI):** 176 185  
Weighted Mean Difference (Fixed): 0.67 [-0.61, 2.04]  
Test for heterogeneity chi-square=4.06 df=3 p=0.26 I² =18.2%  
Test for overall effect z=1.28  p=0.2
### Analysis 02.06. Comparison 02 Exercise versus diet, Outcome 06 Change in serum triglycerides (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 06 Change in serum triglycerides (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Mean(SD) N Mean(SD)</td>
<td>95% CI</td>
<td>95% CI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hellenius 1993 39 -0.10 (0.75) 40 0.03 (0.39)</td>
<td>-0.13 [-0.39, 0.13 ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwartz 1987 14 -0.02 (0.40) 12 -0.60 (0.75)</td>
<td>0.58 [ 0.11, 1.05 ]</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stefanick 1998 90 -0.14 (0.54) 95 -0.06 (0.70)</td>
<td>-0.08 [-0.26, 0.10 ]</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Wing 1998 33 0.12 (1.64) 35 -0.30 (1.50)</td>
<td>0.42 [ -0.33, 1.17 ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood 1988 47 -0.16 (0.50) 42 -0.27 (0.72)</td>
<td>0.11 [-0.15, 0.37 ]</td>
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</tr>
</tbody>
</table>

### Analysis 02.07. Comparison 02 Exercise versus diet, Outcome 07 Change in serum HDL (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 07 Change in serum HDL (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Mean(SD) N Mean(SD)</td>
<td>95% CI</td>
<td>95% CI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hellenius 1993 39 0.01 (0.18) 40 0.01 (0.19)</td>
<td>0.00 [-0.08, 0.08 ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwartz 1987 14 0.08 (0.08) 12 0.10 (0.23)</td>
<td>-0.02 [-0.16, 0.12 ]</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stefanick 1998 90 0.04 (0.14) 95 -0.01 (0.13)</td>
<td>0.05 [ 0.01, 0.09 ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wing 1998 33 0.02 (0.16) 35 0.10 (0.20)</td>
<td>-0.08 [-0.17, 0.01 ]</td>
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</tr>
<tr>
<td>Wood 1988 47 0.11 (0.15) 42 0.12 (0.16)</td>
<td>-0.01 [-0.07, 0.05 ]</td>
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</tbody>
</table>
### Analysis 02.08. Comparison 02 Exercise versus diet, Outcome 08 Change in fasting serum glucose (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 02 Exercise versus diet  
**Outcome:** 08 Change in fasting serum glucose (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise</th>
<th>Diet</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.6</td>
<td>-0.09 (0.40)</td>
<td>-0.21 (0.50)</td>
<td>3.6</td>
<td>0.12 [-0.06, 0.30]</td>
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</tr>
<tr>
<td>55.3</td>
<td>-0.37 (0.49)</td>
<td>-0.43 (0.43)</td>
<td>5.3</td>
<td>0.06 [-0.07, 0.19]</td>
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<tr>
<td>13.1</td>
<td>0.00 (0.70)</td>
<td>-0.20 (0.40)</td>
<td>1.1</td>
<td>0.20 [-0.07, 0.47]</td>
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<tr>
<td>100.0</td>
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</tr>
<tr>
<td>Test for heterogeneity chi-square=0.91 df=2 p=0.63 I²=0.0%</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Test for overall effect z=1.93 p=0.05</td>
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### Analysis 03.01. Comparison 03 Exercise + diet versus diet alone, Outcome 01 Weight change in kilograms

**Review:** Exercise for overweight or obesity  
**Comparison:** 03 Exercise + diet versus diet alone  
**Outcome:** 01 Weight change in kilograms

