Long-term non-pharmacological weight loss interventions for adults with prediabetes (Review)

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[Intervention Review]

Long-term non-pharmacological weight loss interventions for adults with prediabetes

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ABSTRACT

Background

Most persons with prediabetes (impaired glucose tolerance or impaired fasting glucose) are overweight, and obesity worsens the metabolic and physiologic abnormalities associated with this condition. Prediabetes is an important risk factor for the development of type 2 diabetes.

Objectives

The objective of this review was to assess the effectiveness of dietary, physical activity, and behavioral weight loss, and weight control interventions for adults with prediabetes.

Search methods

Studies were obtained from computerized searches of multiple electronic bibliographic dababases, supplemented by hand searches of selected journals, and consultation with experts in obesity research. The last search was conducted May, 2004.

Selection criteria

Studies were included if they were published or unpublished randomized controlled trials in any language and examined weight loss or weight control strategies using one or more dietary, physical activity, or behavioral interventions, with a follow-up interval of at least 12 months.

Data collection and analysis

Effects were combined using a random-effects model.

Main results

Nine studies were identified, with a total of 5,168 participants. Follow-up ranged from 1 to 10 years. Quantitative synthesis was limited by the heterogeneity of populations, settings, and interventions and by the small number of studies that examined outcomes other than weight. Overall, in comparisons with usual care, four studies with a follow-up of one year reduced weight by 2.8 kg (95 % confidence interval (CI) 1.0 to 4.7) (3.3% of baseline body weight) and decreased body mass index by 1.3 kg/m^2 (95% CI 0.8 to 1.9). Weight loss at two years was 2.6 kg (95% CI 1.9 to 3.3) (three studies). Modest improvements were noted in the few studies that examined glycemic control, blood pressure, or lipid concentrations (P > 0.05). No data on quality of life or mortality were found. The incidence of diabetes was significantly lower in the intervention groups versus the controls in three of five studies examining this outcome at 3 to 6 years follow-up.

Authors' conclusions

Overall, weight loss strategies using dietary, physical activity, or behavioral interventions produced significant improvements in weight among persons with prediabetes and a significant decrease in diabetes incidence. Further work is needed on the long-term effects of these interventions on morbidity and mortality and on how to implement these interventions in diverse community settings.

PLAIN LANGUAGE SUMMARY

Long-term non-pharmacological weight loss interventions for adults with prediabetes

Persons with blood glucose levels that are abnormal, but not in the range of persons with diabetes, are said to have prediabetes, which often precedes the development of type 2 diabetes. Most persons with prediabetes are overweight and obesity worsens the blood glucose and other problems associated with prediabetes. In this review we found that dietary, physical activity, or behavioral interventions produced significant improvements in weight among persons with prediabetes and a significant decrease in diabetes incidence. Modest, but not statistically significant improvements were noted in the few studies that examined blood sugar control, blood pressure, and lipid levels. No data on quality of life or mortality were found.

BACKGROUND

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG), now referred to collectively as prediabetes, dramatically increase the risk for progression to clinical diabetes (Edelstein 1997), incident cardiovascular disease, and cardiovascular mortality DECODE 2001. IFG and IGT refer to metabolic stages between normal glucose levels and diabetes. Persons with IGT have blood glucose levels greater than 7.8 mmol/L and less than 11.1 mmol/L two hours after a 75 g glucose load. IFG refers to individuals with a fasting plasma glucose greater than 5.6 mmol/L but less than 7.0 mmol/L (ADA 2004). Data from the Third National Health and Nutrition Examination survey (1988-1994) projected to the year 2000 revealed that prediabetes is highly prevalent, affecting almost 12 million overweight persons aged 45-74 years in the United States Benjamin 2003.

Weight loss and control are key goals for persons with diabetes. Weight loss improves insulin sensitivity and glycemic control (ADA 2003) lipid profiles, blood pressure (Maggio 1997), mental health, and quality of life (Wing 1987; Wing 1991). Moderate intentional weight loss sustained over time may be associated with reduced mortality (Williamson 2000; Wing 1985). Similarly, several large randomized controlled trials (RCTs) have shown that weight loss is also a potentially important management strategy for overweight persons with prediabetes, as it may delay or prevent progression to clinically defined type 2 diabetes (DPP 2002; Tuomilehto 2001). The American Diabetes Association recently recommended that "individuals at high risk for developing diabetes need to become aware of the benefits of modest weight loss and participating in regular physical activity" (ADA 2004a).

Dietary and behavioral treatment for weight loss can produce an average loss of 8% of initial body weight over 3 to 12 months (NHLBI 1998). It is difficult to define effective weight control measures for the long term in general populations, however (NHLBI 1998; O'Meara 1998). The majority of obese patients regain most of the weight initially they lost in successful interventions (Maggio 1997; Wadden 1989; Wing 1985). Similarly, Skender and colleagues note that most of the weight lost in the

early phase (16 to 20 weeks) is regained within two to five years Skender 1996.

To assess the effectiveness of dietary, physical activity, and behavioral interventions for weight loss or weight control in adults with prediabetes on the outcomes of weight, other cardiovascular risk factors, and the incidence of diabetes, we conducted a systematic review of RCTs of these interventions. The systematic review and synthesis of all available data allowed us to explore heterogeneity and applicability of interventions and outcomes, potentially achieve pooled estimates of effect with increased precision over single studies, increase the power to explore relationships between intervention characteristics and outcomes, and identify gaps in the existing literature.

OBJECTIVES

The objective of this review was to assess the effects of dietary, physical activity, and behavioral interventions on weight loss or weight control in adults with prediabetes (IFG or IGT).

Primary research questions

- Which intervention strategies achieve or maintain weight loss?
- What characteristics of effective intervention strategies correlate with weight loss or the maintenance of weight loss?
- What characteristics of populations correlate with weight loss or the maintenance of weight loss?
- How does follow-up interval relate to weight loss or the maintenance of weight loss?

Secondary research question

- What intervention strategies affect lipids, blood pressure, glycemic control, morbidity and mortality, and quality of life?

METHODS

Criteria for considering studies for this review

Types of studies

Only RCTs were included in this review, as we identified an adequate number of relevant studies of this design. We, therefore, decided not to include weaker study designs, as originally proposed. Studies with a follow-up of 12 months or greater were included, as long-term weight loss is needed to produce effects on health outcomes such as cardiovascular disease events Wing 1985. We defined the follow-up period from the time of randomization until the last measurement in the study. The intervention itself could be of any duration.
Weight or BMI at baseline and follow-up, or percent weight lost must have been presented in the study to be included.

Types of participants

Participants must have been aged 18 years or greater and have prediabetes. Prediabetes could have been defined by an abnormal oral glucose tolerance test (OGTT), IFG, or a combination of the two. Because criteria for defining IGT and IFG have changed in the last 20 years, we included studies in which participants met criteria for abnormalities at the time of the study, but who would now may be considered in a different category (for example fasting blood sugar 126 to 139 mg/dl is now considered diabetes (ADA 2004), but at the time of many of the studies was considered IFG). Study participants could be of any weight or BMI at baseline; they did not have to be overweight or obese. Weight loss or weight maintenance decreases cardiovascular risk in persons with a BMI less than 25.0 (the lower limit of overweight) (Kuller 2001; Ornish 1998).

Types of interventions

Interventions included in the review had to have weight loss or weight control as one of their primary stated goals; interventions where weight loss was a secondary or unexpected result were excluded. Interventions had to focus on the patient rather than the provider or health care system. Interventions which focused on changing provider behavior were excluded, even when outcomes were measured in the patient (for example, an intervention to educate providers about weight loss counselling, with patient weight change the primary outcome).
Interventions were classified as dietary, physical activity, or behavioral strategies. Dietary programs provided recommendations and/or material support for achieving a specific dietary regime. All types of dietary programs initiated for weight loss or control were examined in this review, including low-calorie diets (800 to 1,500 kcal/day) and very low calorie diets (less than 800 kcal/day) (NHLBI 1998). Studies were excluded if the sole purpose of the intervention was nutrition education or to teach about diet (for example, carbohydrate and fat exchanges, food consumption and the relationship to glycemia) and not explicitly to achieve weight loss or weight control.
Physical activity programs were included if one of the primary goals was to achieve weight loss or weight control by increased physical activity. Physical activity interventions included a specific approach to increasing activity levels (including counselling), an exercise prescription, or participation in either a supervised or unsupervised exercise program. Programs in which participants

were simply advised to increase their level of exercise, with no details of the intervention provided, were not considered physical activity programs for this review.

Behavioral strategies were based on behavioral and learning principles and addressed barriers to diet or physical activity NHLBI 1998. These strategies included one or more of the following interventions: education, cognitive-behavioral therapy (for example stimulus control, reinforcement, goal setting), social support, and psychotherapy. Studies were included that examined the combined effect of two or more of the interventions discussed above.

Excluded interventions:

We excluded pharmacologic therapy, surgery, acupuncture, and hypnosis for the purpose of weight loss, as these interventions have very different mechanisms of action and are best dealt with by a separate review. We also excluded herbal remedies and dietary supplements. Studies examining unintentional weight loss were also excluded, as were studies involving binge eating and other eating disorders.

Types of comparison interventions

We included studies with a range of comparison groups to determine which interventions were more effective than others.

The comparison group could have received:

a. No intervention;

b. Usual care;

c. The same intervention at a different intensity (frequency, duration, time frame for delivery);

d. Any other weight loss or weight control intervention: behavioral strategy, dietary program, physical activity program, drug therapy, surgery.

Types of outcome measures

Primary outcomes

- weight, BMI, or percentage weight loss from baseline;
- mortality: diabetes-related, cardiovascular disease, total;
- quality of life.

Secondary outcomes

- morbidity;
- cardiovascular disease events;
- glycemic control: glycated hemoglobin (GHb), fasting blood sugar;
- serum lipid concentrations: total cholesterol, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL);
- blood pressure.

Potential effect modifiers

The following variables were felt to be potentially related to change in weight: follow-up interval, duration of the intervention, number of intervention contacts, total attrition, year of publication) affected the between-group change in weight. There were explored using meta-regression.

Search methods for identification of studies

Electronic searches

Using Medical Subject Headings (MeSH) and text words, we searched the following databases between the date indicated and May 2004: MEDLINE (1966), EMBASE (1980), CINAHL (1982), ERIC (1980), PsychINFO (1967), Web of Science (1981), Biosis (1969), and Nutrition Abstracts and Review (1980). We also searched the *The Cochrane Library* (2004, Issue 2) and the Cochrane Central Register of Controlled Trials (CENTRAL) (2004, Issue 2). We manually searched journals expected to have the highest relevance, from 1980: Diabetes Care, International Journal of Obesity and Related Metabolic Disorders, Obesity Research (commenced in 1993), American Journal of Clinical Nutrition, and Journal of the American Dietetic Association. Reference lists of all included studies and relevant reviews were examined and experts in obesity were consulted for additional citations. The 1998 review of the National Heart, Lung, and Blood Institute (NHLBI 1998) and the 1997 review of the University of York, National Health Centre for Reviews and Dissemination (UYCRD 1997) were examined for relevant citations.

There were no language restrictions on our searches. Conference proceedings and abstracts were included in a sensitivity analysis but not in the primary review, because they had insufficient detail to evaluate the intervention and the quality of the study. Dissertations were excluded, as they are difficult to locate in full text.

The MEDLINE search strategy is displayed under Appendix 1; strategies for other databases can be obtained from the authors.

Data collection and analysis

Selection of studies

The titles and abstracts were obtained from the searches of the electronic databases noted above and potentially relevant full-text articles were then screened. Two persons (SLN and XZ) screened the MEDLINE titles and abstracts. Duplicate citations were removed prior to retrieval, and studies with multiple related publications are listed in Characteristics of included studies, noting the primary study.

Data extraction and management

For studies that fulfilled inclusion criteria, two reviewers independently abstracted relevant population and intervention characteristics using a standardised template, and consensus was achieved through discussion. Outcomes examined included weight loss, percent weight loss (based on individual data), BMI, fasting blood glucose, GHb, blood pressure, and lipid concentrations. Abstraction of data was not blinded, as there is no evidence that blinding of this process decreases bias in the conduct of systematic reviews and meta-analyses (Berlin 1997; Irwig 1994). We attempted to contact the authors for missing data or when we needed clarification of the data presented.

For continuous outcomes we abstracted for each study group the baseline sample size, pre and post intervention mean and measure of dispersion (SD [standard deviation], standard error of the mean (SEM), or 95% confidence interval [CI]) for the intervention and comparison groups. When necessary, mean and SD were approximated from figures using an image scanner to optimize resolution. If only range (Rhiel 1986) or interquartile range (Hoaglin 1983) was given as the measure of variation, the SD was estimated.

Assessment of risk of bias in included studies

We assessed internal validity by examining each study for potential selection, attrition, and detection bias (Clarke 2001), factors thought to have significant effects on measured outcomes in intervention studies (Feinstein 1985). Studies were not excluded on the basis of poor quality; a sensitivity analysis was planned to compare results between studies with potential bias and those without.

Data synthesis

Exploratory data analysis

Funnel plots were used in exploratory data analysis to assess for the potential existence of small sample bias. There are a number of explanations for the asymmetry of a funnel plot, including true heterogeneity of effect with respect to study size, poor methodological design of small studies (Sterne 2001), and publication bias. Thus, this exploratory data tool may be misleading (Tang 2000; Thornton 2000) and we did not place undue emphasis on this tool (Thornton 2000).

Statistical pooling

When data were available which were sufficiently similar with respect to interventions and outcomes, pooled estimates of effect were obtained using Review Manager software. For continuous variables reported on the same scale, the absolute differences in outcome between each follow-up and the baseline measure were reported for each study group (delta I and delta C). The estimate of variance of (delta I) and (delta C) was calculated from the outcome measures in each study group using the formula Vpre+ Vpost - 2r(SDpre*SDpost), where Vpre is the variance of the mean baseline outcome, Vpost is the variance of the mean follow-up outcome, r is the correlation between the baseline and follow-up values, and SDpre and SDpost are the standard deviations of the baseline and follow-up groups, respectively. The variance of (delta) was then calculated as the sum of the variance of (delta I) and the variance of (delta C). Because studies do not report r, and its true value is unknown, a sensitivity analysis was performed using values of 0.25, 0.5, 0.75 and 1.0. tabular data and the figure are presented using r = 0.75, unless otherwise noted.

Data were pooled using the random-effects model, using the DerSimonian and Laird formula to calculate between-study variance (DerSimonian 1954). Each study was weighted by the inverse of the study variance. Heterogeneity was examined using a standard chi-squared test and a significance level of alpha equals 0.1, in view of the low power of such tests. Heterogeneity was also examined with I^2 , where I^2 values of 75% and more indicate a high level of heterogeneity (Higgins 2003). When heterogeneity was found, we attempted to determine potential reasons for it by examining individual study characteristics and those of subgroups of the main body of evidence.

We analyzed the effects of treatment in individual study arms so as to examine within-group changes for both intervention and comparison groups. These effects were also pooled using the DerSimonian and Laird approach (DerSimonian 1954).

Subgroup analysis and investigation of heterogeneity

Should the quantity of data permit, we planned to examine subgroups based on intervention components, care delivered to the comparison group, and demographic characteristics.

Meta-regression

Meta-regression was performed using SAS (version 8.02, SAS Institute Inc., Cary, N.C.) to determine whether various study-level characteristics (follow-up interval, duration of the intervention, number of intervention contacts, total attrition, year of publication) affected the between-group change in weight. We examined interaction terms for all models.

Sensitivity analysis

We compared the results of fixed- and random-effects models and different values of the correlation coefficient between pre-and post-values. Should the quantity of data permit, we planned to perform a sensitivity analysis based on attrition rates, use of last-outcome-carried-forward, and language of publication.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

Nine eligible RCTs were identified in the published literature (DPP 2002; Dyson 1997; Jarrett 1987; Liao 2002; Lindahl 1999; Mensink 2003; Page 1992; Pan 1997; Tuomilehto 2001). These were all weight loss studies among overweight or obese persons with prediabetes; no study focused exclusively on weight control. No unpublished studies were identified. The study flow diagram is available from the authors. In all, the studies included 5,168 participants (range, 31 to 3,234) and the follow-up interval averaged 3.2 years. The study populations varied somewhat in terms of how abnormal glycemia was defined, with several studies using IGT (variably defined) (Jarrett 1987; Lindahl 1999; Page 1992; Pan 1997). One study (Dyson 1997) specified only fasting glucose, overlapping both normal, IFG, and the current ADA definition of diabetes (ADA 2004) and two other studies (Mensink 2003; Tuomilehto 2001) also overlapped with the current criteria for diabetes (ADA 2004). It was not possible to exclude patients with normoglycemia by current standards from analyses as these populations were not presented as subgroups in the original papers. Some studies combined restrictions on fasting glucose with IGT (DPP 2002; Liao 2002; Mensink 2003; Tuomilehto 2001). Mean age, weight, and BMI at baseline, as well as ethnicity and sex all varied considerably among the studies. Overall, the mean age was 51.2 years, and studies contained 50% women, on average. Mean baseline weight was 82.2 kg (range, 69.7 to 94.2), BMI 28.7 (range, 25.8 to 34.0), and GHb 5.8% (range, 5.7 to 5.9%).

The nine interventions included in this review were heterogeneous in components, content, and intensity, but the intervention group used at least one dietary, physical activity, or behavioral intervention. The duration of interventions ranged from four weeks (Lindahl 1999) to 10 years (Jarrett 1987), although the latter study involved only annual contacts over the last fife years. Total contacts ranged from four (Dyson 1997) to 78 (Liao 2002), and one study (Lindahl 1999) involved a 28-day in-residence lifestyle intervention. Both individual and group sessions were used. A variety of facilitators or educators were involved, but most studies involved a dietitian as a member of the care team.

Seven of the nine studies involved caloric restriction; one (Liao 2002) involved a diet intended to be isocaloric, with specification of the percent of total intake contributed by fats and carbohydrates, and one involved carbohydrate restriction intended to produce weight loss (Jarrett 1987). Diets often included a weight loss goal (DPP 2002; Mensink 2003) or restrictions on fat intake (DPP 2002; Dyson 1997; Mensink 2003). The physical activity interventions varied from counselling to encouraging increased activity (Page 1992; Pan 1997) to supervised sessions several times a week (DPP 2002; Liao 2002; Mensink 2003; Tuomilehto 2001) to a daily 2.5-hour-per-day aerobic session in an in-residence program Lindahl 1999. In one study there was no physical activity intervention Jarrett 1987. Behavioral interventions were used in five studies, and such interventions were very intensive in the Diabetes Prevention Program study DPP 2002, which included a variety of behavioral techniques. The other four studies were much less intensive, consisting of goal setting (Mensink 2003; Tuomilehto 2001), self-feedback with food or exercise diaries (Dyson 1997; Liao 2002; Tuomilehto 2001), stress management, or improved coping skills Lindahl 1999.

