

## PRACTICE

## UNCERTAINTIES PAGE

# What is the most effective way to maintain weight loss in adults?

Sharon A Simpson *senior research fellow*<sup>1</sup>, Christine Shaw *reader in nursing research*<sup>2</sup>, Rachel McNamara *senior trial manager*<sup>1</sup>

<sup>1</sup>South East Wales Trials Unit, School of Medicine, Cardiff University, Cardiff CF14 4XN, UK; <sup>2</sup>Faculty of Health and Sports Science, University of Glamorgan, Pontypridd, CF37 1DL

This is one of a series of occasional articles that highlight areas of practice where management lacks convincing supporting evidence. The series adviser is David Tovey, editor in chief, the *Cochrane Library*. This paper is based on a research priority identified and commissioned by the National Institute for Health Research's Health Technology Assessment programme on an important clinical uncertainty. To suggest a topic for this series, please email us at [uncertainties@bmj.com](mailto:uncertainties@bmj.com).

Although weight loss is achievable for many adults, weight maintenance is elusive. After completing weight loss programmes, around a third of the weight lost is regained in the following year, with small differences between groups that received an intervention and controls<sup>1</sup>. Randomised controlled trials have suggested that maintenance interventions can improve longer term weight loss maintenance<sup>2,3</sup> but it is unclear what form these interventions should take and how they should be delivered. NICE guidance<sup>4</sup> currently recommends a low fat, fibre rich diet, increasing physical activity, minimising sedentary activities and regular self monitoring of weight or waist size.

## What is the evidence of the uncertainty?

We searched PubMed, the Cochrane Library, and PsychInfo to identify clinical trials or systematic reviews using the search terms: "weight loss maintenance", "maintain\* weight loss" and "overweight", "obes\*". We excluded trials targeting pregnant women and patients with an eating disorder. We included trials with a distinct focus on maintenance of weight already lost, as well as those which include long term weight loss with at least a year of follow-up. This approach was in line with US Institute of Medicine guidance,<sup>5</sup> which defines successful long term weight loss as losing at least 5% of body weight for at least one year. After reviewing abstracts of 918 papers we identified 67 potentially relevant published trials and 12 systematic reviews or meta-analyses. Four additional systematic reviews were identified from reference list searches.

## Lifestyle and behavioural interventions

Lifestyle and behavioural changes are key to weight loss maintenance. A systematic review and meta-analysis of 30 randomised controlled trials, most of which included behavioural plus other strategies (13 on diet alone, four on diet and exercise, four on exercise alone, seven on meal replacements, and two on very low energy diets) found that diet alone, diet and exercise, and meal replacements led to weight loss at 12 months of between 4.8% and 8%, and between 3% and 4.3% at 24, 36, and 48 months. At 48 months no groups regained weight to baseline levels. Only two of the studies of meal replacements went beyond one year follow-up and exercise alone did not appear to lead to successful weight loss maintenance. When large weight losses are achieved using very low energy diets, weight regain was rapid, but 5% loss could be maintained at 36 months.<sup>6</sup> Nevertheless very low energy diets (<600 kcal) should be treated with caution as they can result in hypokalemia or cardiac arrhythmia. A systematic review of six randomised controlled trials evaluating diet, exercise, or diet and exercise together indicated some advantage to combined diet and exercise interventions, which achieved a 20% greater sustained weight loss at one year than diet alone.<sup>7</sup>

There is heterogeneity in the results of trials exploring type of diet. A meta-analysis of five trials found no differences between low carbohydrate and low fat diets at 12 months.<sup>8</sup> A systematic review of 14 randomised controlled trials found that low fat, 600 kcal deficit, or low calorie diets were associated with weight loss at 12, 24, and 36 months.<sup>9</sup>

There is limited evidence about the type or amount of exercise required for weight loss maintenance. A systematic review including 11 randomised controlled trials and 35 prospective or non-randomised studies concluded that higher levels of physical activity may be associated with weight loss maintenance, but this is difficult to maintain in the longer term.<sup>10</sup> Secondary analyses of one well designed trial found individuals

reporting higher levels of physical activity (275 mins per week) were better able to maintain 10% weight loss at 24 months.<sup>11</sup>

Most trials included in these reviews, however, are of poor or moderate quality, often with high attrition, inadequate reporting of randomisation processes or blinding, and lack of intention to treat analyses.