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Mean(SD)</td>
<td>N Mean(SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>-15.20 (6.30)</td>
<td>-14.80 (5.30)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.6</td>
<td>-7.10 (2.90)</td>
<td>-5.80 (3.90)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>11.5</td>
<td>-4.80 (0.70)</td>
<td>-3.20 (1.20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.4</td>
<td>-10.50 (3.60)</td>
<td>-10.00 (3.90)</td>
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<tr>
<td>2.8</td>
<td>-6.90 (5.50)</td>
<td>-4.50 (5.70)</td>
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<tr>
<td>1.3</td>
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<td>-11.40 (3.50)</td>
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<tr>
<td>7.8</td>
<td>-3.70 (4.00)</td>
<td>-2.80 (3.50)</td>
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<tr>
<td>6.9</td>
<td>-10.30 (3.00)</td>
<td>-9.50 (2.80)</td>
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<tr>
<td>1.5</td>
<td>-16.40 (7.30)</td>
<td>-16.70 (5.50)</td>
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<td>1.2</td>
<td>-17.70 (4.20)</td>
<td>-13.10 (2.40)</td>
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<tr>
<td>0.8</td>
<td>-10.30 (7.70)</td>
<td>-9.10 (6.40)</td>
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</tbody>
</table>

Test for heterogeneity chi-square=17.0 df=2 p=0.0001 I²=79.7%
Test for overall effect z=2.18 p=0.029

(Continued ...)
<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
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<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>CI (%)</td>
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<tr>
<td>Wood 1991</td>
<td>81</td>
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<td>71</td>
<td>-2.30 (6.00)</td>
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<tr>
<td>Subtotal (95% CI)</td>
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<td>470</td>
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<tr>
<td>02 Weight change - males</td>
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<tr>
<td>Aggel-Leijssen 2001</td>
<td>20</td>
<td>-15.20 (6.30)</td>
<td>17</td>
<td>-14.80 (5.30)</td>
<td>0.6</td>
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<tr>
<td>Ross 1996</td>
<td>22</td>
<td>-12.40 (3.90)</td>
<td>11</td>
<td>-11.40 (3.50)</td>
<td>1.3</td>
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<tr>
<td>Subtotal (95% CI)</td>
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<td>28</td>
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<tr>
<td>03 Weight change - females</td>
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</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-10.50 (3.60)</td>
<td>13</td>
<td>-10.00 (3.90)</td>
<td>1.4</td>
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<tr>
<td>Neumark 1995</td>
<td>21</td>
<td>-3.60 (2.60)</td>
<td>19</td>
<td>-3.80 (2.00)</td>
<td>4.4</td>
</tr>
<tr>
<td>Nierman 1998</td>
<td>22</td>
<td>-7.80 (3.30)</td>
<td>26</td>
<td>-8.00 (3.10)</td>
<td>2.7</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-10.30 (3.00)</td>
<td>50</td>
<td>-9.50 (2.80)</td>
<td>6.9</td>
</tr>
<tr>
<td>Wadden 1997</td>
<td>91</td>
<td>-16.40 (7.30)</td>
<td>29</td>
<td>-16.70 (5.50)</td>
<td>1.5</td>
</tr>
<tr>
<td>Whatley 1994</td>
<td>16</td>
<td>-17.70 (4.20)</td>
<td>7</td>
<td>-13.10 (2.40)</td>
<td>1.2</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
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<td>144</td>
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<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>04 Weight change - mean age &lt; 45 years</td>
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</tr>
<tr>
<td>Aggel-Leijssen 2001</td>
<td>20</td>
<td>-15.20 (6.30)</td>
<td>17</td>
<td>-14.80 (5.30)</td>
<td>0.6</td>
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<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-10.50 (3.60)</td>
<td>13</td>
<td>-10.00 (3.90)</td>
<td>1.4</td>
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<tr>
<td>Kiernan 2001</td>
<td>81</td>
<td>-6.90 (5.50)</td>
<td>71</td>
<td>-5.50 (5.70)</td>
<td>2.8</td>
</tr>
<tr>
<td>Ross 1996</td>
<td>22</td>
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<td>11</td>
<td>-11.40 (3.50)</td>
<td>1.3</td>
</tr>
<tr>
<td>Wadden 1997</td>
<td>91</td>
<td>-16.40 (7.30)</td>
<td>29</td>
<td>-16.70 (5.50)</td>
<td>1.5</td>
</tr>
<tr>
<td>Whatley 1994</td>
<td>16</td>
<td>-17.70 (4.20)</td>
<td>7</td>
<td>-13.10 (2.40)</td>
<td>1.2</td>
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<tr>
<td>Subtotal (95% CI)</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>05 Weight change - mean age &gt; 45 years</td>
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<td></td>
</tr>
<tr>
<td>Gordon 1997</td>
<td>19</td>
<td>-7.10 (2.90)</td>
<td>15</td>
<td>-5.80 (3.90)</td>
<td>1.6</td>
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<tr>
<td>Hays 2004</td>
<td>11</td>
<td>-4.80 (0.90)</td>
<td>11</td>
<td>-3.20 (1.20)</td>
<td>1.1</td>
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<tr>
<td>Nierman 1998</td>
<td>22</td>
<td>-7.80 (3.30)</td>
<td>26</td>
<td>-8.00 (3.10)</td>
<td>2.7</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-10.30 (3.00)</td>
<td>50</td>
<td>-9.50 (2.80)</td>
<td>6.9</td>
</tr>
</tbody>
</table>
### Analysis 03.02. Comparison 03 Exercise + diet versus diet alone, Outcome 02 Change in body mass index (BMI)