The comparison group interventions were fairly minimal, consisting of "usual care" or general information and counselling on diet and physical activity (DPP 2002; Dyson 1997; Jarrett 1979; Lindahl 1999; Mensink 2003; Page 1992; Pan 1997; Tuomilehto 2001). One study (Liao 2002) prescribed a diet to the comparison group, but it was less restrictive than that of the intervention group, which also received a supervised physical activity intervention.

Kappa for agreement in the screening of titles and abstracts was 0.64. Differences were reconciled by consensus, and if agreement not was not achieved the full text was retrieved. Agreement on inclusion of studies was 100%, achieved through consensus.

Risk of bias in included studies

The sampling frame for study participants was a community in five studies (Jarrett 1987; Lindahl 1999; Mensink 2003; Pan 1997; Tuomilehto 2001) a medical clinic population in one (Dyson 1997) a combination of a clinical population and a community in one (DPP 2002) and was not reported in two studies (Liao 2002; Page 1992). Only one trial reported on how the randomization sequence was generated (Tuomilehto 2001) and no studies documented adequate concealment of allocation. Attrition ranged between 4% (at one-year follow-up) (Lindahl 1999) and 43% (10-year follow-up) (Jarrett 1979).

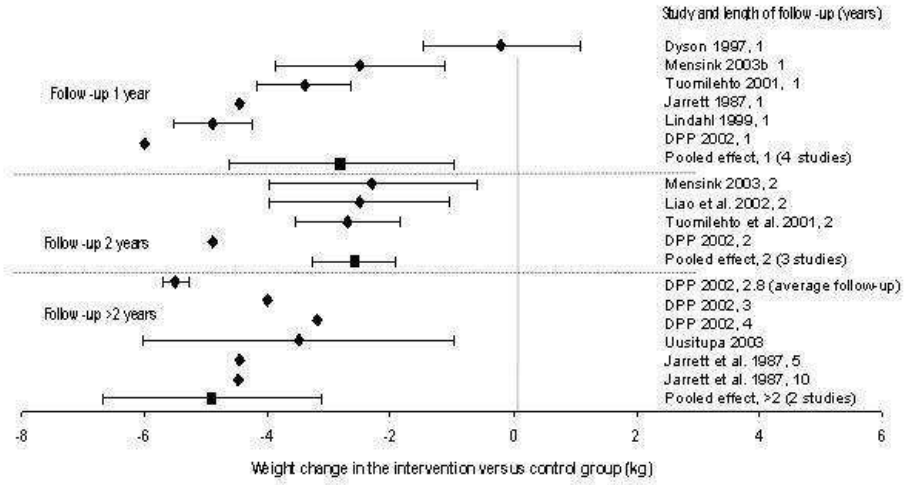
We created a funnel plot examining the relationship between total sample size and weight change. The plot was visually asymmetric, but there were too few studies for us to draw conclusions about small sample effects and outcomes.

Effects of interventions

The effects of interventions on net change in weight are shown in Figure 1, Appendix 3 and Appendix 4. The range of weight loss was 0.2 to 6.0 kg for the six studies with a follow-up of one year. Compared with usual care, the four studies with a follow-up interval of one year and with complete data for obtaining a pooled estimate (Dyson 1997; Lindahl 1999; Mensink 2003; Tuomilehto 2001) reduced weight by 2.8 kg (95% CI 1.0 to 4.7) (3.3% of baseline body weight) and decreased BMI by 1.3 kg/m^2 (95% CI, 0.8 to 1.9) (Lindahl 1999; Lindstrom 2003; Mensink

2003). Statistically significant heterogeneity was noted for change in weight at one-year follow-up (I^2=93.6%).

Figure 1. Weight change (kg) (difference between control and intervnetion groups) for each study, stratified by follow-up interval in years. Pooled estimates are shown as square symbols.



The pooled weight loss for the three studies that examined outcomes at two years and for which a standard error was reported (Liao 2002; Mensink 2003; Tuomilehto 2001) was 2.6 kg (95% CI 1.9 to 3.3). The most marked mean weight change was in the lifestyle arm of the DPP 2002 with a loss of 5.5 kg at an average follow-up of 2.8 years. This study population was larger than all the other study populations combined, and constituted 63% of the total population examined. Weight loss (in kg) at other follow-up intervals in the DPP was 6.0 at one year; 4.9 at two years, 4.0 at three years, and 3.2 at four years (results obtained from a graphical display of the original data). No measures of uncertainty were available for these estimates, therefore they were not included in the pooled analyses.

Three studies examined BMI, with a pooled effect of -1.3 (95% CI -1.9 to -0.8) at one year, and -0.8 (95% CI -1.2 to -0.5). Heterogeneity was significant at one year, however, with an I^2 of 87.5% (P value for Q = 0.0003). Weight loss as measured as the percent of baseline weight lost revealed similar small, but statistically significant results (Appendix 4).

Only a few studies examined other outcomes, and we believed these were insufficiently representative of all nine studies to justify pooling the effects (Appendix 5). Changes ranged from 0.0% to -0.3% for GHb (Dyson 1997; Uusitupa 2003) and generally corresponded to changes in weight. Systolic and diastolic (data not shown) blood pressure were measured in four studies, and a small decrease was noted in most. Lipids were examined in four studies, and minor improvements were noted. There were no data

on adverse events, mortality, and quality of life.

Five studies examined the effect of interventions on the incidence of diabetes (DPP 2002; Jarrett 1979; Liao 2002; Pan 1997; Tuomilehto 2001), and three of these demonstrated a significant decrease in cumulative incidence (DPP 2002; Li 2002; Tuomilehto 2001; Li 2002) (Appendix 6). These three large trials were adequately powered to detect effects and involved intensive, sustained, multicomponent interventions.

We performed sensitivity analyses to examine the effect of different assumed values of the correlation between the study groups before and after the intervention, and no significant changes were noted in pooled estimates and 95% CIs (Appendix 3; Appendix 4). The characteristics of study quality were not sufficiently heterogeneous for us to examine the effects of randomization procedure, allocation concealment, or blinding on change in weight. No unpublished data were identified, so comparisons were not made among publication status. Study-level characteristics (including length of follow-up, duration of the intervention, and attrition) were examined using meta-regression, and no significant effects on weight change were noted. The total number of intervention contacts correlated positively with a decrease in weight (P value 0.015).

The performance of stratified (subgroup) analyses was limited by sparse data. The number of studies was insufficient to examine whether a physical activity intervention added to the effectiveness of dietary interventions.

DISCUSSION

RCTs of weight loss interventions using dietary, physical activity, or behavioral interventions produced statistically significant between-group weight loss of 2 to 3 kg (3% of initial body weight) at one- and two-year follow-up. In two studies where weight was examined at longer follow-up intervals (up to 10 years), similar weight reduction was maintained. The number of intervention contacts with subjects was significantly correlated with weight loss. Data are limited, but the small number of available studies demonstrated improvements in GHb, blood pressure, and triglycerides, although these changes were for the most part not statistically significant. Although the weight loss demonstrated in this review is small, even modest loss in general populations may have health benefits; improvements in blood pressure, blood glucose, and serum lipid concentrations have been associated with weight loss (Anderson 2001), including the magnitudes noted here.

The findings in this review are consistent with other reviews of educational interventions for weight loss among persons with diabetes (Norris 2002) and in nondiabetic populations where comprehensive, intensive, group dietary and behavioral programs produced a mean loss of 8 -10 kg at six months with a regain of 30% to 35% of weight lost at one year (Kramer 1989; Wadden 2000). The number of contacts with patients has also been shown to correlate with glycemic control in diabetes education, where attempts are made to change complex behaviors and lifestyle (NHLBI 1998).

The three studies with effective interventions for decreasing the incidence of diabetes were associated with weight loss, although the change in BMI in Pan et al. Pan 1997 was only -0.4 kg/m^2 (95% CI -0.9 to 0.1). These effective interventions demonstrate that diabetes prevention is achievable in a variety of settings in populations with prediabetes, but sustained, long-term, intensive, multicomponent interventions are required. It is noteworthy, however, that Tuomilehto et al. (Tuomilehto 2001) had somewhat fewer contacts with participants (15 over 3.2 years on average), yet achieved a 58% reduction in relative risk (P value <0.001) in diabetes incidence over the course of the study.

Attrition is an important issue in weight-loss studies because of selective loss to follow-up Kaplan 1987. In this review, however, mean attrition was 9.6%, perhaps because participants were most commonly self-selected and thus perhaps more motivated to complete the study. Jarrett and colleagues (Jarrett 1987) noted sustained weight loss at 10-year follow-up, but their attrition rate was 43%, which likely contributed to the large measured weight loss among participants who persisted with the intervention over the long term.

The successful interventions we examined in this review (DPP 2002; Pan 1997; Tuomilehto 2001) had prolonged frequent contacts, low attrition rates, and evidence of persisting behavior change, which likely contributed to the effectiveness of the interventions. Few data are available on changes in patterns of behaviors over time. At follow-up of the DPP (DPP 2002) (range, 1.8 to 4.6 years), 58% of participants continued to meet the goals of at least 150 minutes of self-reported physical activity per week. Total caloric and fat intake, examined at one year, decreased by 450 kcal/day in the lifestyle group and 249 kcal/day in the placebo group. Tuomilehto et al. (Tuomilehto 2001) also reported significant between-group behavior change at one year. Pan and colleagues (Pan 1997) noted no significant differences between treatment groups at six-year follow-up for daily caloric intake and calorie composition, but physical exercise was increased significantly in both the exercise group and the diet-plus-exercise group. In smaller studies, Mensink et al. (Mensink 2003) and Page et al. (Page 1992) demonstrated improved dietary habits at one and two years, respectively. Considering both attrition from study programs and recidivism with respect to positive lifestyle changes, the applicability of the results of these studies to general populations of persons with prediabetes is unclear. Behavioral (Jeffery 2000) and environmental (French 2001) barriers to weight loss abound; populations that are not self-selected or participating in a research study might demonstrate less pronounced improvements in behavior and weight.

Lindahl and colleagues had a very successful intervention with 1 year follow-up (Lindahl 1999), contributing to the high level

of heterogeneity noted in the pooled effect at 1 year. This intervention was different from others: it was a residential treatment program with close, daily, supervision and 2.5 hours of physical activity each day. The comparison group was usual care.

With 63% of all participants studied in the meta-analyses from the DPP, that study had the largest impact on the results of the meta-analyses. However, the use of a random-effects model to combine studies accounts for between-study heterogeneity, thus weighting each study more equally than pure sample size would indicate. This approach recognizes potential heterogeneity among the different interventions and settings in which the research was conducted and increases the generalizability of our results.

Pharmacotherapy and surgery have been used to help prevent the progression of IGT to diabetes and may be important adjuncts to lifestyle interventions in the future. In the DPP (DPP 2002) the study group receiving metformin lost a mean of 2.1 kg at an average follow-up of 2.8 years, and had a relative decrease in the incidence of diabetes of 31%. These outcomes were less pronounced than those achieved with the lifestyle intervention, however. The weight loss agent orlistat, a pancreatic lipase inhibitor, is currently being studied in the XENDOS study: at four-year follow-up a comparison of a lifestyle intervention with orlistat revealed a significant decrease in weight (2.8 kg compared to the control group) and a relative risk reduction of 37.2% in the cumulative incidence of type 2 diabetes (Scheen 2002). The Troglitazone in Prevention of Diabetes (TRIPOD) study has shown a 56% relative reduction in the progression to diabetes in Hispanic women with previous gestational diabetes at median follow-up of 30 months (Buchanen 2002). In the STOP-NIDDM trial, a 25% reduction in relative risk for progression to diabetes was noted at 3.3 years in the group using the alpha-glucosidase inhibitor acarbose Chaisson 2002. Other drugs have been associated with a decreased incidence of diabetes in *post hoc* analyses of initially normoglycemic populations, including captopril (Hansson 1999), ramipril (Yusuf 2001), and pravastatin (Freeman 2001), and with estrogen-progestin combination therapy (Kanaya 2003). Weight loss from bariatric surgery has also been shown to significantly decrease the progression of IGT to diabetes (Long 1994, Sjostrom 2000).

This review is limited to published studies; although subject experts were contacted for additional unpublished literature, none was obtained. The quality of individual studies in this review varied, and some common deficiencies were noted: in particular, randomization procedures and allocation concealment were rarely reported. In addition, the studies included were heterogeneous with respect to population, setting, and intervention, and the data were very limited for most outcomes. Quantitative synthesis was therefore not justified for most outcomes, and the pooled effect for weight loss at one year must be interpreted with caution.

Whether the benefits of weight loss in persons with prediabetes differ from those in persons with diabetes (Williamson 2000, Wing 1987) in terms of macrovascular and microvascular disease remains to be seen. Is primary prevention of diabetes among high risk adults any different from the treatment of diabetes? Certainly, insulin sensitivity and glycemia represent a spectrum, and persons with glucose concentrations below those defined for diabetes have significantly greater risk of cardiovascular disease than persons with normoglycemia (DECODE 2001). Preventing and treating diabetes are different, however: the current clinical approaches differ by frequency of laboratory and clinical testing, guidelines for blood pressure and lipid values differ, persons with diabetes are at risk for acute complications such as hyperglycemia, and microvascular complications are not well documented in prediabetes ADA 2004. Thus it is as yet unclear whether similar treatment strategies and goals for weight, lipids, glycemia, and blood pressure are warranted in prediabetes.

AUTHORS' CONCLUSIONS

Implications for practice

Small improvements in weight and in other cardiovascular disease risk factors appear achievable in populations with prediabetes. Further research is needed to examine the effect of these interventions on morbidity and mortality and their effectiveness in other high-risk populations. Work is also needed to explore translation and implementation of these results in the community setting.

Implications for research

Future research needs to focus on how best to sustain interventions and behavioral change, and long-term outcomes such as cardiovascular events and mortality need further study. Researchers need to explore the effectiveness of interventions shown to work in populations with IGT and in other populations (for example, those with isolated IFG, the metabolic syndrome, type 2 diabetes, overweight, or obesity). There is some information available on the effectiveness of these interventions when nonselective community recruitment is used (Lindahl 1999; Mensink 2003; Pan 1997), but further research needs to explore whether and how to translate these results to broadly defined communities. Should interventions focus on diet and physical activity change specifically, or more broadly on the social determinants of behavior and disease, such as social status or empowerment (Syme 2004)? The role of diet versus physical activity interventions for weight loss in persons with prediabetes needs additional study. Physical activity interventions demonstrate benefits among persons with diabetes, independent of weight loss (Boule 2001), and some data support a positive effect of physical activity on the incidence of diabetes that is independent of weight loss (Kelley 2001). The role of other weight loss strategies (in isolation or in combination with dietary, activity or behavioral interventions), such as pharmacotherapy (Norris 2004), surgical interventions, or public health

interventions (such as changes in the physical and social environments), remains to be determined. Further research is needed on weight control strategies and obesity prevention.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

DPP 1999

Methods	Companion to DPP 2002	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

DPP 2000

Methods	Companion to DPP 2002	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

DPP 2002

Methods	Follow-up: Average 2.8 years; range 1.8 to 4.6 yearsNumber study arms: 3: lifestyle, metformin (not reported here) and control Setting: Multicenter, USA Number: 3,234 Comparison group care: Standard lifestyle: written information and annual 30-minute individual session on healthy lifestyles
Participants	Age (years): 50.6 (10.7) Sex (% female): 67.7 Baseline BMI: 34.0 (6.7) Inclusion criteria: BMI>24, FPG 95-125 mg/dl (5.2-6.9 mmol/l) and 2-h 75-g OGTT PG 140-199 mg/

DPP 2002 (*Continued*)

	dl (7.8-11.0 mmol/l)
Interventions	Duration: Average 2.8 years; range 1.8 to 4.6 years Frequency: 16 lessons in first 24 weeks, then monthly No. of contacts: 40 Group/individual: Lessons individual; some follow-up group sessions Medium: In person Facilitator: Case manager ("lifestyle coach"), usually a dietitian Dietary intervention: 16 lessons covering diet, exercise, and behavioral modification; goal 7% weight loss; low-calorie, low-fat Physical activity intervention: Intensive lifestyle arm: moderate-intensity exercise for 150 minutes a week; supervised sessions twice a week, with supplemental group classes Behavioral intervention: Goal setting, individual case managers, individualization, culturally sensitive materials and strategies, motivational strategies
Outcomes	Weight: YesBMI: Yes>5% loss (%):Cholesterol:LDL:HDL:TG:SBP:DBP:Incidence of diabetes: Yes
Notes	Sampling method: Self- and provider-selected from clinic and community Randomization procedure: Attrition (%): 8Blinding assessor: YesBaseline comparable: Yes

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

DPP 2002a

Methods	Companion to DPP 2002
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

DPP 2002b

Methods	Companion to DPP 2002
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Dyson 1997

Methods	Follow-up: 12 months Number study arms: 2 Setting: France and United Kingdom Number: 227 Comparison group care: Written information; weight loss and activity advice if BMI>25; visits every 3 months
Participants	Age (years): 50 (9) Sex (% female): 59.0 Baseline BMI: NR Inclusion criteria: FPG on 2 occasions 5.5-7.7 mmol/l (99-139 mg/dl). There is some overlap with this population and diabetes (as defined by the American Diabetes Association 1997). Also at baseline 27% had diabetes as defined by OGTT (WHO 1985)
Interventions	Duration: 52 weeks Frequency: Every 3 months No. of contacts: 4 Group/individual: Individual Medium: In person Facilitator: Dietitian, fitness instructor Dietary intervention: 500-700 kcal/day deficit if BMI>22; decrease fat; increase fiber Physical activity intervention: Encouraged to exercise starting at 2-3 times a week for 20 minutes with a variety of aerobic exercise; increase to five or six times a week; seen by fitness instructor every 3 months Behavioral intervention: Food and exercise diaries
Outcomes	Weight: YesBMI: >5% loss (%):Cholesterol: YesLDL: YesHDL: YesTG: Yes SBP: YesDBP: YesIncidence of diabetes:
Notes	Sampling method: Self-selected from clinicsRandomization procedure: NRAttrition (%): 11Blinding assessor: NRBaseline comparable: Yes

Dyson 1997 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Eriksson 1999

Methods	Companion to Tuomilehto 2001	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Eriksson 1999a

Methods	Companion to Tuomilehto 2001	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Jarrett 1979