The majority of the trials in the reviews included elements of behaviour therapy as part of the intervention, alongside other elements like dietary change, but the effects of these elements are not teased out. Behavioural interventions that have been specifically assessed in high quality randomised controlled trials and shown to offer significant benefit for weight loss maintenance are peer or social support,<sup>2</sup> frequent continued professional support,<sup>2,3</sup> behavioural methods like goal setting,<sup>3</sup> problem solving,<sup>2,3</sup> relapse prevention,<sup>3</sup> self monitoring,<sup>2,3</sup> and daily self weighing.<sup>2</sup>

### Web based interventions

There is evidence that web based interventions may be useful in weight loss maintenance. A large, well designed, three arm randomised controlled trial comparing monthly personal contact, unlimited access to an interactive technology based intervention, or self directed control found that weight regain was significantly lower in the interactive technology group than in the self directed group at 18 and 24 months, but not at 30 months. Some weight loss maintenance benefit was obtained from monthly personal contact.<sup>3</sup> Another well conducted trial found that the proportion of participants who regained 2.3 kg or more over 18 month follow-up was significantly higher in controls than in groups assigned to face-to-face support or internet support (72.4%; 45.7%; 54.8%, respectively).<sup>2</sup>

A systematic review of five studies (rated moderate quality) suggests that web based interventions are about as effective as face-to-face interventions and higher website use may be associated with weight loss maintenance,<sup>12</sup> but further research is needed as the evidence is limited.

### Anti-obesity medication

A Cochrane review of 30 randomised controlled trials suggests that compared with placebo, orlistat, rimonabant, and sibutramine may be moderately effective for weight loss maintenance.<sup>13</sup> However, sibutramine has been withdrawn from the world market and a study of rimonabant was halted because of psychiatric side effects.<sup>14</sup> The only drug approved worldwide for treating obesity is orlistat. A meta-analysis of 12 randomised controlled trials indicates that orlistat conferred an advantage above diet alone of 3.1 kg weight loss (standard deviation 10.5) at 24 months.<sup>6</sup> Another systematic review of 12 clinical trials found that orlistat plus dietary or lifestyle intervention resulted in 3-10 kg loss after 12 to 24 months and increased the odds of attaining 5% weight loss or greater at 24 months.<sup>15</sup> However, studies suffer from high attrition rates—on average between 30-50%—highly selected patient populations, inadequate description of randomisation, and few use intention to treat analyses. There is a need for a better designed, longer term evaluation of orlistat, as well as other potentially useful medications.<sup>13</sup>

### Bariatric surgery

A systematic review of the clinical and cost effectiveness of bariatric surgery in obese adults concluded that bariatric surgery is more effective than non-surgical options for weight loss. Two of the trials reported that weight loss was significantly higher in the surgery group at two year follow-up (20% and 21% versus

1.4% and 5.5%).<sup>16</sup> Surgery is, however, associated with adverse effects, including postoperative mortality. Most of the trials included in this review had an uncertain risk of bias, only five out of 23 reported adequate allocation concealment, and most did not report whether those assessing outcome were blinded. NICE guidance suggests that bariatric surgery should be first line for those with a body mass index over 50, and should be considered for adults with a BMI of over 40—and for those with a BMI between 35 and 40 if they have another disease that could be improved by weight loss (all other appropriate methods of weight loss should have been tried for at least six months).<sup>4</sup>

### Is ongoing research likely to provide relevant evidence?

We searched controlled-trials.com/mrct and identified 18 relevant ongoing trials. The evidence base is equivocal and many questions remain unanswered in relation to weight loss maintenance.

Current ongoing randomised controlled trials will attempt to answer some of these questions. These include an evaluation of the level of activity ([www.controlled-trials.com/mrct/trial/427141/wyatt](http://www.controlled-trials.com/mrct/trial/427141/wyatt)), a few trials of specific psychological interventions such as mindfulness based therapy ([www.controlled-trials.com/mrct/trial/1051017/wolever](http://www.controlled-trials.com/mrct/trial/1051017/wolever)), and others of less intensive—and thus less costly—interventions such as telephone ([www.controlled-trials.com/mrct/trial/452607/sherwood](http://www.controlled-trials.com/mrct/trial/452607/sherwood)) or web based interventions.<sup>17</sup> A combination of interventions appears most effective,<sup>9</sup> and trials that are based on theories of behaviour change are more likely to be able to identify active components. The Weight Loss Maintenance in Adults trial ([www.hta.ac.uk/project/2083.asp](http://www.hta.ac.uk/project/2083.asp)) is one such trial. This three arm trial (comparing intensive, less intensive, and control) is evaluating whether motivational interviewing with self monitoring and peer support is effective in maintaining weight at three year follow-up.

### What should we do in the light of uncertainty?

Evidence from trials is often contradictory; they are heterogeneous in terms of setting, length of follow up, and type and duration of intervention, and many have methodological flaws. This makes it difficult to draw conclusions about what works in weight loss maintenance. High levels of attrition are problematic in these long term trials, and this is likely associated with weight loss maintenance failure. The issue of translation of trial findings to clinical practice is also problematic, not least because trial recruits are likely to be highly selected and more motivated than the general population. However, current evidence indicates that these interventions are likely to be helpful:

Ongoing regular support/follow-up;

Behavioural techniques such as goal setting, relapse prevention, self monitoring of weight, as well as diet and physical activity;

Increase in physical activity levels, alongside a moderately calorie reduced diet;

A lower fat, higher protein diet;

A low energy diet (600 kcal deficit); orlistat in the short term; however, patients need to develop healthy lifestyles for successful weight loss maintenance;

Bariatric surgery for appropriate patients.