Review: Exercise for overweight or obesity

Comparison: 03 Exercise + diet versus diet alone

Outcome: 02 Change in body mass index (BMI)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI (%)</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-10.30 (7.70)</td>
<td>35</td>
<td>-9.10 (6.40)</td>
<td>0.8</td>
</tr>
<tr>
<td>Anderssen 1996</td>
<td>65</td>
<td>-2.20 (1.80)</td>
<td>52</td>
<td>-1.60 (1.80)</td>
<td>18.5</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.60 (1.00)</td>
<td>40</td>
<td>-0.30 (1.00)</td>
<td>41.0</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-4.00 (1.10)</td>
<td>13</td>
<td>-4.00 (1.40)</td>
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<tr>
<td>Kiernan 2001</td>
<td>81</td>
<td>-2.30 (1.80)</td>
<td>71</td>
<td>-1.60 (1.80)</td>
<td>24.2</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-3.70 (2.60)</td>
<td>35</td>
<td>-3.30 (2.20)</td>
<td>5.8</td>
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<tr>
<td>Total (95% CI)</td>
<td>241</td>
<td>211</td>
<td>241</td>
<td>211</td>
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</table>

Test for heterogeneity chi-square=2.37 df=4 p=0.67 I² =0.0%

Test for overall effect z=2.96  p=0.003
### Analysis 03.03. Comparison 03 Exercise + diet versus diet alone, Outcome 03 Change in systolic blood pressure (mmHg)

**Review:** Exercise for overweight or obesity  
**Comparison:** 03 Exercise + diet versus diet alone  
**Outcome:** 03 Change in systolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
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<td>19</td>
<td>-12.50 (6.30)</td>
<td>15</td>
<td>-11.30 (12.10)</td>
<td>4.1</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-4.00 (9.60)</td>
<td>40</td>
<td>-7.00 (11.30)</td>
<td>8.7</td>
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<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-3.10 (7.60)</td>
<td>95</td>
<td>-2.60 (7.80)</td>
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<td>Svendsen 1993</td>
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<td>-11.00 (11.00)</td>
<td>50</td>
<td>-13.00 (12.00)</td>
<td>8.9</td>
</tr>
<tr>
<td>Wing 1998</td>
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<td>-12.30 (9.50)</td>
<td>35</td>
<td>-10.20 (9.20)</td>
<td>9.1</td>
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<tr>
<td>Wood 1991</td>
<td>81</td>
<td>-4.50 (8.00)</td>
<td>71</td>
<td>-4.10 (7.30)</td>
<td>31.3</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>309</strong></td>
<td><strong>Mean(SD) = 306</strong></td>
<td><strong>Mean(SD) =</strong></td>
<td><strong>95% CI = [0.0]</strong></td>
<td><strong>95% CI = [-1.48, 1.25]</strong></td>
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</table>

Test for heterogeneity chi-square=3.58 df=5 p=0.61 I² =0.0%
Test for overall effect z=0.16  p=0.9