Methods	Companion to Jarrett 1987
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Jarrett 1987

Methods	Follow-up: 10 years Number study arms: 2 Setting: United Kingdom Number: 204 Comparison group care: Recommended to reduce use of table sugar
Participants	Age (years): 55.0 (7.6) Sex (% female): 0.0 Baseline BMI: 25.8 (3.4) Inclusion criteria: Random capillary BG 110-199 mg/dl (1.6-11.0 mmol/l), followed by 50-g OGTT with peak >180 mg/dl (9.0 mmol/l) and 2-h 120-199 mg/dl (6.6-11.0 mmol/l) and/or 2 values >180 mg/dl (9.0 mmol/l) and/or mean 2-h >120 mg/dl (6.6 mmol/l)
Interventions	Duration: 10 years Frequency: Every 6 months for 5 years, then every year No. of contacts: 15 Group/individual: Unclear Medium: In person and written Facilitator: NR Dietary intervention: 120g/day carbohydrate Physical activity intervention: None Behavioral intervention: None
Outcomes	Weight: YesBMI: Yes>5% loss (%):Cholesterol:LDL:HDL:TG:SBP: YesDBP: YesIncidence of diabetes: Yes
Notes	Sampling method: Self-selected, community recruitmentRandomization procedure: Attrition (%): 43Blinding assessor: NRBaseline comparable: NR

Risk of bias

Jarrett 1987 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Li 2002

Methods	Companion to Pan 1997
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Liao 2002

Methods	Follow-up: 24 monthsNumber study arms: 2Setting: USA, Americans with Japanese ancestryNumber: 64 Comparison group care: Stretching exercises in a group three times a week and American Heart Association step 1 diet (30% fat, 50% CHO, <300 mg cholesterol); intended to be isocaloric with prior intake
Participants	Age (years): 54.0 (10.2)Sex (% female): 55Baseline BMI: 26.2 (4.5)Inclusion criteria: FPG <127 mg/dl (<7.0 mol/l) and 2-h post 75-g glucose load of >140 mg/dl (7.8 mmol/l) and <200 mg/dl (11.1 mmol/l)
Interventions	Duration: 2 years Frequency: 3 times per week No. of contacts: 3 times per week for 6m then unsupervised; 78 sessions Group/individual: Individual Medium: In person Facilitator: Exercise physiologist, dietitian Dietary intervention: American Heart Association step 2 diet: <30% fat, 55% carbohydrate; <200 mg cholesterol; individual prescription by dietitian; intended to be isocaloric with prior intake Physical activity intervention: Supervised treadmill for 1 hour 3 times a week for 6 months; initial goal 50% maximum heart rate reserve, then increase to 70%; continued unsupervised for next 18 months Behavioral intervention: Food records for feedback
Outcomes	Weight: YesBMI: Yes>5% loss (%):Cholesterol:LDL:HDL:TG:SBP:DBP:Incidence of diabetes:
Notes	Sampling method: UnclearRandomization procedure: NRAttrition (%): 17Blinding assessor: NRBaseline comparable: Intervention group had more women

Liao 2002 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Lindahl 1999

Methods	Follow-up: 12 monthsNumber study arms: 2Setting: Swedish communityNumber: 194 Comparison group care: Usual care
Participants	Age (years): 55.4 (8.9) Sex (% female): 63 Baseline BMI: 30.6 (3.3) Inclusion criteria: BMI>27, abnormal OGTT (WHO 1985)
Interventions	Duration: 4 weeks Frequency: Daily No. of contacts: Daily for 4 weeks Group/individual: Combined Medium: In person Facilitator: NR Dietary intervention: Residential treatment with 1800 kcal/day for men, 1500 for women Physical activity intervention: 2.5 hours/day aerobic activity Behavioral intervention: Stress management, coping and relapse prevention strategies
Outcomes	Weight: YesBMI: Yes>5% loss (%):Cholesterol: YesLDL:HDL:TG: YesSBP: YesDBP: YesIncidence of diabetes:
Notes	Sampling method: Subset of a community intervention registry Randomization procedure: NR Attrition (%): 4 Blinding assessor: NR Baseline comparable: Intervention group had lower fasting blood glucose than control group, otherwise 2 groups similar

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Lindstrom 2003

Methods	Companion to Tuomilehto 2001
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Mensink 2003

Methods	Follow-up: 24 months Number study arms: 2 Setting: The Netherlands Number: 114 Comparison group care: Initially given written information about healthy diet and physical activity
Participants	Age (years): 56.6 (7.2)Sex (% female): 47Baseline BMI: 29.4 (3.6)Inclusion criteria: Mean 2-h 75g OGTT BG >140mg/dl (7.8 mmol/l) and <225 mg/dl (12.5 mmol/l); FBG <140mg/dl (7.8 mmol/l)
Interventions	Duration: 2 years Frequency: Every 3 months for dietary intervention, weekly for physical activity training No. of contacts: 5 for dietary; 52 for supervised physical activity Group/individual: Combined Medium: In person Facilitator: Exercise physiologist, dietitian Dietary intervention: Goal 5%-7% wt loss; carbohydrate 55%, 30-35% fat, and <300 mg cholesterol daily Physical activity intervention: Encouraged to do moderate activity 30 minutes for 5 or more days a week; 1-hour weekly training sessions with trainer Behavioral intervention: Goal setting
Outcomes	Weight: YesBMI: Yes>5% loss (%):Cholesterol: YesLDL: YesHDL: YesTG: YesSBP:DBP:Incidence of diabetes:
Notes	Sampling method: Patients in existing community cohort at high risk for diabetes Randomization procedure: NR Attrition (%): 10 at 1 year, 23 at 2 years Blinding assessor: NR Baseline comparable: Yes

Risk of bias

Mensink 2003 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Mensink 2003a

Methods	Companion to Mensink 2003
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Mensink 2003b

Methods	Companion to Mensink 2003
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Page 1992

Methods	Follow-up: 24 monthsNumber study arms: 2Setting: United KingdomNumber: 31 Comparison group care: Usual care
Participants	Age (years): 39.4 (10.7)Sex (% female): NRBaseline BMI: 26.6 (4.0)Inclusion criteria: IGT based on 2 continuous infusion of glucose with model assessment (CIGMA) tests, or FBG >5.6 mmol/l (101 mg/dl)
Interventions	Duration: 26 weeks Frequency: NR No. of contacts: NR Group/individual: Group Medium: In-person Facilitator: Dietitian Dietary intervention: Dietary advice to participant and spouse to increase fiber, increase carbohydrate, decrease fat, decrease energy intake if appropriate; advice and support for 6 months, then asked to continue on own Physical activity intervention: Advice to exercise for 20 or more minutes 3 times a week Behavioral intervention: None
Outcomes	Weight: BMI: Yes>5% loss (%):Cholesterol: YesLDL: YesHDL: YesTG: YesSBP: YesDBP: YesIncidence of diabetes:
Notes	Sampling method: UnclearRandomization procedure: NRAttrition (%): 26Blinding assessor: NRBaseline comparable: NR

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Pan 1997

Methods	Follow-up: 6 yearsNumber study arms: 4: diet, physical activity, diet and physical activity, controlSetting: Chinese communityNumber: 577 Comparison group care: General information; usual care
Participants	Age (years): 45.0 (9.1) Sex (% female): 47.0 Baseline BMI: 25.8 (3.8) Inclusion criteria: 2-h post prandial BG >=120 mg/dl (6.7 mmol/l) and <200 mg/dl (11.0 mmol/l), followed by 75-g OGTT (WHO 1985)
Interventions	Duration: 6 years Frequency: Both diet and exercise interventions: weekly for 1 month, then monthly for 3 months, then every 3 months for both diet and activity counseling No. of contacts: 30 Group/individual: Both Medium: In person Facilitator: Physician and team Dietary intervention: Diet and diet-plus-exercise groups: if BMI <25, 25-30 kcal/day with 50-65% car-

Pan 1997 (*Continued*)

	bohydrate, 10%-15% protein, 15%-30% fat; if BMI>25, goal to lose 0.5 to 1.0 kg/month until BMI 23 Physical activity intervention: Exercise and diet-plus-exercise groups: counseled regarding daily aerobic exercise; duration dependent on intensity Behavioral intervention: None
Outcomes	Weight: Yes BMI: >5% loss (%): Cholesterol: LDL: HDL: TG: SBP: DBP: Incidence of diabetes: Yes
Notes	Sampling method: 87% of target population (a community in China) were screenedRandomization procedure: By clinic; otherwise not reported Allocation concealment: NRAttrition (%): 8Blinding assessor: NRBaseline comparable: Yes

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Pan 1997 (diet)

Methods	Treatment arm of Pan 1997
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Pan 1997 (diet+PA)

Methods	Treatment arm of Pan 1997	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Pan 1997 (exercise)

Methods	Treatment arm of Pan 1997	
Participants		
Interventions		
Outcomes		
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Tuomilehto 2001

Methods	Follow-up: Mean 38 months (Tuomilehto 2001); 3 years (Lindstrom 2003); 4 years (Uusitupa 2003) (range, 17 - 72 months) Number study arms: 2 Setting: Finland Number: 523 Comparison group care: General written and oral information at baseline and annually
Participants	Age (years): 55.0 (7.0) Sex (% female): 67.0 Baseline BMI: 31.1 (4.6) Inclusion criteria: BMI>=25; IGT (2-h post prandial plasma glucose 140-200 mg/dl [7.8-11.0 mmol/l]) and FG <140mg/dl (7.8 mmol/l)

Tuomilehto 2001 (*Continued*)

Interventions	Duration: Mean 3.2 years (Tuomilehto 2001) Frequency: seven sessions with dietitian first year, then every 3 months No. of contacts: 15 Group/individual: Individual dietary advice Medium: In person Facilitator: Dietitian, other unclear Dietary intervention: Low fat, high-fiber diet; goal BMI <25 or 5-10-kg weight loss; <50% carbohydrate, <30% fat, <300 mg/day cholesterol, increase fiber Physical activity intervention: Individual counseling regarding moderate activity 30 minutes/day; supervised strength training; frequency and availability varied among study centers Behavioral intervention: Food records; goal setting
Outcomes	Weight: YesBMI: Yes>5% loss (%): YesCholesterol: YesLDL: YesHDL: YesTG: YesSBP: YesDBP: Yes Incidence of diabetes: Yes
Notes	Sampling method: Epidemiologic surveys and opportunistic population screening Randomization: Using a list Attrition (%): 8 at 3.2 years Blinding patient: No Blinding assessor: Yes Blinding provider: Partial (nurse blinded but not provider) Baseline comparable: Yes

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Uusitupa 2000

Methods	Companion to Tuomilehto 2001
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Uusitupa 2003

Methods	Companion to Tuomilehto 2001
Participants	Self-selected group (n=87) from original study who were willing to do an intravenous glucose tolerance test
Interventions	
Outcomes	Weight: Yes BMI: Yes >5% loss (%): Cholesterol: LDL: HDL: TG: SBP: DBP: Incidence of diabetes:
Notes	

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

BMI, body mass index (kg/m²); BG, blood glucose; CHO, carbohydrate; DBP, diastolic blood pressure; DPP, Diabetes Prevention Program; FBG, fasting blood glucose; FPG, fasting plasma glucose; HDL, high density lipoprotein; IGT, impaired glucose tolerance; LDL, low density lipoprotein; NR, not reported; OGTT, oral glucose tolerance test; PG plasma glucose; SD, standard deviation; SBP, systolic blood pressure; TG, triglycerides; WHO, World Health Organization

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

Study	Reason for exclusion
Ley 2004	Impaired glucose tolerance and diabetes participants combined in outcomes
Ratzmann 1982	Normal-glucose tolerant and impaired glucose tolerant patients combined in outcomes
Watanabe 2003	No weight outcomes.

DATA AND ANALYSES

Comparison 1. IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 weight loss (kg)	4	1016	Mean Difference (IV, Fixed, 95% CI)	-3.65 [-4.08, -3.22]
2 BMI	3	802	Mean Difference (IV, Fixed, 95% CI)	-1.50 [-1.66, -1.33]
3 FBS	4	1016	Mean Difference (IV, Fixed, 95% CI)	-0.14 [-0.22, -0.06]
4 GHb	3	806	Mean Difference (IV, Fixed, 95% CI)	-0.12 [-0.20, -0.03]
5 SBP	3	914	Mean Difference (IV, Fixed, 95% CI)	-4.41 [-6.16, -2.66]
6 DBP	3	914	Mean Difference (IV, Fixed, 95% CI)	-1.56 [-2.70, -0.43]
7 Total Cholesterol	4	1028	Mean Difference (IV, Fixed, 95% CI)	-0.18 [-0.21, -0.16]
8 LDL	2	312	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.10, 0.13]
9 HDL	3	834	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.01, 0.03]
10 Triglycerides	4	1028	Mean Difference (IV, Fixed, 95% CI)	-0.17 [-0.26, -0.09]
11 % weight loss	4	1016	Mean Difference (IV, Fixed, 95% CI)	-4.21 [-4.70, -3.72]
12 weight loss (kg)	4	1016	Mean Difference (IV, Random, 95% CI)	-2.81 [-4.65, -0.98]
13 BMI	3	802	Mean Difference (IV, Random, 95% CI)	-1.34 [-1.86, -0.82]
14 FBS	7	3365	Mean Difference (IV, Random, 95% CI)	-0.16 [-0.33, 0.01]
15 GHb	3	806	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.25, 0.04]
16 SBP	4	939	Mean Difference (IV, Random, 95% CI)	-4.04 [-6.20, -1.87]
17 DBP	4	939	Mean Difference (IV, Random, 95% CI)	-1.61 [-2.73, -0.49]
18 Total Cholesterol	5	1053	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.22, 0.02]
19 LDL	3	337	Mean Difference (IV, Random, 95% CI)	-0.04 [-0.24, 0.17]
20 HDL	4	859	Mean Difference (IV, Random, 95% CI)	0.02 [-0.03, 0.07]
21 Triglycerides	5	1053	Mean Difference (IV, Random, 95% CI)	-0.18 [-0.26, -0.09]
22 % weight loss	4	1016	Mean Difference (IV, Random, 95% CI)	-3.26 [-5.26, -1.26]

Comparison 2. IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 weight loss (kg)	3	700	Mean Difference (IV, Fixed, 95% CI)	-2.59 [-3.27, -1.92]
2 BMI	3	203	Mean Difference (IV, Fixed, 95% CI)	-0.83 [-1.21, -0.45]
3 FBS	3	661	Mean Difference (IV, Fixed, 95% CI)	-0.28 [-0.39, -0.18]
4 GHb	2	178	Mean Difference (IV, Fixed, 95% CI)	-0.12 [-0.36, 0.13]
5 Total Cholesterol	2	139	Mean Difference (IV, Fixed, 95% CI)	-0.10 [-0.35, 0.15]
6 LDL	2	139	Mean Difference (IV, Fixed, 95% CI)	-0.04 [-0.29, 0.20]
7 HDL	2	139	Mean Difference (IV, Fixed, 95% CI)	0.04 [-0.02, 0.11]
8 Triglycerides	2	139	Mean Difference (IV, Fixed, 95% CI)	-0.55 [-0.85, -0.24]
9 % weight loss	3	700	Mean Difference (IV, Fixed, 95% CI)	-3.05 [-3.85, -2.25]
10 weight loss (kg)	3	700	Mean Difference (IV, Random, 95% CI)	-2.59 [-3.27, -1.92]
11 BMI	3	203	Mean Difference (IV, Random, 95% CI)	-0.83 [-1.21, -0.45]
12 FBS	3	661	Mean Difference (IV, Random, 95% CI)	-0.27 [-0.40, -0.15]
13 GHb	2	178	Mean Difference (IV, Random, 95% CI)	-0.37 [-1.35, 0.61]

14 SBP	1	25	Mean Difference (IV, Random, 95% CI)	1.0 [-7.71, 9.71]
15 DBP	1	25	Mean Difference (IV, Random, 95% CI)	-1.00 [-9.18, 3.18]
16 Total Cholesterol	2	139	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.35, 0.15]
17 LDL	2	139	Mean Difference (IV, Random, 95% CI)	-0.04 [-0.29, 0.20]
18 HDL	2	139	Mean Difference (IV, Random, 95% CI)	0.12 [-0.12, 0.36]
19 Triglycerides	2	139	Mean Difference (IV, Random, 95% CI)	-0.55 [-0.85, -0.24]
20 % weight loss	3	700	Mean Difference (IV, Random, 95% CI)	-3.05 [-3.85, -2.25]

Comparison 3. IGT: wt loss and GHb (follow-up >2 y, rho=0.75)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 weight loss (fixed)	2	2229	Mean Difference (IV, Fixed, 95% CI)	-5.49 [-5.70, -5.27]
2 GHb (random)	2	2229	Mean Difference (IV, Random, 95% CI)	-0.18 [-0.30, -0.05]
3 weight loss (random)	2	2229	Mean Difference (IV, Random, 95% CI)	-4.91 [-6.70, -3.13]

Comparison 4. IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 weight loss (kg)	6	2799	Mean Difference (IV, Fixed, 95% CI)	-5.20 [-5.40, -5.01]
2 BMI	6	628	Mean Difference (IV, Fixed, 95% CI)	-1.49 [-1.67, -1.31]
3 FBS	7	2923	Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 GHb	4	2541	Mean Difference (IV, Fixed, 95% CI)	-0.07 [-0.16, 0.01]
5 SBP	4	939	Mean Difference (IV, Fixed, 95% CI)	-4.20 [-5.91, -2.49]
6 DBP	4	939	Mean Difference (IV, Fixed, 95% CI)	-1.61 [-2.73, -0.49]
7 Total Cholesterol	5	965	Mean Difference (IV, Fixed, 95% CI)	-0.10 [-0.19, -0.01]
8 LDL	3	337	Mean Difference (IV, Fixed, 95% CI)	0.06 [-0.06, 0.19]
9 HDL	4	771	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.05]
10 Triglycerides	5	965	Mean Difference (IV, Fixed, 95% CI)	-0.15 [-0.26, -0.05]
11 % weight loss	6	2799	Mean Difference (IV, Fixed, 95% CI)	-5.67 [-5.87, -5.46]
12 weight loss (kg)	6	2799	Mean Difference (IV, Random, 95% CI)	-3.23 [-4.76, -1.70]
13 BMI	6	628	Mean Difference (IV, Random, 95% CI)	-1.08 [-1.63, -0.53]
14 FBS	7	2923	Mean Difference (IV, Random, 95% CI)	-0.14 [-0.31, 0.04]
15 GHb	4	2541	Mean Difference (IV, Random, 95% CI)	-0.07 [-0.20, 0.07]
16 SBP	4	939	Mean Difference (IV, Random, 95% CI)	-4.04 [-6.20, -1.87]
17 DBP	4	939	Mean Difference (IV, Random, 95% CI)	-1.61 [-2.73, -0.49]
18 Total Cholesterol	5	965	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.19, -0.01]
19 LDL	3	337	Mean Difference (IV, Random, 95% CI)	0.06 [-0.06, 0.19]
20 HDL	4	771	Mean Difference (IV, Random, 95% CI)	0.03 [-0.02, 0.08]
21 Triglycerides	5	965	Mean Difference (IV, Random, 95% CI)	-0.19 [-0.36, -0.02]
22 % weight loss	6	2799	Mean Difference (IV, Random, 95% CI)	-3.86 [-5.35, -2.37]