Obesity should be viewed as a chronic condition for which longer term support is needed. The development of healthy habits is crucial for weight loss maintenance and weight loss can only be maintained by behaviours that fit with individual lifestyles, motivations, and preferences.

Contributors: SS, CS and RM contributed to the planning, data interpretation, revising, and final pre-publication approval of the article. SS wrote the article and is responsible for the overall content and will act as guarantor.

Competing interests: All authors have completed the ICMJE uniform disclosure form at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work other than SS is the Chief Investigator of the Weight Loss Maintenance in Adults trial, CS is a Co-Investigator and RM is the Trial Manager.

Provenance and peer review: Commissioned; externally peer reviewed

- 1 NIH Technology Assessment Conference Panel. Methods for voluntary weight loss and control. *Ann Intern Med* 1993;119:764-70.
- 2 Wing RR, Tate DF, Gorin AA, Raynor HA, Fava JL. A self-regulation program for maintenance of weight loss. *N Engl J Med* 2006;355(15):1563-71.
- 3 Svetkey LP, Stevens VJ, Brantley PJ, Appel LJ, Hollis JF, Loria CM, et al. Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *JAMA* 2008;299:1139-48.
- 4 NICE. (2006) Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children, CG43, London: National Institute for Clinical Excellence

- 5 Institute of Medicine National Academy of Sciences. Weighing the Options: Criteria for Evaluating Weight Management Programs. Government Printing Office, 1995.
- 6 Franz MJ, VanWormer JJ, Crain AL, Boucher JL, Histon T, Caplan W, et al. Weight-loss outcomes: a systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. *J Am Diet Assoc* 2007;107:1755-67.
- 7 Curioni CC, Lourenco PM. Long-term weight loss after diet and exercise: a systematic review. *Int J Obes (Lond)* 2005;29:1168-74.
- 8 Nordmann AJ, Nordmann A, Briel M, Keller U, Yancy WSJr., Brehm BJ, et al. Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials. *Arch Intern Med* 2006;166:285-93.
- 9 Avenell A, Broom J, Brown TJ, Poobalan A, Aucott L, Stearns SC, et al. Systematic review of the long-term effects and economic consequences of treatments for obesity and implications for health improvement. *Health Technol Assess* 2004;8:1-182.
- 10 Fogelholm M, Kukkonen-Harjula K. Does physical activity prevent weight gain—a systematic review. *Obes Rev* 2000;1:95-111.
- 11 Jakicic JM, Marcus BH, Lang W, Janney C. Effect of exercise on 24-month weight loss maintenance in overweight women. *Arch Intern Med* 2008;168:1550-9.
- 12 Neve M, Morgan PJ, Jones PR, Collins CE. Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis. *Obes Rev* 2010;11:306-21.
- 13 Padwal R, Rucker D, Li S, Curioni C, Lau D. Long-term pharmacotherapy for obesity and overweight. *Cochrane Database of Systematic Reviews* 2003;4: CD004094.
- 14 Topol E, Bousser MG, Fox KA, Creager MA, Despres JP, Easton JD, et al. Rimonabant for prevention of cardiovascular events (CRESCENDO): a randomised, multicenter, placebo-controlled trial. *Lancet* 2010;376:517-23.
- 15 Douketis J, Macie C, Thabane L, Williamson DF. Systematic review of long-term weight loss studies in obese adults: clinical significance and applicability to clinical practice. *Int J Obes (Lond)* 2005;29:1153-67.
- 16 Picot J, Jones J, Colquitt JL, Gospodarevskaya E, Loveman E, Baxter L, et al. The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. *Health Technol Assess* 2009;13:1-190.
- 17 Collins CE, Morgan PJ, Jones P, Fletcher K, Martin J, Aguiar EJ, et al. Evaluation of a commercial web-based weight loss and weight loss maintenance program in overweight and obese adults: a randomized controlled trial. *BMC Public Health* 2010;10:669.

Accepted: 29 September 2011

Cite this as: *BMJ* 2011;343:d8042

© BMJ Publishing Group Ltd 2011

**Recommendations for further research**

In overweight and obese adults who have lost at least >5% of their body weight:

- What kind of online interventions are most effective compared to other online interventions?
- What types of diet are most effective, compared with other types of diet?
- What level and types of physical activity are most effective?
- Which behavioural or psychological interventions are most effective?
- Is a high intensity intervention with ongoing support versus a lower intensity intervention with minimal ongoing support more effective?
- What is the long term impact on weight maintenance of treatment with orlistat or other potentially useful medications?