---

### Analysis 03.04. Comparison 03 Exercise + diet versus diet alone, Outcome 04 Change in diastolic blood pressure (mmHg)

**Review:** Exercise for overweight or obesity  
**Comparison:** 03 Exercise + diet versus diet alone  
**Outcome:** 04 Change in diastolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Gordon 1997</td>
<td>19</td>
<td>-7.90 (4.30)</td>
<td>15</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-2.00 (8.00)</td>
<td>40</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-2.90 (5.60)</td>
<td>95</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-9.00 (8.00)</td>
<td>50</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-6.90 (10.40)</td>
<td>35</td>
</tr>
<tr>
<td>Wood 1991</td>
<td>81</td>
<td>-3.50 (4.90)</td>
<td>71</td>
</tr>
</tbody>
</table>

---
### Analysis 03.05. Comparison 03 Exercise + diet versus diet alone, Outcome 05 Change in total serum cholesterol (mmol/l)

Review: Exercise for overweight or obesity
Comparison: 03 Exercise + diet versus diet alone
Outcome: 05 Change in total serum cholesterol (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.45 (1.02)</td>
<td>40</td>
<td>-0.19 (0.97)</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-0.15 (0.48)</td>
<td>13</td>
<td>-0.83 (0.36)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-0.49 (0.53)</td>
<td>95</td>
<td>-0.27 (0.50)</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-1.23 (0.70)</td>
<td>50</td>
<td>-1.40 (0.80)</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-0.33 (0.61)</td>
<td>35</td>
<td>-0.49 (0.71)</td>
</tr>
<tr>
<td>Wood 1991</td>
<td>81</td>
<td>-0.32 (0.70)</td>
<td>71</td>
<td>-0.40 (0.60)</td>
</tr>
</tbody>
</table>

Total (95% CI) 315 304
Test for heterogeneity chi-square=8.96 df=5 p=0.11 I² =44.2%
Test for overall effect z=1.55 p=0.1

### Analysis 03.06. Comparison 03 Exercise + diet versus diet alone, Outcome 06 Change in serum triglycerides (mmol/l)

Review: Exercise for overweight or obesity
Comparison: 03 Exercise + diet versus diet alone
Outcome: 06 Change in serum triglycerides (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.12 (0.62)</td>
<td>40</td>
<td>0.03 (0.39)</td>
<td>18.7 [-0.15, -0.38, 0.08]</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-0.31 (0.70)</td>
<td>13</td>
<td>-0.32 (1.60)</td>
<td>1.2 [0.01, -0.90, 0.92]</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-0.10 (0.60)</td>
<td>95</td>
<td>-0.06 (0.70)</td>
<td>28.0 [-0.04, -0.23, 0.15]</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-0.30 (0.46)</td>
<td>50</td>
<td>-0.50 (0.70)</td>
<td>18.0 [0.20, -0.03, 0.43]</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-0.69 (1.45)</td>
<td>35</td>
<td>-0.30 (1.45)</td>
<td>2.0 [-0.39, -1.09, 0.31]</td>
</tr>
<tr>
<td>Wood 1991</td>
<td>81</td>
<td>-0.24 (0.60)</td>
<td>71</td>
<td>-0.03 (0.50)</td>
<td>32.1 [-0.21, -0.38, -0.04]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>315</td>
<td></td>
<td>304</td>
<td></td>
<td>100.0 [-0.08, -0.18, 0.02]</td>
</tr>
</tbody>
</table>

Exercise for overweight or obesity (Review)
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### Analysis 03.07. Comparison 03 Exercise + diet versus diet alone, Outcome 07 Change in serum HDL (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 03 Exercise + diet versus diet alone  
**Outcome:** 07 Change in serum HDL (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Hellenius 1993</td>
<td>39</td>
<td>-0.03 (0.21)</td>
<td>40</td>
<td>0.01 (0.19)</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-0.06 (0.14)</td>
<td>13</td>
<td>-0.05 (0.24)</td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-0.01 (0.15)</td>
<td>95</td>
<td>-0.01 (0.13)</td>
</tr>
<tr>
<td>Svendsen 1993</td>
<td>48</td>
<td>-0.10 (0.23)</td>
<td>50</td>
<td>-0.05 (0.31)</td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>0.06 (0.16)</td>
<td>35</td>
<td>0.10 (0.17)</td>
</tr>
<tr>
<td>Wood 1991</td>
<td>81</td>
<td>0.08 (0.18)</td>
<td>71</td>
<td>-0.05 (0.20)</td>
</tr>
</tbody>
</table>