Comparison 5. IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 weight loss (kg)	5	1080	Mean Difference (IV, Fixed, 95% CI)	-3.56 [-3.97, -3.15]
2 BMI	5	548	Mean Difference (IV, Fixed, 95% CI)	-1.51 [-1.70, -1.32]
3 FBS	6	1204	Mean Difference (IV, Fixed, 95% CI)	-0.14 [-0.22, -0.06]
4 GHb	2	300	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.14, 0.10]
5 SBP	4	939	Mean Difference (IV, Fixed, 95% CI)	-4.20 [-5.91, -2.49]
6 DBP	4	939	Mean Difference (IV, Fixed, 95% CI)	-1.61 [-2.73, -0.49]
7 Total Cholesterol	4	939	Mean Difference (IV, Fixed, 95% CI)	-0.03 [-0.12, 0.05]
8 LDL	2	223	Mean Difference (IV, Fixed, 95% CI)	0.08 [-0.06, 0.22]
9 HDL	3	745	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.04]
10 Triglycerides	4	939	Mean Difference (IV, Fixed, 95% CI)	-0.17 [-0.27, -0.08]
11 % weight loss	5	1080	Mean Difference (IV, Fixed, 95% CI)	-4.19 [-4.67, -3.71]
12 weight loss (kg)	5	1080	Mean Difference (IV, Random, 95% CI)	-2.76 [-4.32, -1.20]
13 BMI	5	548	Mean Difference (IV, Random, 95% CI)	-1.06 [-1.68, -0.45]
14 FBS	6	1204	Mean Difference (IV, Random, 95% CI)	-0.13 [-0.32, 0.06]
15 GHb	2	300	Mean Difference (IV, Random, 95% CI)	-0.02 [-0.14, 0.10]
16 SBP	4	939	Mean Difference (IV, Random, 95% CI)	-4.04 [-6.20, -1.87]
17 DBP	4	939	Mean Difference (IV, Random, 95% CI)	-1.61 [-2.73, -0.49]
18 Total Cholesterol	4	939	Mean Difference (IV, Random, 95% CI)	-0.03 [-0.12, 0.05]
19 LDL	2	223	Mean Difference (IV, Random, 95% CI)	0.06 [-0.13, 0.26]
20 HDL	3	745	Mean Difference (IV, Random, 95% CI)	0.04 [-0.03, 0.11]
21 Triglycerides	4	939	Mean Difference (IV, Random, 95% CI)	-0.17 [-0.27, -0.08]
22 % weight loss	6	3241	Mean Difference (IV, Random, 95% CI)	-3.85 [-5.22, -2.47]

Analysis 1.1. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 1 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

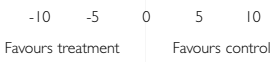
Outcome: 1 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		11.4 %	-0.20 [-1.47, 1.07]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		47.1 %	-4.90 [-5.53, -4.27]
Mensink 2003b	47	-2.7 (3.43)	55	-0.2 (3.71)		9.6 %	-2.50 [-3.89, -1.11]
Tuomilehto 2001	265	-4.2 (5.1)	257	-0.8 (3.7)		31.8 %	-3.40 [-4.16, -2.64]
Total (95% CI)	**503**		**513**			**100.0 %**	**-3.65 [-4.08, -3.22]**

Heterogeneity: Chi² = 46.53, df = 3 (P<0.00001); I² =94%

Test for overall effect: Z = 16.64 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 1.2. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 2 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 2 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		54.2 %	-1.80 [-2.02, -1.58]
Lindstrom 2003	256	-1.6 (1.8)	250	-0.4 (1.3)		36.8 %	-1.20 [-1.47, -0.93]
Mensink 2003b	47	-0.9 (1.37)	55	0 (1.48)		9.0 %	-0.90 [-1.45, -0.35]
Total (95% CI)	**403**		**399**			**100.0 %**	**-1.50 [-1.66, -1.33]**

Heterogeneity: Chi² = 15.98, df = 2 (P = 0.00034); I² =87%

Test for overall effect: Z = 17.73 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 1.3. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 3 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 3 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		31.8 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		11.2 %	-0.19 [-0.43, 0.05]
Mensink 2003b	47	-0.1 (0.69)	55	0.1 (0.74)		8.3 %	-0.20 [-0.48, 0.08]
Tuomilehto 2001	265	-0.22 (0.67)	257	0.06 (0.67)		48.7 %	-0.28 [-0.39, -0.17]
Total (95% CI)	**503**		**513**			**100.0 %**	**-0.14 [-0.22, -0.06]**

Heterogeneity: Chi^2 = 16.98, df = 3 (P = 0.00071); I^2 =82%

Test for overall effect: Z = 3.48 (P = 0.00050)

Test for subgroup differences: Not applicable

Analysis 1.4. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 4 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

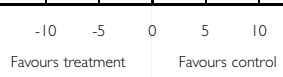
Outcome: 4 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		36.7 %	0.0 [-0.14, 0.14]
Lindstrom 2003	256	-0.1 (0.7)	250	0.1 (0.6)		54.2 %	-0.20 [-0.31, -0.09]
Mensink 2003b	47	-0.2 (0.69)	55	-0.1 (0.74)		9.1 %	-0.10 [-0.38, 0.18]
Total (95% CI)	**394**		**412**			**100.0 %**	**-0.12 [-0.20, -0.03]**

Heterogeneity: Chi² = 4.83, df = 2 (P = 0.09); I² =59%

Test for overall effect: Z = 2.76 (P = 0.0059)

Test for subgroup differences: Not applicable



Analysis 1.5. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 5 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 5 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		16.9 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		34.0 %	-6.20 [-9.20, -3.20]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		49.2 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**456**		**458**			**100.0 %**	**-4.41 [-6.16, -2.66]**

Heterogeneity: Chi² = 2.71, df = 2 (P = 0.26); I² =26%

Test for overall effect: Z = 4.95 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 1.6. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 6 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 6 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.8 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		20.0 %	-2.40 [-4.95, 0.15]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		54.2 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**456**		**458**			**100.0 %**	**-1.56 [-2.70, -0.43]**

Heterogeneity: Chi² = 2.60, df = 2 (P = 0.27); I² =23%

Test for overall effect: Z = 2.69 (P = 0.0071)

Test for subgroup differences: Not applicable

Analysis 1.7. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 7 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 7 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		3.5 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		1.0 %	-0.15 [-0.41, 0.11]
Mensink 2003b	55	0 (0.07)	59	0.2 (0.08)		91.0 %	-0.20 [-0.23, -0.17]
Tuomilehto 2001	265	-0.13 (0.72)	257	-0.1 (0.72)		4.5 %	-0.03 [-0.15, 0.09]
Total (95% CI)	**511**		**517**			**100.0 %**	**-0.18 [-0.21, -0.16]**

Heterogeneity: Chi² = 13.88, df = 3 (P = 0.003); I² =78%

Test for overall effect: Z = 13.79 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 1.8. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 8 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 8 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		65.7 %	0.10 [-0.04, 0.24]
Mensink 2003b	55	0.01 (0.59)	59	0.16 (0.46)		34.3 %	-0.15 [-0.35, 0.05]
Total (95% CI)	**146**		**166**			**100.0 %**	**0.01 [-0.10, 0.13]**

Heterogeneity: Chi^2 = 4.14, df = 1 (P = 0.04); I^2 =76%

Test for overall effect: Z = 0.25 (P = 0.81)

Test for subgroup differences: Not applicable

Analysis 1.9. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 9 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 9 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		20.8 %	-0.01 [-0.06, 0.04]
Mensink 2003b	55	-0.04 (0.15)	59	-0.03 (0.15)		17.4 %	-0.01 [-0.07, 0.05]
Tuomilehto 2001	265	0.05 (0.18)	257	0.03 (0.16)		61.8 %	0.02 [-0.01, 0.05]
Total (95% CI)	**411**		**423**			**100.0 %**	**0.01 [-0.01, 0.03]**

Heterogeneity: Chi^2 = 1.55, df = 2 (P = 0.46); I^2 =0.0%

Test for overall effect: Z = 0.73 (P = 0.47)

Test for subgroup differences: Not applicable

Analysis 1.10. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 10 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 10 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		13.9 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		8.6 %	-0.07 [-0.37, 0.23]
Mensink 2003b	55	-0.01 (0.59)	59	0.19 (0.85)		11.0 %	-0.20 [-0.47, 0.07]
Tuomilehto 2001	265	-0.2 (0.58)	257	-0.01 (0.68)		66.5 %	-0.19 [-0.30, -0.08]
Total (95% CI)	**511**		**517**			**100.0 %**	**-0.17 [-0.26, -0.09]**

Heterogeneity: Chi^2 = 0.66, df = 3 (P = 0.88); I^2 =0.0%

Test for overall effect: Z = 3.85 (P = 0.00012)

Test for subgroup differences: Not applicable

Analysis 1.11. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 11 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

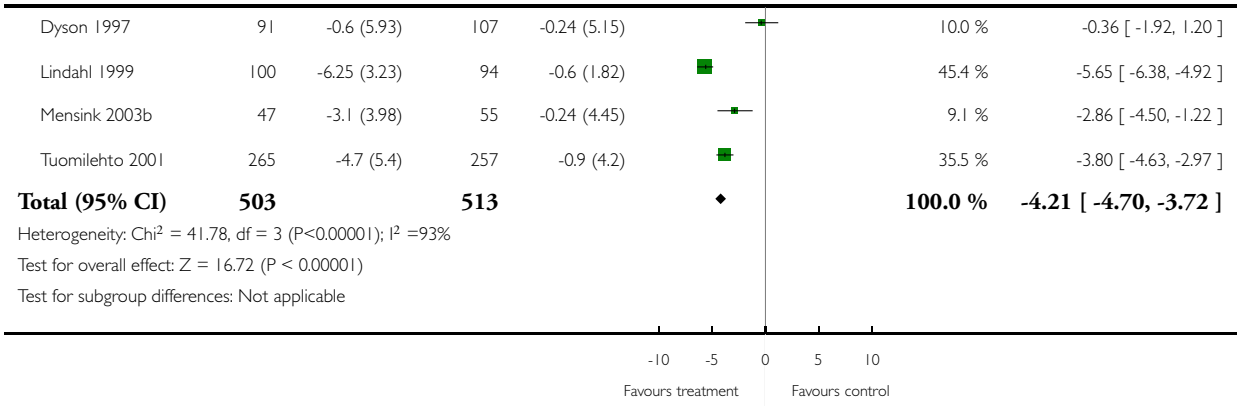
Outcome: 11 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		10.0 %	-0.36 [-1.92, 1.20]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		45.4 %	-5.65 [-6.38, -4.92]
Mensink 2003b	47	-3.1 (3.98)	55	-0.24 (4.45)		9.1 %	-2.86 [-4.50, -1.22]
Tuomilehto 2001	265	-4.7 (5.4)	257	-0.9 (4.2)		35.5 %	-3.80 [-4.63, -2.97]
Total (95% CI)	**503**		**513**			**100.0 %**	**-4.21 [-4.70, -3.72]**

Heterogeneity: Chi² = 41.78, df = 3 (P<0.00001); I² =93%

Test for overall effect: Z = 16.72 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 1.12. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 12 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 12 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		24.1 %	-0.20 [-1.47, 1.07]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		26.4 %	-4.90 [-5.53, -4.27]
Mensink 2003b	47	-2.7 (3.43)	55	-0.2 (3.71)		23.6 %	-2.50 [-3.89, -1.11]
Tuomilehto 2001	265	-4.2 (5.1)	257	-0.8 (3.7)		26.0 %	-3.40 [-4.16, -2.64]
Total (95% CI)	**503**		**513**			**100.0 %**	**-2.81 [-4.65, -0.98]**

Heterogeneity: $Tau^2 = 3.21$; $Chi^2 = 46.53$, df = 3 (P<0.00001); I^2 =94%

Test for overall effect: Z = 3.01 (P = 0.0026)

Analysis 1.13. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 13 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

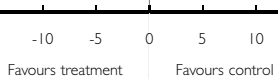
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 13 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		36.9 %	-1.80 [-2.02, -1.58]
Lindstrom 2003	256	-1.6 (1.8)	250	-0.4 (1.3)		35.7 %	-1.20 [-1.47, -0.93]
Mensink 2003b	47	-0.9 (1.37)	55	0 (1.48)		27.4 %	-0.90 [-1.45, -0.35]
Total (95% CI)	**403**		**399**			**100.0 %**	**-1.34 [-1.86, -0.82]**

Heterogeneity: $Tau^2 = 0.18$; $Chi^2 = 15.98$, df = 2 (P = 0.00034); I^2 =87%

Test for overall effect: Z = 5.05 (P < 0.00001)



Analysis 1.14. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 14 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

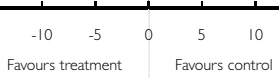
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 14 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	0.05 (3.47)	1082	0.41 (3.47)		14.1 %	-0.36 [-0.65, -0.07]
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		20.7 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		16.3 %	-0.19 [-0.43, 0.05]
Mensink 2003b	47	-0.1 (0.69)	55	0.1 (0.74)		14.7 %	-0.20 [-0.48, 0.08]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		8.0 %	0.10 [-0.39, 0.59]
Pan 1997 (diet+PA)	80	1.79 (2.55)	83	2.2 (2.07)		4.6 %	-0.41 [-1.12, 0.30]
Tuomilehto 2001	265	-0.22 (0.67)	257	0.06 (0.67)		21.8 %	-0.28 [-0.39, -0.17]
Total (95% CI)	**1680**		**1685**			**100.0 %**	**-0.16 [-0.33, 0.01]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 20.48$, df = 6 (P = 0.002); $I^2 = 71\%$

Test for overall effect: Z = 1.87 (P = 0.061)



Analysis 1.15. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 15 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 15 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		38.3 %	0.0 [-0.14, 0.14]
Lindstrom 2003	256	-0.1 (0.7)	250	0.1 (0.6)		43.2 %	-0.20 [-0.31, -0.09]
Mensink 2003b	47	-0.2 (0.69)	55	-0.1 (0.74)		18.5 %	-0.10 [-0.38, 0.18]
Total (95% CI)	**394**		**412**			**100.0 %**	**-0.10 [-0.25, 0.04]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 4.83$, df = 2 (P = 0.09); $I^2 = 59\%$

Test for overall effect: Z = 1.43 (P = 0.15)

Analysis 1.16. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 16 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 16 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		20.1 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		33.0 %	-6.20 [-9.20, -3.20]
Page 1992	18	-6 (9.92)	7	-7 (10)		5.8 %	1.00 [-7.71, 9.71]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		41.1 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**474**		**465**			**100.0 %**	**-4.04 [-6.20, -1.87]**

Heterogeneity: $Tau^2 = 1.35$; $Chi^2 = 4.13$, df = 3 (P = 0.25); $I^2 = 27\%$

Test for overall effect: Z = 3.66 (P = 0.00025)

Analysis 1.17. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 17 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

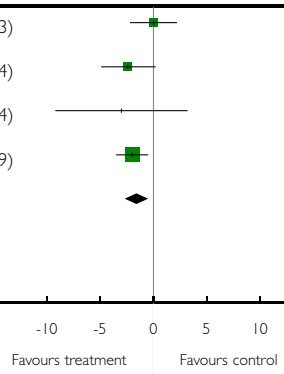
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 17 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.0 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		19.3 %	-2.40 [-4.95, 0.15]
Page 1992	18	-3 (7.67)	7	0 (6.84)		3.3 %	-3.00 [-9.18, 3.18]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		52.4 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**474**		**465**			**100.0 %**	**-1.61 [-2.73, -0.49]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 2.80$, df = 3 (P = 0.42); $I^2 = 0.0\%$

Test for overall effect: Z = 2.82 (P = 0.0048)



Analysis 1.18. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 18 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

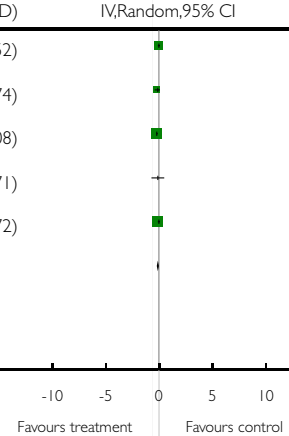
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 18 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		23.5 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		13.2 %	-0.15 [-0.41, 0.11]
Mensink 2003b	55	0 (0.07)	59	0.2 (0.08)		34.5 %	-0.20 [-0.23, -0.17]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		3.4 %	-0.10 [-0.71, 0.51]
Tuomilehto 2001	265	-0.13 (0.72)	257	-0.1 (0.72)		25.4 %	-0.03 [-0.15, 0.09]
Total (95% CI)	**529**		**524**			**100.0 %**	**-0.10 [-0.22, 0.02]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 13.96$, df = 4 (P = 0.01); $I^2 = 71\%$

Test for overall effect: Z = 1.65 (P = 0.098)



Analysis 1.19. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 19 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 19 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		48.0 %	0.10 [-0.04, 0.24]
Mensink 2003b	55	0.01 (0.59)	59	0.16 (0.46)		39.8 %	-0.15 [-0.35, 0.05]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		12.2 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**164**		**173**			**100.0 %**	**-0.04 [-0.24, 0.17]**

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 4.74$, df = 2 (P = 0.09); $I^2 = 58\%$

Test for overall effect: Z = 0.34 (P = 0.73)

Analysis 1.20. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 20 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 20 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		29.2 %	-0.01 [-0.06, 0.04]
Mensink 2003b	55	-0.04 (0.15)	59	-0.03 (0.15)		27.6 %	-0.01 [-0.07, 0.05]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		6.5 %	0.26 [0.08, 0.44]
Tuomilehto 2001	265	0.05 (0.18)	257	0.03 (0.16)		36.7 %	0.02 [-0.01, 0.05]
Total (95% CI)	**429**		**430**			**100.0 %**	**0.02 [-0.03, 0.07]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 9.16$, df = 3 (P = 0.03); $I^2 = 67\%$

