Effective techniques in healthy eating and physical activity interventions: a meta-regression

CRD summary
This review concluded that analyses provided clear support for inclusion of self-monitoring of behaviour in addition to other techniques in behaviour change interventions to promote physical activity and healthy eating in adults. A lack of details on study quality and other methodological concerns in the review methods mean that the authors’ conclusions may be not reliable.

Authors' objectives
To assess the effectiveness of behaviour change interventions to promote physical activity and healthy eating in adult participants.

Searching
MEDLINE, EMBASE, PsycINFO, Allied and Complementary Medicine Database, Health Management Information Consortium, Cochrane Central Register of Controlled Trials (CENTRAL) and HTA database were searched for peer-reviewed published English-language studies from 1990 to 2008. Search terms were not reported. Experts were contacted for additional studies.

Study selection
Experimental and quasi-experimental designs (controlled clinical trials and interrupted time series designs) that evaluated interventions that used cognitive or behavioural change strategies to promote physical activity or healthy eating in adults (at least 18 years old) were eligible for inclusion. Interventions aimed at pregnant or recently postnatal women, athletes, participants with exiting health problems, participants not living in the free population and studies that included another intervention (such as dietary, slimming or fitness programmes) were excluded. Eligible studies had to report objective, standardised or validated self-report outcome measures. Outcomes for evaluation of physical activity interventions included changes in exercise level and energy expenditure. Outcomes for studies of health eating were measures of good and/or poor diet.

Most of the included studies evaluated a multifaceted intervention (used more than one behaviour change technique). Controls of included studies were no treatment, treatment as usual and an active control. The mean number of behaviour change techniques in the intervention groups was six. The mean number of techniques in the control groups was 0.8. Intervention duration varied between studies and ranged from a single session to 2.5 years. Most interventions were delivered at an individual or group level; some were delivered at both individuals and groups. Settings were community, primary care and workplace. Most of the included studies assessed outcomes at follow-up, which ranged from one week to 36 months post intervention. More than one third of studies recruited participants who were sedentary/low active, obese or at increased risk of cardiovascular disease. More than 20% of studies were aimed at women. Most studies were conducted in the USA.

Abstracts and titles of potentially relevant studies were screened for inclusion. Full papers were obtained for assessment. Two reviewers independently assessed abstracts for inclusion; any disagreement was resolved by discussion or in consultation with a third reviewer. The authors did not state how many reviewers assessed full papers for inclusion.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
For continuous data, means and standard deviations (SDs) were extracted to enable calculation of effect sizes. If means and standard deviations were not reported, effect sizes were calculated from the sample size and p values. For dichotomous data, log odds ratios were converted into a standardised mean difference. An average effect size was used when data were reported from multiple time points or outcome measures. Study authors were contacted for additional
information where necessary.

The authors did not state how many reviewers performed the data extraction.

**Methods of synthesis**

Studies were combined in a meta-analysis using a DerSimonian and Laird random-effects model. Pooled effect sizes with 95% confidence intervals (CIs) were calculated. A positive effect size indicated that the intervention had a better outcome than the control.

Statistical heterogeneity was assessed with Q and I² statistics and visual inspection of forest plots. Meta-regression was used to examine a range of intervention characteristics on the outcome; these included target behaviour, number of intervention techniques, duration of interventions, format of delivery, treatment settings and countries. Where the meta-regression suggested a potentially important covariate, subgroup analyses were used to further explore heterogeneity.

Sensitivity analyses were performed by removal of studies that were not randomised at the individual level, removal of studies that were not randomised or for which assumptions about statistical significance were made and removal of studies with results that were classified as outliers. Publication bias was assessed using a funnel plot and the Duval and Tweedie trim and fill method.

**Results of the review**

The review included 101 studies with 122 evaluations (n=44,747): 51 evaluations targeted physical activity only; 35 studies targeted healthy eating only; and 18 studies targeted both physical activity and healthy eating.

When all studies were pooled, behaviour change interventions were associated with a significantly better outcome for promoting physical activity and healthy eating compared with controls (pooled effect size 0.31, 95% CI 0.26 to 0.36; n=44,747). Significant heterogeneity was observed for this outcome (I²=69%).

Subgroup analyses by target behaviour (physical activity or healthy eating) showed similar effect sizes. Compared with controls, behaviour change interventions were associated with a significantly better outcome for promotion of physical activity when 69 physical activity evaluations were pooled (pooled effect size 0.32, 95% CI 0.26 to 0.38; n=18,330) and a significantly better outcome for improved healthy eating when 53 healthy eating evaluations were pooled (pooled effect size 0.31, 95% CI 0.23 to 0.39; n=26,417). Significant heterogeneity was found for both outcomes (I²=58% for physical activity and I²=73% for healthy eating).

Meta-regression showed that the technique of prompt self-monitoring of behaviour explained the greatest amount of between-study heterogeneity (13%). Subgroup analyses showed that self-monitoring in combination with other techniques in behaviour change interventions were significantly more effective (pooled effect size 0.42, 95% CI 0.30 to 0.54; n=10,572) than those interventions that did not include self-monitoring (pooled effect size 0.26, 95% CI 0.21 to 0.30; n=34,175).

Sensitivity analyses did not materially alter the results. Funnel plots suggested evidence of publication bias.

**Authors' conclusions**

The analyses provided clear support for inclusion of self-monitoring of behaviour in addition to other techniques in behaviour change interventions to promote physical activity and healthy eating in adults.

**CRD commentary**

This review's inclusion criteria were clear. Relevant databases were searched. The restriction of the search to peer-reviewed published English-language studies increased risks of both publication and language biases. It was unclear whether sufficient attempts were made to minimise reviewer biases and errors in the processes of study selection and data extraction. No formal validity assessment was performed. Given the diversity of included studies, pooling the results based on studies with different types of study design might be not have been appropriate. High levels of statistical heterogeneity between studies further indicated that the pooled results were of limited value.
Given a lack of details on study quality and other methodological concerns in the review methods, the authors' conclusions may be not reliable.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that a larger set of intervention studies was required to evaluate the impact of inclusion of self-monitoring in combination with other self-regulation behaviour change techniques to promote healthy eating and physical activity in adults.

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