---

### Analysis 03.08. Comparison 03 Exercise + diet versus diet alone, Outcome 08 Change in fasting serum glucose (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 03 Exercise + diet versus diet alone  
**Outcome:** 08 Change in fasting serum glucose (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>Diet + exercise</th>
<th>Diet alone</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Andersen 1996</td>
<td>65</td>
<td>-0.26 (0.60)</td>
<td>52</td>
<td>-0.21 (0.30)</td>
<td></td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>25</td>
<td>-0.10 (0.50)</td>
<td>13</td>
<td>-0.10 (0.40)</td>
<td></td>
</tr>
<tr>
<td>Stefanick 1998</td>
<td>91</td>
<td>-0.43 (0.53)</td>
<td>95</td>
<td>-0.43 (0.43)</td>
<td></td>
</tr>
<tr>
<td>Wing 1998</td>
<td>31</td>
<td>-0.20 (0.40)</td>
<td>35</td>
<td>-0.20 (0.40)</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>212</td>
<td>195</td>
<td></td>
<td></td>
<td>1000.0</td>
</tr>
</tbody>
</table>

Test for heterogeneity: chi-square=0.19 df=3 p=0.98 I² =0.0%  
Test for overall effect: z=0.23 p=0.8
## Analysis 04.01. Comparison 04 High versus low intensity exercise with dietary change, Outcome 01 Weight change in kilograms

**Review:** Exercise for overweight or obesity  
**Comparison:** 04 High versus low intensity exercise with dietary change  
**Outcome:** 01 Weight change in kilograms

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson 1999</td>
<td>20 -8.30 (3.80)</td>
<td>20 -7.90 (4.20)</td>
<td>20.2 -0.40 [-2.88, 2.08]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cox 2004</td>
<td>15 -11.66 (3.10)</td>
<td>14 -10.88 (3.30)</td>
<td>22.8 -0.78 [-3.11, 1.55]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jakicic 1995</td>
<td>27 -6.40 (4.50)</td>
<td>25 -8.90 (5.30)</td>
<td>17.3 2.50 [-0.18, 5.18]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>11 -11.10 (4.40)</td>
<td>14 -10.00 (3.00)</td>
<td>13.5 -1.10 [-4.14, 1.94]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leutholtz 1995</td>
<td>20 -15.70 (5.30)</td>
<td>20 -15.00 (8.40)</td>
<td>6.6 -0.70 [-5.05, 3.65]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whatley 1994</td>
<td>8 -19.60 (4.20)</td>
<td>8 -15.80 (4.20)</td>
<td>7.3 -3.80 [-7.92, 0.32]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>112</td>
<td>112</td>
<td>100.0 -0.08 [-1.20, 1.04]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=8.95 df=6 p=0.18 I² =33.0%  
Test for overall effect z=0.14 p=0.9

---

## Analysis 04.02. Comparison 04 High versus low intensity exercise with dietary change, Outcome 02 Change in body mass index (BMI)

**Review:** Exercise for overweight or obesity  
**Comparison:** 04 High versus low intensity exercise with dietary change  
**Outcome:** 02 Change in body mass index (BMI)

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janssen 2002</td>
<td>11 -4.20 (1.20)</td>
<td>14 -3.90 (1.00)</td>
<td>-0.30 [-1.18, 0.58]</td>
<td></td>
</tr>
</tbody>
</table>
### Analysis 04.03. Comparison 04 High versus low intensity exercise with dietary change, Outcome 03 Change in systolic blood pressure (mmHg)

Review: Exercise for overweight or obesity
Comparison: 04 High versus low intensity exercise with dietary change
Outcome: 03 Change in systolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity</th>
<th>Low Intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Anderson 1999</td>
<td>20</td>
<td>-7.00 (7.10)</td>
<td>20</td>
<td>-7.90 (11.60)</td>
</tr>
</tbody>
</table>