Test for overall effect: Z = 0.74 (P = 0.46)

Analysis 1.21. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 21 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

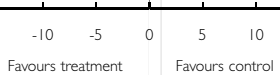
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 21 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		13.8 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		8.6 %	-0.07 [-0.37, 0.23]
Mensink 2003b	55	-0.01 (0.59)	59	0.19 (0.85)		10.9 %	-0.20 [-0.47, 0.07]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		0.6 %	-0.50 [-1.64, 0.64]
Tuomilehto 2001	265	-0.2 (0.58)	257	-0.01 (0.68)		66.1 %	-0.19 [-0.30, -0.08]
Total (95% CI)	**529**		**524**			**100.0 %**	**-0.18 [-0.26, -0.09]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.97$, df = 4 (P = 0.91); $I^2 = 0.0\%$

Test for overall effect: Z = 3.90 (P = 0.000095)



Analysis 1.22. Comparison 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 22 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

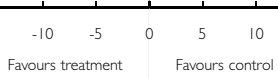
Comparison: 1 IGT (f/u=1y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 22 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		23.7 %	-0.36 [-1.92, 1.20]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		26.6 %	-5.65 [-6.38, -4.92]
Mensink 2003b	47	-3.1 (3.98)	55	-0.24 (4.45)		23.3 %	-2.86 [-4.50, -1.22]
Tuomilehto 2001	265	-4.7 (5.4)	257	-0.9 (4.2)		26.4 %	-3.80 [-4.63, -2.97]
Total (95% CI)	**503**		**513**			**100.0 %**	**-3.26 [-5.26, -1.26]**

Heterogeneity: $Tau^2 = 3.79$; $Chi^2 = 41.78$, df = 3 ($P<0.00001$); $I^2 = 93\%$

Test for overall effect: Z = 3.19 (P = 0.0014)



Analysis 2.1. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 1 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 1 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		21.5 %	-2.50 [-3.96, -1.04]
Mensink 2003b	55	-2.4 (5.19)	59	-0.1 (3.84)		16.0 %	-2.30 [-3.99, -0.61]
Tuomilehto 2001	265	-3.5 (5.5)	257	-0.8 (4.4)		62.5 %	-2.70 [-3.55, -1.85]
Total (95% CI)	**352**		**348**			**100.0 %**	**-2.59 [-3.27, -1.92]**

Heterogeneity: Chi² = 0.19, df = 2 (P = 0.91); I² =0.0%

Test for overall effect: Z = 7.53 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 2.2. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 2 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 2 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		51.0 %	-0.90 [-1.43, -0.37]
Mensink 2003b	55	-0.8 (1.48)	59	0 (1.54)		46.5 %	-0.80 [-1.35, -0.25]
Page 1992	18	0 (2.79)	7	0 (2.74)		2.5 %	0.0 [-2.40, 2.40]
Total (95% CI)	**105**		**98**			**100.0 %**	**-0.83 [-1.21, -0.45]**

Heterogeneity: Chi² = 0.54, df = 2 (P = 0.76); I² =0.0%

Test for overall effect: Z = 4.31 (P = 0.000016)

Test for subgroup differences: Not applicable

Analysis 2.3. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 3 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

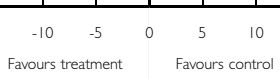
Outcome: 3 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mensink 2003b	55	0.2 (0.74)	59	0.5 (0.08)		28.7 %	-0.30 [-0.50, -0.10]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		4.6 %	0.10 [-0.39, 0.59]
Tuomilehto 2001	265	-0.1 (0.7)	257	0.2 (0.8)		66.7 %	-0.30 [-0.43, -0.17]
Total (95% CI)	**338**		**323**			**100.0 %**	**-0.28 [-0.39, -0.18]**

Heterogeneity: Chi² = 2.42, df = 2 (P = 0.30); I² =17%

Test for overall effect: Z = 5.24 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 2.4. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 4 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

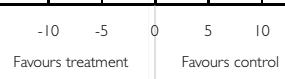
Outcome: 4 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		21.5 %	-0.90 [-1.43, -0.37]
Mensink 2003b	55	0 (0.74)	59	-0.1 (0.77)		78.5 %	0.10 [-0.18, 0.38]
Total (95% CI)	**87**		**91**			**100.0 %**	**-0.12 [-0.36, 0.13]**

Heterogeneity: Chi² = 10.76, df = 1 (P = 0.001); I² =91%

Test for overall effect: Z = 0.92 (P = 0.36)

Test for subgroup differences: Not applicable



Analysis 2.5. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 5 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 5 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mensink 2003b	55	0.3 (0.74)	59	0.4 (0.77)		83.0 %	-0.10 [-0.38, 0.18]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		17.0 %	-0.10 [-0.71, 0.51]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.10 [-0.35, 0.15]**

Heterogeneity: Chi² = 0.0, df = 1 (P = 1.00); I² =0.0%

Test for overall effect: Z = 0.78 (P = 0.44)

Test for subgroup differences: Not applicable

Analysis 2.6. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 6 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 6 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mensink 2003b	55	0.32 (0.82)	59	0.32 (0.69)		78.3 %	0.0 [-0.28, 0.28]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		21.7 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.04 [-0.29, 0.20]**

Heterogeneity: Chi² = 0.43, df = 1 (P = 0.51); I² =0.0%

Test for overall effect: Z = 0.34 (P = 0.73)

Test for subgroup differences: Not applicable

Analysis 2.7. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 7 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 7 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mensink 2003b	55	0.06 (0.22)	59	0.05 (0.15)		86.6 %	0.01 [-0.06, 0.08]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		13.4 %	0.26 [0.08, 0.44]
Total (95% CI)	**73**		**66**			**100.0 %**	**0.04 [-0.02, 0.11]**

Heterogeneity: Chi² = 6.63, df = 1 (P = 0.01); I² =85%

Test for overall effect: Z = 1.31 (P = 0.19)

Test for subgroup differences: Not applicable

Analysis 2.8. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 8 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

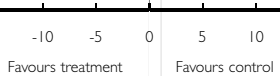
Outcome: 8 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mensink 2003b	55	-0.3 (0.89)	59	0.25 (0.85)		92.7 %	-0.55 [-0.87, -0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		7.3 %	-0.50 [-1.64, 0.64]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.55 [-0.85, -0.24]**

Heterogeneity: Chi² = 0.01, df = 1 (P = 0.93); I² =0.0%

Test for overall effect: Z = 3.48 (P = 0.00051)

Test for subgroup differences: Not applicable



Analysis 2.9. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 9 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

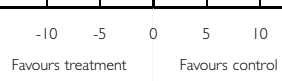
Outcome: 9 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		13.9 %	-3.72 [-5.86, -1.58]
Mensink 2003b	55	-2.8 (6.03)	59	-0.12 (4.59)		16.3 %	-2.68 [-4.66, -0.70]
Tuomilehto 2001	265	-3.9 (6.2)	257	-0.9 (4.9)		69.7 %	-3.00 [-3.96, -2.04]
Total (95% CI)	**352**		**348**			**100.0 %**	**-3.05 [-3.85, -2.25]**

Heterogeneity: Chi^2 = 0.52, df = 2 (P = 0.77); I^2 =0.0%

Test for overall effect: Z = 7.47 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 2.10. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 10 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 10 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		21.5 %	-2.50 [-3.96, -1.04]
Mensink 2003b	55	-2.4 (5.19)	59	-0.1 (3.84)		16.0 %	-2.30 [-3.99, -0.61]
Tuomilehto 2001	265	-3.5 (5.5)	257	-0.8 (4.4)		62.5 %	-2.70 [-3.55, -1.85]
Total (95% CI)	**352**		**348**			**100.0 %**	**-2.59 [-3.27, -1.92]**

Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.19, df = 2 (P = 0.91); I^2 =0.0%

Test for overall effect: Z = 7.53 (P < 0.00001)

Analysis 2.11. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 11 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 11 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		51.0 %	-0.90 [-1.43, -0.37]
Mensink 2003b	55	-0.8 (1.48)	59	0 (1.54)		46.5 %	-0.80 [-1.35, -0.25]
Page 1992	18	0 (2.79)	7	0 (2.74)		2.5 %	0.0 [-2.40, 2.40]
Total (95% CI)	**105**		**98**			**100.0 %**	**-0.83 [-1.21, -0.45]**

Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.54, df = 2 (P = 0.76); I^2 =0.0%

Test for overall effect: Z = 4.31 (P = 0.000016)

Analysis 2.12. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 12 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 12 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Mensink 2003b	55	0.2 (0.74)	59	0.5 (0.08)		33.1 %	-0.30 [-0.50, -0.10]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		6.4 %	0.10 [-0.39, 0.59]
Tuomilehto 2001	265	-0.1 (0.7)	257	0.2 (0.8)		60.5 %	-0.30 [-0.43, -0.17]
Total (95% CI)	**338**		**323**			**100.0 %**	**-0.27 [-0.40, -0.15]**

Heterogeneity: Tau^2 = 0.00; Chi^2 = 2.42, df = 2 (P = 0.30); I^2 =17%

Test for overall effect: Z = 4.24 (P = 0.000023)

Analysis 2.13. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 13 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 13 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		47.4 %	-0.90 [-1.43, -0.37]
Mensink 2003b	55	0 (0.74)	59	-0.1 (0.77)		52.6 %	0.10 [-0.18, 0.38]
Total (95% CI)	**87**		**91**			**100.0 %**	**-0.37 [-1.35, 0.61]**

Heterogeneity: $Tau^2 = 0.45$; $Chi^2 = 10.76$, df = 1 (P = 0.001); $I^2 = 91\%$

Test for overall effect: Z = 0.75 (P = 0.45)

Analysis 2.14. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 14 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 14 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Page 1992	18	-6 (9.92)	7	-7 (10)		100.0 %	1.00 [-7.71, 9.71]
Total (95% CI)	**18**		**7**			**100.0 %**	**1.00 [-7.71, 9.71]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.23 (P = 0.82)

Analysis 2.15. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 15 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 15 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Page 1992	18	-3 (7.67)	7	0 (6.84)		100.0 %	-3.00 [-9.18, 3.18]
Total (95% CI)	**18**		**7**			**100.0 %**	**-3.00 [-9.18, 3.18]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.95 (P = 0.34)

Analysis 2.16. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 16 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 16 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Mensink 2003b	55	0.3 (0.74)	59	0.4 (0.77)		83.0 %	-0.10 [-0.38, 0.18]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		17.0 %	-0.10 [-0.71, 0.51]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.10 [-0.35, 0.15]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.0$, df = 1 (P = 1.00); $I^2 = 0.0\%$

Test for overall effect: Z = 0.78 (P = 0.44)

Analysis 2.17. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 17 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 17 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Mensink 2003b	55	0.32 (0.82)	59	0.32 (0.69)		78.3 %	0.0 [-0.28, 0.28]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		21.7 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.04 [-0.29, 0.20]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.43$, df = 1 (P = 0.51); $I^2 = 0.0\%$

Test for overall effect: Z = 0.34 (P = 0.73)

Analysis 2.18. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 18 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

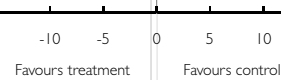
Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 18 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Mensink 2003b	55	0.06 (0.22)	59	0.05 (0.15)		55.5 %	0.01 [-0.06, 0.08]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		44.5 %	0.26 [0.08, 0.44]
Total (95% CI)	**73**		**66**			**100.0 %**	**0.12 [-0.12, 0.36]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 6.63$, df = 1 (P = 0.01); $I^2 = 85\%$

Test for overall effect: Z = 0.98 (P = 0.33)



Analysis 2.19. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 19 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 19 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Mensink 2003b	55	-0.3 (0.89)	59	0.25 (0.85)		92.7 %	-0.55 [-0.87, -0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		7.3 %	-0.50 [-1.64, 0.64]
Total (95% CI)	**73**		**66**			**100.0 %**	**-0.55 [-0.85, -0.24]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.01$, df = 1 (P = 0.93); $I^2 = 0.0\%$

Test for overall effect: Z = 3.48 (P = 0.00051)

Analysis 2.20. Comparison 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 20 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

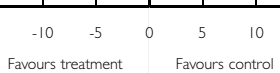
Comparison: 2 IGT (f/u=2y, 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 20 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		13.9 %	-3.72 [-5.86, -1.58]
Mensink 2003b	55	-2.8 (6.03)	59	-0.12 (4.59)		16.3 %	-2.68 [-4.66, -0.70]
Tuomilehto 2001	265	-3.9 (6.2)	257	-0.9 (4.9)		69.7 %	-3.00 [-3.96, -2.04]
Total (95% CI)	**352**		**348**			**100.0 %**	**-3.05 [-3.85, -2.25]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.52$, df = 2 (P = 0.77); $I^2 = 0.0\%$

Test for overall effect: Z = 7.47 (P < 0.00001)



Analysis 3.1. Comparison 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75), Outcome 1 weight loss (fixed).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75)

Outcome: 1 weight loss (fixed)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DPP 2002	1079	-5.6 (2.84)	1082	-0.1 (2.21)		99.3 %	-5.50 [-5.71, -5.29]
Uusitupa 2003	39	-4.9 (4.9)	29	-1.4 (5.5)		0.7 %	-3.50 [-6.02, -0.98]
Total (95% CI)	**1118**		**1111**			**100.0 %**	**-5.49 [-5.70, -5.27]**

Heterogeneity: Chi^2 = 2.39, df = 1 (P = 0.12); I^2 =58%

Test for overall effect: Z = 50.28 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 3.2. Comparison 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75), Outcome 2 GHb (random).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

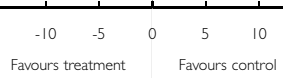
Comparison: 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75)

Outcome: 2 GHb (random)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	0.06 (1.58)	1082	0.23 (1.58)		92.4 %	-0.17 [-0.30, -0.04]
Uusitupa 2003	39	-0.11 (0.99)	29	0.14 (0.95)		7.6 %	-0.25 [-0.71, 0.21]
Total (95% CI)	**1118**		**1111**			**100.0 %**	**-0.18 [-0.30, -0.05]**

Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.11, df = 1 (P = 0.75); I^2 =0.0%

Test for overall effect: Z = 2.69 (P = 0.0070)



Analysis 3.3. Comparison 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75), Outcome 3 weight loss (random).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 3 IGT: wt loss and GHb (follow-up >2 y, rho=0.75)

Outcome: 3 weight loss (random)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	-5.6 (2.84)	1082	-0.1 (2.21)		70.6 %	-5.50 [-5.71, -5.29]
Uusitupa 2003	39	-4.9 (4.9)	29	-1.4 (5.5)		29.4 %	-3.50 [-6.02, -0.98]
Total (95% CI)	**1118**		**1111**			**100.0 %**	**-4.91 [-6.70, -3.13]**

Heterogeneity: $Tau^2 = 1.16$; $Chi^2 = 2.39$, df = 1 (P = 0.12); $I^2 = 58\%$

Test for overall effect: Z = 5.39 (P < 0.00001)

Analysis 4.1. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 1 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

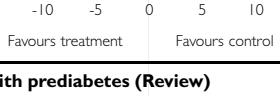
Outcome: 1 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DPP 2002	1079	-5.6 (2.84)	1082	-0.1 (2.21)		84.0 %	-5.50 [-5.71, -5.29]
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		2.4 %	-0.20 [-1.47, 1.07]
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		1.8 %	-2.50 [-3.96, -1.04]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		9.8 %	-4.90 [-5.53, -4.27]
Mensink 2003b	55	-2.4 (5.19)	59	-0.1 (3.84)		1.4 %	-2.30 [-3.99, -0.61]
Uusitupa 2003	39	-4.9 (4.9)	29	-1.4 (5.5)		0.6 %	-3.50 [-6.02, -0.98]
Total (95% CI)	**1396**		**1403**			**100.0 %**	**-5.20 [-5.40, -5.01]**

Heterogeneity: $Chi^2 = 93.98$, df = 5 (P<0.00001); $I^2 = 95\%$

Test for overall effect: Z = 51.86 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 4.2. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 2 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 2 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		12.1 %	-0.90 [-1.43, -0.37]
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		67.0 %	-1.80 [-2.02, -1.58]
Mensink 2003b	55	-0.8 (1.48)	59	0 (1.54)		11.0 %	-0.80 [-1.35, -0.25]
Page 1992	18	0 (2.79)	7	0 (2.74)		0.6 %	0.0 [-2.40, 2.40]
Pan 1997 (diet+PA)	80	-1.6 (2.7)	83	-0.9 (2.4)		5.5 %	-0.70 [-1.49, 0.09]
Uusitupa 2003	39	-1.8 (1.9)	29	-0.5 (2)		3.8 %	-1.30 [-2.24, -0.36]
Total (95% CI)	**324**		**304**			**100.0 %**	**-1.49 [-1.67, -1.31]**

Heterogeneity: Chi^2 = 23.54, df = 5 (P = 0.00027); I^2 =79%

Test for overall effect: Z = 15.87 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 4.3. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 3 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 3 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DPP 2002	1079	0.05 (3.47)	1082	0.41 (3.47)		9.9 %	-0.36 [-0.65, -0.07]
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		41.8 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		14.7 %	-0.19 [-0.43, 0.05]
Mensink 2003b	55	0.2 (0.74)	59	0.5 (0.08)		21.9 %	-0.30 [-0.50, -0.10]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		3.5 %	0.10 [-0.39, 0.59]
Pan 1997 (diet+PA)	80	1.79 (2.55)	83	2.2 (2.07)		1.7 %	-0.41 [-1.12, 0.30]
Uusitupa 2003	39	0.08 (0.73)	29	0.1 (0.75)		6.7 %	-0.02 [-0.38, 0.34]
Total (95% CI)	**1462**		**1461**			**100.0 %**	**-0.09 [-0.18, 0.00]**

Heterogeneity: Chi^2 = 16.67, df = 6 (P = 0.01); I^2 =64%

Test for overall effect: Z = 1.96 (P = 0.050)

Test for subgroup differences: Not applicable

Analysis 4.4. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 4 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

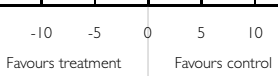
Outcome: 4 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DPP 2002	1079	0.06 (1.58)	1082	0.23 (1.58)		44.5 %	-0.17 [-0.30, -0.04]
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		41.5 %	0.0 [-0.14, 0.14]
Mensink 2003b	55	0 (0.74)	59	-0.1 (0.77)		10.3 %	0.10 [-0.18, 0.38]
Uusitupa 2003	39	-0.11 (0.99)	29	0.14 (0.95)		3.7 %	-0.25 [-0.71, 0.21]
Total (95% CI)	**1264**		**1277**			**100.0 %**	**-0.07 [-0.16, 0.01]**

