Meta-analysis of the benefits of self-monitoring of blood glucose on glycemic control in type 2 diabetes patients: an update

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CRD summary
The authors concluded that self-monitoring of blood glucose was useful in improving glycaemic control in patients with non-insulin dependent type 2 diabetes, particularly patients whose baseline HbA1c was 8% or more. Further research was needed. The authors’ conclusion seems suitably cautious, but the limitations of the included trials highlighted by the authors should be taken into consideration.

Authors’ objectives
To assess the effectiveness of self-monitoring of blood glucose in improving glycaemic control in patients with non-insulin dependent type 2 diabetes.

Searching
An updated search was undertaken in MEDLINE, EMBASE and The Cochrane Library for publications in any language up to June 2009. Search terms were reported. Reference lists of relevant trials and reviews were searched manually.

Study selection
Randomised controlled trials (RCTs) that compared self-monitoring blood glucose versus non self-monitoring blood glucose in patients with non-insulin dependent type 2 diabetes were eligible for inclusion if they reported haemoglobin A1c (HbA1c) as an outcome (glycaemic control). Trials that compared self-monitoring blood glucose with self-monitoring of urine glucose were excluded. Abstracts were excluded.

Inclusion criteria varied. Some patients were treated with diet and/or oral hypoglycaemic agents (including sulphonylureas and metformin). Where reported, patient age ranged from 40 to 80 years. Mean duration of diabetes ranged from 2.8 to 12.7 years. Trial durations ranged from four months to one year. One three-arm trial compared less intensive self-monitoring versus more intensive self-monitoring versus control. Other interventions included in the trials were counselling and education, and carbohydrate counting. Some trials reported hypoglycaemic events.

Two reviewers screened studies for inclusion. Discrepancies were resolved by consensus.

Assessment of study quality
Two reviewers independently assessed study quality according to a modified 11-item version of the Maastricht-Amsterdam score. Studies were rated on each item as yes (bias unlikely), no (bias likely) and don’t know. Studies that scored positive on at least six of the 11 criteria were deemed high quality. Discrepancies were resolved through referral to a third reviewer.

Data extraction
Two reviewers independently extracted mean change in HbA1c from baseline to follow-up and standard deviations (SDs) for each treatment group. Variance was computed if it was not reported. For the three-arm trial, the less intensive and more intensive self-monitoring groups were combined. Discrepancies were resolved through referral to a third reviewer.

Methods of synthesis
Mean differences (MDs) and 95% confidence intervals (CIs) were pooled using a random-effects model where there was evidence of statistical heterogeneity, weighted by the inverse of the variance; otherwise, a fixed-effect model was used. Statistical heterogeneity was assessed using Q and I² statistics.

Subgroup analysis assessed the influence of baseline HbA1c (<8%, 8% to 10% and >10%) on the results. Sensitivity analysis was undertaken by exclusion of studies that enrolled patients with newly diagnosed non-insulin dependent type
2 diabetes.

Publication bias was assessed using a funnel plot and Egger's test.

**Results of the review**

Nine RCTs (n=2,419 patients, range 23 to 689), which included two additional RCTs retrieved in the updated search, were included in this review. Two RCTs and were deemed low quality (score <6) and seven RCTs were high quality (score ≥6).

Self-monitoring of blood glucose statistically significantly improved glycaemic control compared to non self-monitoring of blood glucose in patients with non-insulin dependent type 2 diabetes (weighted mean difference -0.24%, 95% CI -0.34% to -0.14%; nine RCTs). There was no evidence of statistical heterogeneity ($I^2 = 7\%$) and no evidence of publication bias.

Subgroup analyses in patients with a mean baseline HbA$_1c$ of 8% to 10% or more than 10% did not significantly alter the results. In patients with a mean HbA$_1c$ less than 8% the results were no longer significant between those who self-monitored blood glucose and those who did not, but this analysis included only one RCT. Sensitivity analyses did not significantly alter the results.

**Authors’ conclusions**

Self-monitoring of blood glucose was useful in improving glycaemic control in patients with non-insulin dependent type 2 diabetes, particularly patients whose baseline HbA$_1c$ was 8% or more. Further research was needed in newly diagnosed patients and patients with good glycaemic control at baseline.

**CRD commentary**

The review question and supporting inclusion criteria were clearly stated. The literature search was adequate and was undertaken without language restrictions. No attempts were made to locate unpublished data, so relevant studies may have been missed and this was acknowledged by the authors. Formal assessment of publication bias suggested no evidence of bias. But, there was an outlier and as fewer than 10 trials were included the test may be underpowered. The authors undertook each stage of the review process in duplicate, which reduced potential for reviewer error and bias. Previously published criteria were used to assess trial quality. Most trials were reported to be of high quality, but the authors acknowledged that the trials only met the minimum number of criteria (six). There was no evidence of statistical heterogeneity, but the authors acknowledged that there was some methodological heterogeneity between trials. The authors highlighted individual limitations with the included trials, such as poor statistical power.

The authors’ conclusion seems suitably cautious. Interpretation should take into account the limitations of the included trials.

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

**Practice**: The authors stated that a well-established standardised algorithm should be available to patients and/or healthcare professionals to allow adjustments to be made in response to self-monitoring of blood glucose results.

**Research**: The authors stated that large high-quality RCTs were needed, particularly to assess the effects of self-monitoring of blood glucose in patients with newly diagnosed non-insulin dependent type 2 diabetes and patients with good glycaemic control at baseline.

**Funding**

None stated.

**Bibliographic details**


**PubMedID**

20001678
DOI
10.1089/dia.2009.0091

Original Paper URL

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Blood Glucose /metabolism; Blood Glucose Self-Monitoring /methods; Clinical Trials as Topic; Diabetes Mellitus, Type 2 /blood; Hemoglobin A, Glycosylated /analysis; Humans; Randomized Controlled Trials as Topic

AccessionNumber
12010002395

Date bibliographic record published
14/07/2010

Date abstract record published
06/04/2011

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.