### Analysis 04.04. Comparison 04 High versus low intensity exercise with dietary change, Outcome 04 Change in diastolic blood pressure (mmHg)

Review: Exercise for overweight or obesity
Comparison: 04 High versus low intensity exercise with dietary change
Outcome: 04 Change in diastolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity</th>
<th>Low Intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Anderson 1999</td>
<td>20</td>
<td>-2.90 (7.80)</td>
<td>20</td>
<td>2.40 (18.30)</td>
</tr>
</tbody>
</table>

### Analysis 04.05. Comparison 04 High versus low intensity exercise with dietary change, Outcome 05 Change in serum cholesterol (mmol/l)

Review: Exercise for overweight or obesity
Comparison: 04 High versus low intensity exercise with dietary change
Outcome: 05 Change in serum cholesterol (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity</th>
<th>Low Intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Anderson 1999</td>
<td>20</td>
<td>-0.58 (0.40)</td>
<td>20</td>
<td>-0.50 (0.70)</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>11</td>
<td>0.42 (0.60)</td>
<td>14</td>
<td>-0.60 (0.40)</td>
</tr>
</tbody>
</table>
### Analysis 04.06. Comparison 04 High versus low intensity exercise with dietary change, Outcome 06 Change in serum triglycerides (mmol/l)

Review: Exercise for overweight or obesity  
Comparison: 04 High versus low intensity exercise with dietary change  
Outcome: 06 Change in serum triglycerides (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity</th>
<th>Low Intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson 1999</td>
<td>20</td>
<td>20</td>
<td>-0.20 (0.20)</td>
<td>87.3</td>
<td>-0.01</td>
<td>[-0.21, 0.19]</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>11</td>
<td>14</td>
<td>-0.26 (0.50)</td>
<td>12.7</td>
<td>0.09</td>
<td>[-0.42, 0.60]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>31</td>
<td>34</td>
<td>100.0</td>
<td>0.00</td>
<td>0.00</td>
<td>[-0.18, 0.19]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.13 df=1 p=0.72 I² =0.0%
Test for overall effect z=0.03  p=1

### Analysis 04.07. Comparison 04 High versus low intensity exercise with dietary change, Outcome 07 Change in serum HDL (mmol/l)

Review: Exercise for overweight or obesity  
Comparison: 04 High versus low intensity exercise with dietary change  
Outcome: 07 Change in serum HDL (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity</th>
<th>Low Intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson 1999</td>
<td>20</td>
<td>20</td>
<td>-0.13 (0.20)</td>
<td>63.5</td>
<td>0.01</td>
<td>[-0.09, 0.11]</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>11</td>
<td>14</td>
<td>-0.03 (0.20)</td>
<td>36.5</td>
<td>0.06</td>
<td>[-0.07, 0.19]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>31</td>
<td>34</td>
<td>100.0</td>
<td>0.03</td>
<td>0.03</td>
<td>[-0.05, 0.11]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.36 df=1 p=0.55 I² =0.0%
Test for overall effect z=0.71  p=0.5
### Analysis 04.08. Comparison 04 High versus low intensity exercise with dietary change, Outcome 08 Change in serum glucose (mmol/l)

Review: Exercise for overweight or obesity
Comparison: 04 High versus low intensity exercise with dietary change
Outcome: 08 Change in serum glucose (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High Intensity Mean(SD)</th>
<th>Low Intensity Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Janssen 2002</td>
<td>-0.10 (0.50)</td>
<td>-0.10 (0.40)</td>
<td>0.00</td>
<td>[-0.36, 0.36]</td>
</tr>
</tbody>
</table>

### Analysis 05.01. Comparison 05 High versus low intensity exercise without dietary change, Outcome 01 Weight change in kilograms

Review: Exercise for overweight or obesity
Comparison: 05 High versus low intensity exercise without dietary change
Outcome: 01 Weight change in kilograms