Heterogeneity: Chi^2 = 5.16, df = 3 (P = 0.16); I^2 =42%

Test for overall effect: Z = 1.64 (P = 0.10)

Test for subgroup differences: Not applicable



Analysis 4.5. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 5 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

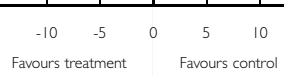
Outcome: 5 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		16.2 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		32.6 %	-6.20 [-9.20, -3.20]
Page 1992	18	-6 (9.92)	7	-7 (10)		3.9 %	1.00 [-7.71, 9.71]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		47.3 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**474**		**465**			**100.0 %**	**-4.20 [-5.91, -2.49]**

Heterogeneity: Chi^2 = 4.13, df = 3 (P = 0.25); I^2 =27%

Test for overall effect: Z = 4.81 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 4.6. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 6 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

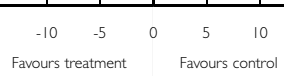
Outcome: 6 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.0 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		19.3 %	-2.40 [-4.95, 0.15]
Page 1992	18	-3 (7.67)	7	0 (6.84)		3.3 %	-3.00 [-9.18, 3.18]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		52.4 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**474**		**465**			**100.0 %**	**-1.61 [-2.73, -0.49]**

Heterogeneity: Chi^2 = 2.80, df = 3 (P = 0.42); I^2 =0.0%

Test for overall effect: Z = 2.82 (P = 0.0048)

Test for subgroup differences: Not applicable



Analysis 4.7. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 7 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

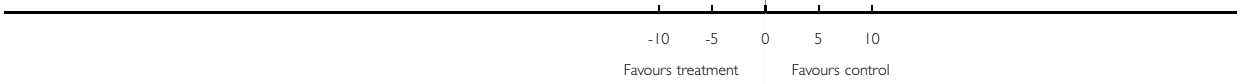
Outcome: 7 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		41.9 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		12.5 %	-0.15 [-0.41, 0.11]
Lindstrom 2003	231	-0.1 (0.9)	203	0.1 (0.8)		32.5 %	-0.20 [-0.36, -0.04]
Mensink 2003b	55	0.3 (0.74)	59	0.4 (0.77)		10.8 %	-0.10 [-0.38, 0.18]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		2.2 %	-0.10 [-0.71, 0.51]
Total (95% CI)	**495**		**470**			**100.0 %**	**-0.10 [-0.19, -0.01]**

Heterogeneity: Chi^2 = 3.58, df = 4 (P = 0.47); I^2 =0.0%

Test for overall effect: Z = 2.08 (P = 0.037)

Test for subgroup differences: Not applicable



Analysis 4.8. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 8 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

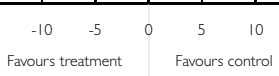
Outcome: 8 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		75.5 %	0.10 [-0.04, 0.24]
Mensink 2003b	55	0.32 (0.82)	59	0.32 (0.69)		19.2 %	0.0 [-0.28, 0.28]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		5.3 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**164**		**173**			**100.0 %**	**0.06 [-0.06, 0.19]**

Heterogeneity: Chi^2 = 1.41, df = 2 (P = 0.50); I^2 =0.0%

Test for overall effect: Z = 1.04 (P = 0.30)

Test for subgroup differences: Not applicable



Analysis 4.9. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 9 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 9 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		28.7 %	-0.01 [-0.06, 0.04]
Lindstrom 2003	231	0.14 (0.2)	203	0.11 (0.19)		54.0 %	0.03 [-0.01, 0.07]
Mensink 2003b	55	0.06 (0.22)	59	0.05 (0.15)		15.0 %	0.01 [-0.06, 0.08]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		2.3 %	0.26 [0.08, 0.44]
Total (95% CI)	**395**		**376**			**100.0 %**	**0.02 [-0.01, 0.05]**

Heterogeneity: Chi^2 = 8.78, df = 3 (P = 0.03); I^2 =66%

Test for overall effect: Z = 1.51 (P = 0.13)

Test for subgroup differences: Not applicable

Analysis 4.10. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 10 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 10 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		18.7 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		11.7 %	-0.07 [-0.37, 0.23]
Lindstrom 2003	231	-0.1 (0.6)	203	0 (0.8)		58.5 %	-0.10 [-0.23, 0.03]
Mensink 2003b	55	-0.3 (0.89)	59	0.25 (0.85)		10.3 %	-0.55 [-0.87, -0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		0.8 %	-0.50 [-1.64, 0.64]
Total (95% CI)	**495**		**470**			**100.0 %**	**-0.15 [-0.26, -0.05]**

Heterogeneity: Chi^2 = 7.17, df = 4 (P = 0.13); I^2 =44%

Test for overall effect: Z = 2.93 (P = 0.0034)

Test for subgroup differences: Not applicable

Analysis 4.11. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 11 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 11 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
DPP 2002	1079	-5.94 (2.84)	1082	-0.11 (2.21)		88.4 %	-5.83 [-6.04, -5.62]
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		1.7 %	-0.36 [-1.92, 1.20]
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		0.9 %	-3.72 [-5.86, -1.58]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		7.6 %	-5.65 [-6.38, -4.92]
Mensink 2003b	55	-2.8 (6.03)	59	-0.12 (4.59)		1.0 %	-2.68 [-4.66, -0.70]
Uusitupa 2003	39	-5.8 (5.8)	29	-1.7 (6.5)		0.5 %	-4.10 [-7.08, -1.12]
Total (95% CI)	**1396**		**1403**			**100.0 %**	**-5.67 [-5.87, -5.46]**

Heterogeneity: Chi² = 59.62, df = 5 (P<0.00001); I² =92%

Test for overall effect: Z = 55.05 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 4.12. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 12 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 12 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	-5.6 (2.84)	1082	-0.1 (2.21)		19.3 %	-5.50 [-5.71, -5.29]
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		17.1 %	-0.20 [-1.47, 1.07]
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		16.5 %	-2.50 [-3.96, -1.04]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		18.8 %	-4.90 [-5.53, -4.27]
Mensink 2003b	55	-2.4 (5.19)	59	-0.1 (3.84)		15.7 %	-2.30 [-3.99, -0.61]
Uusitupa 2003	39	-4.9 (4.9)	29	-1.4 (5.5)		12.7 %	-3.50 [-6.02, -0.98]
Total (95% CI)	**1396**		**1403**			**100.0 %**	**-3.23 [-4.76, -1.70]**

Heterogeneity: $Tau^2 = 3.16$; $Chi^2 = 93.98$, df = 5 (P<0.00001); $I^2 = 95\%$

Test for overall effect: Z = 4.13 (P = 0.000036)

Analysis 4.13. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 13 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

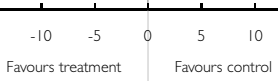
Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 13 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		20.4 %	-0.90 [-1.43, -0.37]
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		24.1 %	-1.80 [-2.02, -1.58]
Mensink 2003b	55	-0.8 (1.48)	59	0 (1.54)		20.0 %	-0.80 [-1.35, -0.25]
Page 1992	18	0 (2.79)	7	0 (2.74)		4.3 %	0.0 [-2.40, 2.40]
Pan 1997 (diet+PA)	80	-1.6 (2.7)	83	-0.9 (2.4)		16.6 %	-0.70 [-1.49, 0.09]
Uusitupa 2003	39	-1.8 (1.9)	29	-0.5 (2)		14.5 %	-1.30 [-2.24, -0.36]
Total (95% CI)	**324**		**304**			**100.0 %**	**-1.08 [-1.63, -0.53]**

Heterogeneity: $Tau^2 = 0.31$; $Chi^2 = 23.54$, df = 5 (P = 0.00027); $I^2 = 79\%$

Test for overall effect: Z = 3.85 (P = 0.00012)



Analysis 4.14. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 14 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

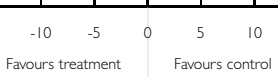
Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 14 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	0.05 (3.47)	1082	0.41 (3.47)		15.1 %	-0.36 [-0.65, -0.07]
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		22.0 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		17.4 %	-0.19 [-0.43, 0.05]
Mensink 2003b	55	0.2 (0.74)	59	0.5 (0.08)		19.5 %	-0.30 [-0.50, -0.10]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		8.6 %	0.10 [-0.39, 0.59]
Pan 1997 (diet+PA)	80	1.79 (2.55)	83	2.2 (2.07)		4.9 %	-0.41 [-1.12, 0.30]
Uusitupa 2003	39	0.08 (0.73)	29	0.1 (0.75)		12.6 %	-0.02 [-0.38, 0.34]
Total (95% CI)	**1462**		**1461**			**100.0 %**	**-0.14 [-0.31, 0.04]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 16.67$, df = 6 (P = 0.01); $I^2 = 64\%$

Test for overall effect: Z = 1.53 (P = 0.13)



Analysis 4.15. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 15 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 15 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	0.06 (1.58)	1082	0.23 (1.58)		38.6 %	-0.17 [-0.30, -0.04]
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		37.5 %	0.0 [-0.14, 0.14]
Mensink 2003b	55	0 (0.74)	59	-0.1 (0.77)		16.8 %	0.10 [-0.18, 0.38]
Uusitupa 2003	39	-0.11 (0.99)	29	0.14 (0.95)		7.2 %	-0.25 [-0.71, 0.21]
Total (95% CI)	**1264**		**1277**			**100.0 %**	**-0.07 [-0.20, 0.07]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 5.16$, df = 3 (P = 0.16); $I^2 = 42\%$

Test for overall effect: Z = 0.99 (P = 0.32)

Analysis 4.16. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 16 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 16 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		20.1 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		33.0 %	-6.20 [-9.20, -3.20]
Page 1992	18	-6 (9.92)	7	-7 (10)		5.8 %	1.00 [-7.71, 9.71]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		41.1 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**474**		**465**			**100.0 %**	**-4.04 [-6.20, -1.87]**

Heterogeneity: $Tau^2 = 1.35$; $Chi^2 = 4.13$, df = 3 (P = 0.25); $I^2 = 27\%$

Test for overall effect: Z = 3.66 (P = 0.00025)

Analysis 4.17. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 17 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 17 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.0 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		19.3 %	-2.40 [-4.95, 0.15]
Page 1992	18	-3 (7.67)	7	0 (6.84)		3.3 %	-3.00 [-9.18, 3.18]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		52.4 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**474**		**465**			**100.0 %**	**-1.61 [-2.73, -0.49]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 2.80$, df = 3 (P = 0.42); $I^2 = 0.0\%$

Test for overall effect: Z = 2.82 (P = 0.0048)

Analysis 4.18. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 18 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 18 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		41.9 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		12.5 %	-0.15 [-0.41, 0.11]
Lindstrom 2003	231	-0.1 (0.9)	203	0.1 (0.8)		32.5 %	-0.20 [-0.36, -0.04]
Mensink 2003b	55	0.3 (0.74)	59	0.4 (0.77)		10.8 %	-0.10 [-0.38, 0.18]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		2.2 %	-0.10 [-0.71, 0.51]
Total (95% CI)	**495**		**470**			**100.0 %**	**-0.10 [-0.19, -0.01]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 3.58$, df = 4 (P = 0.47); $I^2 = 0.0\%$

Test for overall effect: Z = 2.08 (P = 0.037)

Analysis 4.19. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 19 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 19 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		75.5 %	0.10 [-0.04, 0.24]
Mensink 2003b	55	0.32 (0.82)	59	0.32 (0.69)		19.2 %	0.0 [-0.28, 0.28]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		5.3 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**164**		**173**			**100.0 %**	**0.06 [-0.06, 0.19]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.41$, df = 2 (P = 0.50); $I^2 = 0.0\%$

Test for overall effect: Z = 1.04 (P = 0.30)

Analysis 4.20. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 20 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 20 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		31.3 %	-0.01 [-0.06, 0.04]
Lindstrom 2003	231	0.14 (0.2)	203	0.11 (0.19)		35.8 %	0.03 [-0.01, 0.07]
Mensink 2003b	55	0.06 (0.22)	59	0.05 (0.15)		25.2 %	0.01 [-0.06, 0.08]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		7.8 %	0.26 [0.08, 0.44]
Total (95% CI)	**395**		**376**			**100.0 %**	**0.03 [-0.02, 0.08]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 8.78$, df = 3 (P = 0.03); $I^2 = 66\%$

Test for overall effect: Z = 1.09 (P = 0.28)

Analysis 4.21. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 21 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

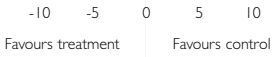
Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 21 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		24.5 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		18.8 %	-0.07 [-0.37, 0.23]
Lindstrom 2003	231	-0.1 (0.6)	203	0 (0.8)		37.2 %	-0.10 [-0.23, 0.03]
Mensink 2003b	55	-0.3 (0.89)	59	0.25 (0.85)		17.4 %	-0.55 [-0.87, -0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		2.0 %	-0.50 [-1.64, 0.64]
Total (95% CI)	**495**		**470**			**100.0 %**	**-0.19 [-0.36, -0.02]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 7.17$, df = 4 (P = 0.13); $I^2 = 44\%$

Test for overall effect: Z = 2.25 (P = 0.024)



Analysis 4.22. Comparison 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75), Outcome 22 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

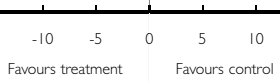
Comparison: 4 IGT (distal follow-up; 1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 22 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	-5.94 (2.84)	1082	-0.11 (2.21)		21.1 %	-5.83 [-6.04, -5.62]
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		17.2 %	-0.36 [-1.92, 1.20]
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		14.7 %	-3.72 [-5.86, -1.58]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		20.2 %	-5.65 [-6.38, -4.92]
Mensink 2003b	55	-2.8 (6.03)	59	-0.12 (4.59)		15.4 %	-2.68 [-4.66, -0.70]
Uusitupa 2003	39	-5.8 (5.8)	29	-1.7 (6.5)		11.4 %	-4.10 [-7.08, -1.12]
Total (95% CI)	**1396**		**1403**			**100.0 %**	**-3.86 [-5.35, -2.37]**

Heterogeneity: $Tau^2 = 2.72$; $Chi^2 = 59.62$, df = 5 ($P<0.00001$); $I^2 = 92\%$

Test for overall effect: $Z = 5.09$ ($P < 0.00001$)



Analysis 5.1. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 1 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

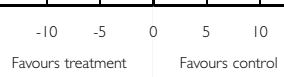
Outcome: 1 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		10.5 %	-0.20 [-1.47, 1.07]
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		8.0 %	-2.50 [-3.96, -1.04]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		43.3 %	-4.90 [-5.53, -4.27]
Mensink 2003b	47	-2.7 (3.43)	55	-0.2 (3.71)		8.9 %	-2.50 [-3.89, -1.11]
Tuomilehto 2001	265	-4.2 (5.1)	257	-0.8 (3.7)		29.3 %	-3.40 [-4.16, -2.64]
Total (95% CI)	**535**		**545**			**100.0 %**	**-3.56 [-3.97, -3.15]**

Heterogeneity: Chi^2 = 48.75, df = 4 (P<0.00001); I^2 =92%

Test for overall effect: Z = 16.91 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 5.2. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 2 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

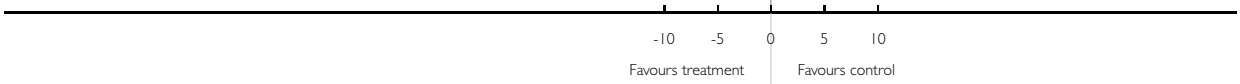
Outcome: 2 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		12.6 %	-0.90 [-1.43, -0.37]
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		69.6 %	-1.80 [-2.02, -1.58]
Mensink 2003b	47	-0.9 (1.37)	55	0 (1.48)		11.5 %	-0.90 [-1.45, -0.35]
Page 1992	18	0 (2.79)	7	0 (2.74)		0.6 %	0.0 [-2.40, 2.40]
Pan 1997 (diet+PA)	80	-1.6 (2.7)	83	-0.9 (2.4)		5.7 %	-0.70 [-1.49, 0.09]
Total (95% CI)	**277**		**271**			**100.0 %**	**-1.51 [-1.70, -1.32]**

Heterogeneity: Chi^2 = 21.76, df = 4 (P = 0.00022); I^2 =82%

Test for overall effect: Z = 15.77 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 5.3. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 3 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 3 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		30.6 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		10.7 %	-0.19 [-0.43, 0.05]
Mensink 2003b	47	-0.1 (0.69)	55	0.1 (0.74)		8.0 %	-0.20 [-0.48, 0.08]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		2.6 %	0.10 [-0.39, 0.59]
Pan 1997 (diet+PA)	80	1.79 (2.55)	83	2.2 (2.07)		1.2 %	-0.41 [-1.12, 0.30]
Tuomilehto 2001	265	-0.22 (0.67)	257	0.06 (0.67)		46.8 %	-0.28 [-0.39, -0.17]
Total (95% CI)	**601**		**603**			**100.0 %**	**-0.14 [-0.22, -0.06]**

Heterogeneity: Chi^2 = 18.45, df = 5 (P = 0.002); I^2 =73%

Test for overall effect: Z = 3.47 (P = 0.00052)

Test for subgroup differences: Not applicable

Analysis 5.4. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 4 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 4 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		80.2 %	0.0 [-0.14, 0.14]
Mensink 2003b	47	-0.2 (0.69)	55	-0.1 (0.74)		19.8 %	-0.10 [-0.38, 0.18]
Total (95% CI)	**138**		**162**			**100.0 %**	**-0.02 [-0.14, 0.10]**

Heterogeneity: $Chi^2 = 0.40$, df = 1 (P = 0.53); $I^2 = 0.0\%$

Test for overall effect: Z = 0.31 (P = 0.75)

Test for subgroup differences: Not applicable

Analysis 5.5. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 5 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

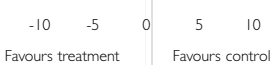
Outcome: 5 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		16.2 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		32.6 %	-6.20 [-9.20, -3.20]
Page 1992	18	-6 (9.92)	7	-7 (10)		3.9 %	1.00 [-7.71, 9.71]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		47.3 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**474**		**465**			**100.0 %**	**-4.20 [-5.91, -2.49]**

Heterogeneity: $Chi^2 = 4.13$, df = 3 (P = 0.25); $I^2 = 27\%$

Test for overall effect: Z = 4.81 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 5.6. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 6 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

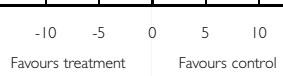
Outcome: 6 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.0 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		19.3 %	-2.40 [-4.95, 0.15]
Page 1992	18	-3 (7.67)	7	0 (6.84)		3.3 %	-3.00 [-9.18, 3.18]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		52.4 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**474**		**465**			**100.0 %**	**-1.61 [-2.73, -0.49]**

Heterogeneity: Chi^2 = 2.80, df = 3 (P = 0.42); I^2 =0.0%

Test for overall effect: Z = 2.82 (P = 0.0048)

Test for subgroup differences: Not applicable



Analysis 5.7. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 7 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

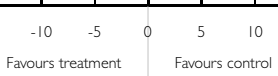
Outcome: 7 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		37.7 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		11.3 %	-0.15 [-0.41, 0.11]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		2.0 %	-0.10 [-0.71, 0.51]
Tuomilehto 2001	265	-0.13 (0.72)	257	-0.1 (0.72)		49.0 %	-0.03 [-0.15, 0.09]
Total (95% CI)	**474**		**465**			**100.0 %**	**-0.03 [-0.12, 0.05]**

Heterogeneity: Chi^2 = 1.05, df = 3 (P = 0.79); I^2 =0.0%

Test for overall effect: Z = 0.76 (P = 0.45)

Test for subgroup differences: Not applicable



Analysis 5.8. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 8 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 8 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		93.4 %	0.10 [-0.04, 0.24]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		6.6 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**109**		**114**			**100.0 %**	**0.08 [-0.06, 0.22]**

Heterogeneity: Chi^2 = 1.15, df = 1 (P = 0.28); I^2 =13%

Test for overall effect: Z = 1.15 (P = 0.25)

Test for subgroup differences: Not applicable

Analysis 5.9. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 9 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 9 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		24.7 %	-0.01 [-0.06, 0.04]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		2.0 %	0.26 [0.08, 0.44]
Tuomilehto 2001	265	0.05 (0.18)	257	0.03 (0.16)		73.3 %	0.02 [-0.01, 0.05]
Total (95% CI)	**374**		**371**			**100.0 %**	**0.02 [-0.01, 0.04]**

Heterogeneity: Chi^2 = 8.38, df = 2 (P = 0.02); I^2 =76%

Test for overall effect: Z = 1.36 (P = 0.17)

Test for subgroup differences: Not applicable

Analysis 5.10. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 10 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 10 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		15.5 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		9.6 %	-0.07 [-0.37, 0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		0.7 %	-0.50 [-1.64, 0.64]
Tuomilehto 2001	265	-0.2 (0.58)	257	-0.01 (0.68)		74.2 %	-0.19 [-0.30, -0.08]
Total (95% CI)	**474**		**465**			**100.0 %**	**-0.17 [-0.27, -0.08]**

Heterogeneity: Chi^2 = 0.93, df = 3 (P = 0.82); I^2 =0.0%

Test for overall effect: Z = 3.62 (P = 0.00029)

Test for subgroup differences: Not applicable

Analysis 5.11. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 11 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 11 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		9.5 %	-0.36 [-1.92, 1.20]
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		5.0 %	-3.72 [-5.86, -1.58]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		43.1 %	-5.65 [-6.38, -4.92]
Mensink 2003b	47	-3.1 (3.98)	55	-0.24 (4.45)		8.6 %	-2.86 [-4.50, -1.22]
Tuomilehto 2001	265	-4.7 (5.4)	257	-0.9 (4.2)		33.7 %	-3.80 [-4.63, -2.97]
Total (95% CI)	**535**		**545**			**100.0 %**	**-4.19 [-4.67, -3.71]**

Heterogeneity: Chi² = 41.97, df = 4 (P<0.00001); I² =90%

Test for overall effect: Z = 17.06 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 5.12. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 12 weight loss (kg).

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

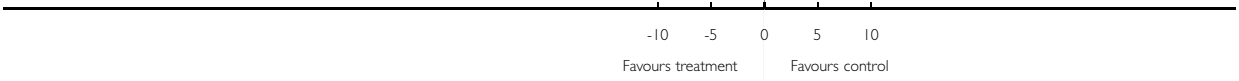
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 12 weight loss (kg)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.4 (4.82)	107	-0.2 (4.22)		19.5 %	-0.20 [-1.47, 1.07]
Liao 2002	32	-1.8 (2.69)	32	0.7 (3.23)		18.7 %	-2.50 [-3.96, -1.04]
Lindahl 1999	100	-5.4 (2.79)	94	-0.5 (1.52)		21.6 %	-4.90 [-5.53, -4.27]
Mensink 2003b	47	-2.7 (3.43)	55	-0.2 (3.71)		19.0 %	-2.50 [-3.89, -1.11]
Tuomilehto 2001	265	-4.2 (5.1)	257	-0.8 (3.7)		21.2 %	-3.40 [-4.16, -2.64]
Total (95% CI)	**535**		**545**			**100.0 %**	**-2.76 [-4.32, -1.20]**

Heterogeneity: $Tau^2 = 2.83$; $Chi^2 = 48.75$, df = 4 ($P<0.00001$); $I^2 = 92\%$

Test for overall effect: $Z = 3.47$ ($P = 0.00052$)



Analysis 5.13. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 13 BMI.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

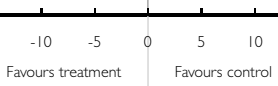
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 13 BMI

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Liao 2002	32	-0.7 (1.08)	32	0.2 (1.08)		23.8 %	-0.90 [-1.43, -0.37]
Lindahl 1999	100	-2 (1.02)	94	-0.2 (0.51)		27.9 %	-1.80 [-2.02, -1.58]
Mensink 2003b	47	-0.9 (1.37)	55	0 (1.48)		23.4 %	-0.90 [-1.45, -0.35]
Page 1992	18	0 (2.79)	7	0 (2.74)		5.3 %	0.0 [-2.40, 2.40]
Pan 1997 (diet+PA)	80	-1.6 (2.7)	83	-0.9 (2.4)		19.6 %	-0.70 [-1.49, 0.09]
Total (95% CI)	**277**		**271**			**100.0 %**	**-1.06 [-1.68, -0.45]**

Heterogeneity: $Tau^2 = 0.34$; $Chi^2 = 21.76$, df = 4 (P = 0.00022); $I^2 = 82\%$

Test for overall effect: Z = 3.41 (P = 0.00066)



Analysis 5.14. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 14 FBS.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

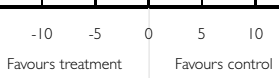
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 14 FBS

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.53)		23.9 %	0.10 [-0.04, 0.24]
Lindahl 1999	100	-0.5 (0.61)	94	-0.31 (1.03)		19.0 %	-0.19 [-0.43, 0.05]
Mensink 2003b	47	-0.1 (0.69)	55	0.1 (0.74)		17.1 %	-0.20 [-0.48, 0.08]
Page 1992	18	0.5 (0.85)	7	0.4 (0.4)		9.4 %	0.10 [-0.39, 0.59]
Pan 1997 (diet+PA)	80	1.79 (2.55)	83	2.2 (2.07)		5.4 %	-0.41 [-1.12, 0.30]
Tuomilehto 2001	265	-0.22 (0.67)	257	0.06 (0.67)		25.1 %	-0.28 [-0.39, -0.17]
Total (95% CI)	**601**		**603**			**100.0 %**	**-0.13 [-0.32, 0.06]**

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 18.45$, df = 5 (P = 0.002); $I^2 = 73\%$

Test for overall effect: Z = 1.37 (P = 0.17)



Analysis 5.15. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 15 GHb.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

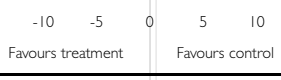
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 15 GHb

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.47)	107	-0.1 (0.52)		80.2 %	0.0 [-0.14, 0.14]
Mensink 2003b	47	-0.2 (0.69)	55	-0.1 (0.74)		19.8 %	-0.10 [-0.38, 0.18]
Total (95% CI)	**138**		**162**			**100.0 %**	**-0.02 [-0.14, 0.10]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.40$, df = 1 (P = 0.53); $I^2 = 0.0\%$

Test for overall effect: Z = 0.31 (P = 0.75)



Analysis 5.16. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 16 SBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 16 SBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-2 (14.6)	107	0 (15.91)		20.1 %	-2.00 [-6.25, 2.25]
Lindahl 1999	100	-4.9 (12.14)	94	1.3 (9.02)		33.0 %	-6.20 [-9.20, -3.20]
Page 1992	18	-6 (9.92)	7	-7 (10)		5.8 %	1.00 [-7.71, 9.71]
Tuomilehto 2001	265	-5 (14)	257	-1 (15)		41.1 %	-4.00 [-6.49, -1.51]
Total (95% CI)	**474**		**465**			**100.0 %**	**-4.04 [-6.20, -1.87]**

Heterogeneity: Tau^2 = 1.35; Chi^2 = 4.13, df = 3 (P = 0.25); I^2 =27%

Test for overall effect: Z = 3.66 (P = 0.00025)

Analysis 5.17. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 17 DBP.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 17 DBP

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	0 (9.73)	107	0 (5.3)		25.0 %	0.0 [-2.24, 2.24]
Lindahl 1999	100	-3.2 (9.04)	94	-0.8 (9.04)		19.3 %	-2.40 [-4.95, 0.15]
Page 1992	18	-3 (7.67)	7	0 (6.84)		3.3 %	-3.00 [-9.18, 3.18]
Tuomilehto 2001	265	-5 (9)	257	-3 (9)		52.4 %	-2.00 [-3.54, -0.46]
Total (95% CI)	**474**		**465**			**100.0 %**	**-1.61 [-2.73, -0.49]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 2.80$, df = 3 (P = 0.42); $I^2 = 0.0\%$

Test for overall effect: Z = 2.82 (P = 0.0048)

Analysis 5.18. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 18 Total Cholesterol.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 18 Total Cholesterol

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.2 (0.49)	107	-0.2 (0.52)		37.7 %	0.0 [-0.14, 0.14]
Lindahl 1999	100	-0.21 (1.07)	94	-0.06 (0.74)		11.3 %	-0.15 [-0.41, 0.11]
Page 1992	18	-0.4 (0.68)	7	-0.3 (0.71)		2.0 %	-0.10 [-0.71, 0.51]
Tuomilehto 2001	265	-0.13 (0.72)	257	-0.1 (0.72)		49.0 %	-0.03 [-0.15, 0.09]
Total (95% CI)	**474**		**465**			**100.0 %**	**-0.03 [-0.12, 0.05]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.05$, df = 3 (P = 0.79); $I^2 = 0.0\%$

Test for overall effect: Z = 0.76 (P = 0.45)

Analysis 5.19. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 19 LDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 19 LDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.1 (0.49)	107	-0.2 (0.52)		87.8 %	0.10 [-0.04, 0.24]
Page 1992	18	-0.3 (0.6)	7	-0.1 (0.61)		12.2 %	-0.20 [-0.73, 0.33]
Total (95% CI)	**109**		**114**			**100.0 %**	**0.06 [-0.13, 0.26]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 1.15$, df = 1 (P = 0.28); $I^2 = 13\%$

Test for overall effect: Z = 0.64 (P = 0.52)

Analysis 5.20. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 20 HDL.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 20 HDL

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.01 (0.15)	107	0 (0.21)		40.7 %	-0.01 [-0.06, 0.04]
Page 1992	18	0 (0.21)	7	-0.26 (0.2)		12.3 %	0.26 [0.08, 0.44]
Tuomilehto 2001	265	0.05 (0.18)	257	0.03 (0.16)		47.0 %	0.02 [-0.01, 0.05]
Total (95% CI)	**374**		**371**			**100.0 %**	**0.04 [-0.03, 0.11]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 8.38$, df = 2 (P = 0.02); $I^2 = 76\%$

Test for overall effect: Z = 1.03 (P = 0.31)

Analysis 5.21. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 21 Triglycerides.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

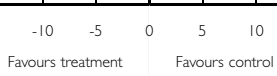
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 21 Triglycerides

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Dyson 1997	91	-0.13 (1.03)	107	0.01 (0.57)		15.5 %	-0.14 [-0.38, 0.10]
Lindahl 1999	100	-0.16 (1.07)	94	-0.09 (1.07)		9.6 %	-0.07 [-0.37, 0.23]
Page 1992	18	-0.2 (0.63)	7	0.3 (1.49)		0.7 %	-0.50 [-1.64, 0.64]
Tuomilehto 2001	265	-0.2 (0.58)	257	-0.01 (0.68)		74.2 %	-0.19 [-0.30, -0.08]
Total (95% CI)	**474**		**465**			**100.0 %**	**-0.17 [-0.27, -0.08]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.93$, df = 3 (P = 0.82); $I^2 = 0.0\%$

Test for overall effect: Z = 3.62 (P = 0.00029)



Analysis 5.22. Comparison 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75), Outcome 22 % weight loss.

Review: Long-term non-pharmacological weight loss interventions for adults with prediabetes

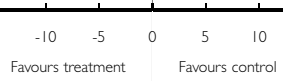
Comparison: 5 IGT without DPP (1-11: fixed models. 12-22: random models, rho=0.75)

Outcome: 22 % weight loss

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
DPP 2002	1079	-5.94 (2.84)	1082	-0.11 (2.21)		19.4 %	-5.83 [-6.04, -5.62]
Dyson 1997	91	-0.6 (5.93)	107	-0.24 (5.15)		15.5 %	-0.36 [-1.92, 1.20]
Liao 2002	32	-2.72 (4.09)	32	1 (4.63)		13.2 %	-3.72 [-5.86, -1.58]
Lindahl 1999	100	-6.25 (3.23)	94	-0.6 (1.82)		18.4 %	-5.65 [-6.38, -4.92]
Mensink 2003b	47	-3.1 (3.98)	55	-0.24 (4.45)		15.2 %	-2.86 [-4.50, -1.22]
Tuomilehto 2001	265	-4.7 (5.4)	257	-0.9 (4.2)		18.2 %	-3.80 [-4.63, -2.97]
Total (95% CI)	**1614**		**1627**			**100.0 %**	**-3.85 [-5.22, -2.47]**

Heterogeneity: $Tau^2 = 2.51$; $Chi^2 = 79.40$, df = 5 (P<0.00001); $I^2 = 94\%$

Test for overall effect: Z = 5.50 (P < 0.00001)



APPENDICES

Appendix 1. Search strategy

ELECTRONIC SEARCHES:
Unless otherwise stated, search terms were free text terms; exp = exploded MeSH: Medical subject heading (Medline medical index term); the dollar sign ($) stands for any character(s); the question mark (?) = to substitute for one or no characters; tw = text word; pt = publication type; sh = MeSH: Medical subject heading (Medline medical index term); adj = adjacency.

1. diabetes mellitus, non insulin dependent[MeSH Terms]
2. insulin resistance[MeSH Terms]
3. obesity in diabetes[MeSH Terms]
4. impaired glucose toleranc*[Title/Abstract]
5. impaired fasting glucose
6. glucose intoleranc*[Title/Abstract]
7. insulin resist*[Title/Abstract]

(*Continued*)

8. MODY[Title/Abstract]
9. dm2[Title/Abstract]
10. niddm[Title/Abstract]
11. iidm[Title/Abstract]
12. non insulin depend*[Title/Abstract]
13. noninsulin depend*[Title/Abstract]
14. noninsulindepend*[Title/Abstract]
15. non insulin?depend*[Title/Abstract]
16. type 2 diab*[Title/Abstract]
17. type ii diab*[Title/Abstract]
18. keto* resist* diabet*[Title/Abstract]
19. non keto* diabet*[Title/Abstract]
20. nonketo* diabet*[Title/Abstract]
21. adult onset diabet*[Title/Abstract]
22. late onset diabet*[Title/Abstract]
23. matur* onset diabet*[Title/Abstract]
24. slow onset diabet*[Title/Abstract]
25. stabl* onset diabet*[Title/Abstract
26. metabolic* syndrom*[Title/Abstract]
27. plurimetabolic* syndrom*[Title/Abstract]
28. pluri metabolic* syndrom*[Title/Abstract]
29. or/1-28
30. dermatomyositis[MeSH Terms]
31. Myotonic dystrophy[MeSH Terms]
32. Diabetes insipidus[MeSH Terms]
33. dermatomyositis[Title/Abstract]
34. myotonic dystroph*[Title/Abstract]
35. diabet* insipidus[Title/Abstract]
36. or/30-35
37. 29 not 36
38. obesity[MeSH Terms]
39. obes*[Title/Abstract]
40. weight gain*[Title/Abstract]
41. weight gain[MeSH Terms]
42. weight loss[Title/Abstract]
43. weight loss[MeSH Terms]
44. body mass index [Title/Abstract]
45. body mass index[MeSH Terms]
46. adipos* [Title/Abstract]
47. overweight[Title/Abstract]
48. over weight [Title/Abstract]
49. overload syndrom*[Title/Abstract]
50. overeat*[Title/Abstract]
51. over eat*[Title/Abstract]
52. overfeed*[Title/Abstract]
53. over feed*[Title/Abstract]
54. weight cycling[Title/Abstract]
55. weight reduc*[Title/Abstract]
56. weight losing[Title/Abstract]

(*Continued*)

57. weight maint*[Title/Abstract]
58. weight decreas*[Title/Abstract]
59. weight watch*[Title/Abstract]
60. weight control*[Title/Abstract]
61. or/38-60
62. exercise[MeSH Terms]
63. "physical education and training"[MeSH Terms]
64. "physical fitness"[MeSH Terms]
65. exercis*[Title/Abstract]
66. exertion*[Title/Abstract]
67. sport*[Title/Abstract]
68. walking[Title/Abstract]
69. jogging[Title/Abstract]
70. swimming[Title/Abstract]
71. strength train*[Title/Abstract]
72. resistance train*[Title/Abstract]
73. aerobic train*[Title/Abstract]
74. physical education*[Title/Abstract]
75. physical fitness[Title/Abstract]
76. training[Title/Abstract]
77. Life style[MeSH Terms]
78. Health education[MeSH Terms]
79. health behavior[MeSH Terms]
80. health promotion[MeSH Terms]
81. sports[MeSH Terms]
82. exertion[MeSH Terms]
83. exercise-therapy[MeSH Terms]
84. nutrition[MeSH Terms]
85. nutrition*[Title/Abstract]
86. diet therapy[MeSH Terms]
87. feeding-behavior[MeSH Terms]
88. life style[Title/Abstract]
89. lifestyle[Title/Abstract]
90. health* behav*[Title/Abstract]
91. health* educ*[Title/Abstract]
92. health* promot*[Title/Abstract]
93. physic* activ*[Title/Abstract]
94. bicyc*[Title/Abstract]
95. cycling[Title/Abstract]
96. weight lift*[Title/Abstract]
97. gymnastic*[Title/Abstract]
98. danc*[Title/Abstract]
99. diabetic diet[MeSH Terms]
100. diet*[Title/Abstract]
101. diet therapy[MeSH Terms]
102. or/62-101
103. 37 and 61 and 102