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity Mean(SD)</th>
<th>Low intensity Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Cox 2004</td>
<td>-1.55 (2.40)</td>
<td>17 -0.44 (1.80)</td>
<td>26.9</td>
<td>-1.11 [ -2.67, 0.45 ]</td>
</tr>
<tr>
<td>Irwin 2003</td>
<td>-1.30 (3.60)</td>
<td>66 0.10 (3.40)</td>
<td>60.1</td>
<td>-1.40 [ -2.44, -0.36 ]</td>
</tr>
<tr>
<td>Jelicic 2003</td>
<td>-8.90 (7.30)</td>
<td>49 -6.30 (5.60)</td>
<td>9.9</td>
<td>-2.60 [ -5.18, -0.02 ]</td>
</tr>
<tr>
<td>Wallace 1997</td>
<td>-4.20 (4.10)</td>
<td>8 -1.90 (5.10)</td>
<td>3.2</td>
<td>-2.30 [ -6.83, 2.23 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>157 160</td>
<td></td>
<td>100.0</td>
<td>-1.47 [ -2.28, -0.66 ]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=1.09 df=3 p=0.78 I² =0.0%
Test for overall effect z=3.56  p=0.0004

### Analysis 05.02. Comparison 05 High versus low intensity exercise without dietary change, Outcome 02 Change in systolic blood pressure (mmHg)

Review: Exercise for overweight or obesity
Comparison: 05 High versus low intensity exercise without dietary change
Outcome: 02 Change in systolic blood pressure (mmHg)

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity Mean(SD)</th>
<th>Low intensity Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>Cox 1996</td>
<td>-3.60 (4.15)</td>
<td>17 -3.20 (3.38)</td>
<td>-0.40</td>
<td>[-3.17, 2.37]</td>
</tr>
</tbody>
</table>

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## Analysis 05.03. Comparison 05 High versus low intensity exercise without dietary change, Outcome 03
Change in diastolic blood pressure

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cox 1996</td>
<td>13 -2.90 (2.20)</td>
<td>17 -3.10 (3.10)</td>
<td>0.20 [ -1.70, 2.10 ]</td>
<td></td>
</tr>
</tbody>
</table>

### Analysis 05.04. Comparison 05 High versus low intensity exercise without dietary change, Outcome 04
Change in serum triglycerides (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallace 1997</td>
<td>8 -0.49 (0.15)</td>
<td>8 -0.36 (0.14)</td>
<td>-0.13 [ -0.27, 0.01 ]</td>
<td></td>
</tr>
</tbody>
</table>

### Analysis 05.05. Comparison 05 High versus low intensity exercise without dietary change, Outcome 05
Change in serum HDL (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallace 1997</td>
<td>8 0.13 (0.03)</td>
<td>8 0.07 (0.04)</td>
<td>0.06 [ 0.03, 0.09 ]</td>
<td></td>
</tr>
</tbody>
</table>
### Analysis 05.06. Comparison 05 High versus low intensity exercise without dietary change, Outcome 06 Change in serum glucose (mmol/l)

**Review:** Exercise for overweight or obesity  
**Comparison:** 05 High versus low intensity exercise without dietary change  
**Outcome:** 06 Change in serum glucose (mmol/l)

<table>
<thead>
<tr>
<th>Study</th>
<th>High intensity N</th>
<th>Mean(SD)</th>
<th>Low intensity N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed) 95% CI (%)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cox 2004</td>
<td>13</td>
<td>-0.01 (0.50)</td>
<td>17</td>
<td>0.51 (1.00)</td>
<td>6.7</td>
<td>-0.52 [-1.07, 0.03]</td>
<td></td>
</tr>
<tr>
<td>Wallace 1997</td>
<td>8</td>
<td>-0.62 (0.16)</td>
<td>8</td>
<td>-0.33 (0.14)</td>
<td>93.3</td>
<td>-0.29 [-0.44, -0.14]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>21</td>
<td></td>
<td>25</td>
<td></td>
<td>100.0</td>
<td>-0.31 [-0.45, -0.16]</td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square=0.63 df=1 p=0.43 I² =0.0%
Test for overall effect z=4.21 p=0.00003