Appendix 2. Study characteristics

Reference	Sample size	Follow-up (yrs)	Age (yrs)	Sex (%female)	BMI	Inclusion criteria	Sampling method	Attrition (%)
DPP 2002	3,234	mean 2. 8 (range, 1. 8-4.6)	50.6 (10.7)	67.7	34.0 (6.7)	BMI>24 FPG 95-125 mg/dl (5.2-6.9 mmol/l) and 2-h 75-g OGTT PG 140-199 mg/dl (7.8-11.0 mmol/l)	Self- and provider-selected from clinic and community	8 8
Dyson 1997	227	1	50 (9)	59.0	NR	FPG on 2 occasions 5. 5-7.7 mmol/l (99-139 mg/dl). There is some over-lap with this population and diabetes (as defined by the American Diabetes As-so-ciation 1997) . Also at base-line 27% had diabetes as defined by OGTT (World Health Orga-nization, 1985)	Self-selected from clinics	11
Jarrett et al. 1987	204	10.0	55.0 (7.6)	0.0	25.8 (3.4)	Random cap-illary BG 110-199 mg/dl (1.6-11.0 mmol/l) , followed by 50-g OGTT with peak >180 mg/dl (9.0 mmol/l)	Self-selected, community recruitment	43

(*Continued*)

						and 2-h 120-199 mg/dl (6.6-11.0 mmol/l) and/or 2 values >180 mg/dl (9.0 mmol/l) and/or mean 2-h >120 mg/dl (6.6 mmol/l)		
Liao et al. 2002	64	2.0	54.0 (10.2)	55.0	26.2 (4.5)	FPG <127 mg/dl (<7.0 mol/l) and 2-h post 75-g glucose load of >140 mg/dl (7.8 mmol/l) and <200 mg/dl (11.1 mmol/l)	Unclear	17
Lindahl 1999	194	1.0	55.4 (8.9)	63.0	30.6 (3.3)	BMI>27 Abnormal OGTT (World Health Organization, 1985)	Subset of a community intervention registry	4
Mensink 2003	114	2.0	56.6 (7.2)	47.0	29.4 (3.6)	Mean 2-h 75g OGTT BG >140mg/dl (7.8 mmol/l) and <225 mg/dl (12.5 mmol/l); FBG <140mg/dl (7.8 mmol/l)	Patients in existing community cohort who were at high risk for diabetes were given OGTT	10
Page 1992	31	2.0	39.4 (10.7)	NR	26.6 (4.0)	IGT based on 2 continuous infusion of glucose with model assess-	Unclear	26

(*Continued*)

						ment (CIGMA) tests, or FBG >5.6 mmol/l (101 mg/dl)		
Pan 1997	577	6.0	45.0 (9.1)	47.0	25.8 (3.8)	2-h post-prandial BG >=120 mg/dl (6.7 mmol/l) and <200 mg/dl (11.0 mmol/l), followed by 75-g OGTT (abnormal by 1985 WHO criteria)	87% of target population (a community in China) were screened	8
Tuomilehto 2001	523	mean 3.2 (range, 1.6-6.0)	55.0 (7.0)	67.0	31.1 (4.6)	BMI>= 25 IGT (2-h post prandial plasma glucose 140-200 mg/dl [7.8-11.0 mmol/l]) and FG <140mg/dl (7.8 mmol/l)	Epidemiologic surveys and opportunistic population screening	
Mean	5,168 (total)	3.2	51.2 (9.9)	50.2	28.7 (5.9)			15.6
Range	31-3,234	1-10	39.3-56.6	0.0-67.7	25.8-34.0			4.0-43

Appendix 3. Primary outcomes, summary of pooled estimates, fixed-effects model

Variable	Follow-up interval	Number studies	rho = 0.25	rho = 0.5	rho = 0.75	rho = 1.00
Weight loss (kg)	1 year	4	-3.7 (95% CI -4.1 to -3.2)	-3.7 (95% CI -4.1 to -3.2)	-3.7 (95% CI -4.1 to -3.2)	-3.7 (95% CI -4.1 to -3.2)
	2 years	3	-2.6 (95% CI -3.3 to -1.9)	-2.6 (95% CI -3.3 to -1.9)	-2.6 (95% CI -3.3 to -1.9)	-2.6 (95% CI -3.3 to -1.9)

(*Continued*)

	> 2 years	2	-5.5 (95% CI -5.7 to -5.3)	-5.5 (95% CI -5.7 to -5.3)	-5.5 (95% CI -5.7 to -5.3)	-5.5 (95% CI -5.7 to -5.3)
	Most distal follow-up	6	-5.2 (95% CI -5.4 to -5.0)	-5.2 (95% CI -5.4 to -5.0)	-5.2 (95% CI -5.4 to -5.0)	-5.2 (95% CI -5.4 to -5.0)
BMI	1 year	3	-1.5 (95% CI -1.7 to -1.3)	-1.5 (95% CI -1.7 to -1.3)	-1.5 (95% CI -1.7 to -1.3)	-1.5 (95% CI -1.7 to -1.3)
	2 years	3	-0.9 (95% CI -1.2 to -0.5)	-0.8 (95% CI -1.2 to -0.5)	-0.8 (95% CI -1.2 to -0.5)	-0.2 (95% CI -0.4 to 0.0)
Weight loss (%)	1 year	4	-4.2 (95% CI -4.7 to -3.7)	-4.2 (95% CI -4.7 to -3.7)	-4.2 (95% CI -4.7 to -3.7)	-4.2 (95% CI -4.7 to -3.7)
	2 years	3	-3.1 (95% CI -3.9 to -2.3)	-3.1 (95% CI -3.9 to -2.3)	-3.1 (95% CI -3.9 to -2.3)	-3.1 (95% CI -3.9 to -2.3)

Appendix 4. Primary outcomes, summary of pooled estimates, random-effects model

Variable	**Follow-up interval**	**Number studies**	**rho = 0.25**	**rho = 0.5**	**rho = 0.75**	**rho = 1.0**
Weight loss (kg)	1 year	4	-2.8 (95% CI -4.7 to -1.0) Q = 46.53 p < 0.00001 I squared = 93.6%	-2.8 (95% CI -4.7 to -1.0) Q = 46.53 p < 0.00001 I squared = 93.6%	-2.8 (95% CI -4.7 to -1.0) Q = 46.53 p < 0.00001 I squared = 93.6%	-2.8 (95% CI -4.7 to -1.0) Q = 46.53 p < 0.00001 I squared = 93.6%
	2 years	3	-2.6 (95% CI -3.3 to -1.9) Q = 0.19 p = 0.91 I squared = 0%	-2.6 (95% CI -3.3 to -1.9) Q = 0.19 p = 0.91 I squared = 0%	-2.6 (95% CI -3.3 to -1.9) Q = 0.19 p = 0.91 I squared = 0%	-2.6 (95% CI -3.3 to -1.9) Q = 0.19 p = 0.91 I squared = 0%
	> 2 years	2	-4.9 (95% CI -6.7 to -3.1) Q = 2.39 p = 0.12 I squared = 58.2%	-4.9 (95% CI -6.7 to -3.1) Q = 2.39 p = 0.12 I squared = 58.2%	-4.9 (95% CI -6.7 to -3.1) Q = 2.39 p = 0.12 I squared = 58.2%	-4.9 (95% CI -6.7 to -3.1) Q = 2.39 p = 0.12 I squared = 58.2%
	most distal follow-up	6	-3.2 (95% CI -4.8 to -1.7) Q = 93.98 p < 0.00001 I squared = 94.7%	-3.2 (95% CI -4.8 to -1.7) Q = 93.98 p < 0.00001 I squared = 94.7%	-3.2 (95% CI -4.8 to -1.7) Q = 93.98 p < 0.00001 I squared = 94.7%	-3.2 (95% CI -4.8 to -1.7) Q = 93.98 p < 0.00001 I squared = 94.7%

(*Continued*)

BMI	1 year	3	-1.3 (95% CI -1.9 to -0.8) Q = 15.98 p = 0.0003 I squared = 87.5%	-1.3 (95% CI -1.9 to -0.8) Q = 15.98 p = 0.0003 I squared = 87.5%	-1.3 (95% CI -1.9 to -0.8) Q = 15.98 p = 0.0003 I squared = 87.5%	-1.3 (95% CI -1.9 to -0.8) Q = 15.98 p = 0.0003 I squared = 87.5%
	2 years	3	-0.9 (95% CI -1.2 to -0.5) Q = 0.23 p = 0.89 I squared = 0%	-0.8 (95% CI -1.2 to -0.5) Q = 0.31 p = 0.86 I squared = 0%	-0.8 (95% CI -1.2 to -0.5) Q = 0.54 p = 0.76 I squared = 0%	-0.5 (95% CI -1.2 to -0.1) Q = 14.12 p = 0.0009 I squared = 85.8%
Weight loss (%)	1 year	4	-3.3 (95% CI -5.3 to -1.3) Q = 41.78 p < 0.00001 I squared = 92.8%	-3.3 (95% CI -5.3 to -1.3) Q = 41.78 p < 0.00001 I squared = 92.8%	-3.3 (95% CI -5.3 to -1.3) Q = 41.78 p < 0.00001 I squared = 92.8%	-3.3 (95% CI -5.3 to -1.3) Q = 41.78 p < 0.00001 I squared = 92.8%
	2 years	3	-3.1 (95% CI -3.9 to -2.3) Q = 0.52 p = 0.77 I squared = 0%	-3.1 (95% CI -3.9 to -2.3) Q = 0.52 p = 0.77 I squared = 0%	-3.1 (95% CI -3.9 to -2.3) Q = 0.52 p = 0.77 I squared = 0%	-3.1 (95% CI -3.9 to -2.3) Q = 0.52 p = 0.77 I squared = 0%

Appendix 5. Secondary outcomes (net between-group change and 95% confidence interval)

Study	Follow-up (yrs)	Weight (kg)	BMI (kg/m2)	GHb (%)	SBP	Cholesterol (mmol/l)	LDL (mmol/l)	TG (mmol/l)
DPP 2002	2.8	-5.5(-5.7, -5.3)	NR	-0.2	NR	NR	NR	NR
Dyson 1997	1.0	-0.2(-1.4, 1.0)	NR	0.0(-0.1, 0.1)	-2.0(-6.0, 2.0)	0.0(-0.1, 0.1)	0.1(0.0, 0.2)	-0.14(-0.4, 0.1)
Jarrett 1987	1.0	-4.5(NR)	NR	NR	-8.4(NR)	NR	NR	NR
Jarrett 1987	5.0	-4.5(NR)	NR	NR	-6.8(NR)	NR	NR	NR
Jarrett 1987	10.0	-4.4(NR)	NR	NR	10.4(NR)	NR	NR	NR
Liao 2002	2	-2.5(-4.0, -1.0)	-0.9(-1.4, -0.4)	NR	NR	NR	NR	NR
Lindahl 1999	1	-4.9(-5.5, -4.3)	-1.8(-2.0, -1.6)	NR	-6.2(-9.2, -3.2)	-0.15(-0.4, 0.1)	NR	-0.07(-0.4, 0.2)

(*Continued*)

Mensink 2003a	1	-2.5(-3.8, -1.2)	-0.9(-1.4, -0.4)	-0.1(-0.4, 0.2)	NR	NR	NR	NR
Mensink 2003	2	-2.7(-4.7, -0.7)	-0.8(-1.4, -0.3)	0.1(-0.2, 0.4)	NR	-0.1(-0.4, 0.2)	0(-0.3, 0.3)	-0.6(-0.9, -0.2)
Page 1992	2	NR	0(-2.2, 2.2)	NR	1.0(-7.0, 9.0)	-0.1(-0.7, -0.5)	-0.2(-0.7, 0.3)	-0.5(-1.6, 0.6)
Pan 1997	6	-0.1(NR)	-0.4(-0.9, 0.1)	NR	NR	NR	NR	NR
Tuomilehto 2001	1.0	-3.4(-4.2, -2.6)	NR	NR	-4(-6.5, -1.5)	-0.03(-0.2, 0.1)	NR	-0.19(NR)
Tuomilehto 2001	2	-2.7(-3.6, -1.9)	NR	NR	NR	NR	NR	NR
Lindstrom 2003	3	-2.6(-3.6, -1.6)	-1.0(-1.4, -0.6)	-0.2(-0.3, -0.1)	NR	-0.2(-0.4, -0.1)	NR	-0.1(-0.2, 0.0)
Uusitupa 2003	4	-3.5(-6.0, -1.0)	-1.3(-2.2, -0.4)	-0.3(-0.7, 0.2)	NR	NR	NR	NR

Appendix 6. Effect of interventions on the incidence of diabetes

Study	Group	Follow-up (yrs)	Definition diabetes	Cumulative incidence	RR reduction	Incidence**	NNT	Comments
DPP 2002	Lifestyle	3.0	FPG>126 mg/dl or 2-h OGTT>200 mg/dl, with repeat	14.4(NR)	58 (48, 66)	4.8	16.1	All 3 pairwise comparisons significant; NNTover duration of the study 6.9 (5.4, 9.5) for lifestyle group, 13.9 (8.7, 33.9) for metformin group
	Metformin			21.7(NR)	31 (27, 43)	7.8	31.3	

(*Continued*)

	Placebo			28.9(NR)		11.0		
Jarrett 1979	Diet	5.0	2-h blood glucose >200 mg/dl twice, or 3 nonsuccessive measures, or signs or symptoms of diabetes, or 2-h 75 g OGTT >200 mg/dl	18.2(NR)	Not applicable as intervention group had higher rate of diabetes than control group	3.6*	Not applicable	No significant differences between each group
	Control			13.3(NR)		2.7*		
Liao 2002	Lifestyle	2.0	2-h OGTT >200 mg/dl	3.1(NR)	51*	1.6*	62.5	One person developed diabetes in the intervention group (n=32) and 2 persons in the control group did so (n=32) . Study not designed to demonstrate prevention of diabetes
	Control			6.3(NR)		3.2*		
Pan 2002	Diet plus physical activity	6.0	FPG>140 mg/dl or PG >200 mg/dl 2h after OGTT	38.2(NR)	43*	8.0 (5.1, 10.95)	13.9	Treatment groups differed significantly from controls: diet plus physical activity (p<0.005) , diet only (p<0.03),

(*Continued*)

								and physical activity only (p<0.0005)
	Diet only			44.4(NR)	34*	10.1 (7.0, 13.2)	19.1	
	Physical activity only			52.1(NR)	23*	10.7 (7.5, 13.5)	22.2	
	Control			67.4(NR)		15.2 (11.3, 19.7)		
Tuomilehto et al. 2001	Lifestyle intervention	2.0	FPG>140 mg/dl or PG >200 mg/dl 2h after OGTT	6(3,9)	58% (for all person-years accumulated)	3.2	21.7	For all person-years accumulated, lifestyle differed significantly from the control group (p<0.001)
	Control			14(10,19)		7.8		
	Lifestyle intervention	4.0		11(6,15)				
	Control			23(17,29)				

WHAT'S NEW

Last assessed as up-to-date: 30 May 2004.

Date	Event	Description
27 October 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 2, 2005

Review first published: Issue 2, 2005

CONTRIBUTIONS OF AUTHORS

Susan L. Norris: Study supervision, study concept and design, acquisition of data, analysis and interpretation of the data, drafting and critical revision of the manuscript.

Xuanping Zhang: Study concept and design, acquisition of data, analysis and interpretation of the data, critical revision of the manuscript, technical support.

Alison Avenell: Study concept and design, analysis and interpretation of the data, critical revision of the manuscript.

Edward Gregg: Study concept and design, analysis and interpretation of the data, critical revision of the manuscript.

Christopher Schmid: Analysis and interpretation of the data, critical revision of the manuscript.

Joseph Lau: Study concept and design, analysis and interpretation of the data, critical revision of the manuscript.

DECLARATIONS OF INTEREST

None known.

With regard to the contribution of S.L. Norris, the views expressed in this review are those of the author, and no official endorsement by the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services is intended or should be inferred.

With regard to the contributions of A. Avenell, the Health Services Research Unit is core funded by the Chief Scientist Office of the Scottish Executive Health Department; however, the views expressed here are those of the authors.

SOURCES OF SUPPORT

Internal sources

- Centers for Disease Control and Pevention, USA.

External sources

- No sources of support supplied

NOTES

Figure 1. Effect of interventions on weight change

Studies are presented on the y axis, ordered by follow-up interval.

The pooled estimates assume a correlation of 0.75.

DPP, Diabetes Prevention Program

Confidence interval for the DPP at 2.8 year follow-up was provided by S. Edelstein (Personal Communication 10/13/03).

Corrected standard error for the study by Liao and colleagues (Liao 2002) was obtained from D. Liao (Personal Communication 10/8/03).

Appendices:

Appendix 2: Study characteristics

BMI, body mass index (kg/m²); BG, blood glucose; DPP, Diabetes Prevention Program; FBG, fasting blood glucose; FPG, fasting plasma glucose; IGT, impaired glucose tolerance; NR, not reported; OGTT, oral glucose tolerance test; PG plasma glucose; SD, standard deviation; WHO, World Health Organization

Appendix 3: Summary of pooled estimates, fixed effects model

BMI, body mass index (kg/m²); CI, confidence interval

Appendix 4: Primary outcomes, summary of pooled estimates, random-effects model

BMI, body mass index (kg/m²); CI, confidence interval

Appendix 5: Secondary outcomes (net between-group change and 95% confidence intervals)

BMI, body mass index (kg/m²); DPP, Diabetes Prevention Program; GHb, glycated hemoglobin; LDL, low density lipoprotein; NR, not reported; SBP, systolic blood pressure; TG triglycerides

Appendix 6: Effect of interventions on the incidence of diabetes among persons with prediabetes

Cumulative incidence (%) is over the duration of the study, with 95% confidence interval

Number needed to treat (NNT) calculated from the incidence per 100 person years

* Calculated from the cumulative incidence and the duration of the study, thus yearly incidence estimates are approximate.

** Incidence per 100 person years (95% confidence interval)

CI, confidence interval; DPP, Diabetes Prevention Program; FPG, fasting plasma glucose; NR, not reported; OGTT, oral glucose tolerance test; PG, plasma glucose; RR, relative risk

INDEX TERMS

Medical Subject Headings (MeSH)

*Weight Loss; Behavior Therapy; Exercise; Prediabetic State [diet therapy; *therapy]; Randomized Controlled Trials as Topic

MeSH check words

Adult; Humans