

DEBATE:

Self-monitoring of blood glucose by people with type 2 diabetes

To what extent, if at all, should blood glucose self-monitoring be recommended for people with type 2 diabetes not treated with insulin? We have asked two experts to comment.

The argument against

Jeffrey W Stephens

*“If you cannot measure it, you cannot improve it”
“If you’ve measured it, you must do something about it”*

Lord Kelvin 1824-1907

The self-monitoring of blood glucose (SMBG) is generally accepted as integral to the management of diabetes, particularly for people who require insulin. This allows the patient to detect hyperglycaemia or hypoglycaemia; helps inform decisions about adjustment of insulin dosage; and may suggest a change in some aspect of

lifestyle. However, evidence on the effectiveness of SMBG for non-insulin treated type 2 diabetes is unclear. A series of systematic reviews and meta-analyses provides inconclusive results in relation to glycaemic control and furthermore it is also unclear whether particular groups may benefit from a period of self-monitoring.

In UK practice, the National Institute of Clinical Excellence (NICE) recommends that SMBG be offered to a person newly diagnosed with type 2 diabetes only as an integral part of self-management education (NICE Clinical Guideline 87; May 2009, accessed 3rd June 2014). NICE also recommends that SMBG be made available to those on insulin; on oral medication to provide information on hypoglycaemia; to assess changes associated with medication or lifestyle or illness; and to ensure safety during activities, including driving. This should be assessed at least annually in a structured manner including the use of self-monitoring skills, quality and appropriate frequency of testing, and the continued benefit should be assessed. The American Diabetes Association recommends SMBG ≥ 6 per day for people on multiple-dose insulin (MDI) or insulin pump therapy but is unclear about type 2 diabetes and with no specific frequency recommended.¹

The pros and cons of SMBG

The advantages and disadvantages of SMBG are shown in Figure 1. It should be noted that the financial cost of SMBG is considerable. In the UK during 2008, the costs of SMBG were estimated to be GBP 120 million for all patients

with diabetes and GBP 38 million for patients with type 2 diabetes. The costs of unsubsidised test strips vary from \$0.35 in Australia to \$3.11 in India. In the DiGEM (Diabetes Glycaemic Education and Monitoring) trial, there was a full economic evaluation of SMBG. Costs for the intervention were GBP 89 for standardized usual care, GBP 181 for less intensive SMBG (2 days, 3 tests daily) and GBP 173 for more intensive SMBG. Of interest, there were higher losses to follow-up in the more intensive SMBG group which could incur additional long-term costs.

Evidence for and against SMBG

The evidence supporting SMBG in type 2 diabetes is unclear. Table 1 summarises the results of randomised clinical trials. As shown, the evidence supporting improved overall glucose control is unclear. More recently a meta-analysis by Farmer and colleagues² concluded that the clinical management of non-insulin treated diabetes using SMBG compared with no SMBG results in a HbA_{1c} reduction of 0.25% with a mean pooled HbA_{1c} levels across the groups of 0.88% in the SMBG v 0.69% in the no SMBG. Of interest, no change in HbA_{1c} level was observed for older and

Figure 1. Pros and cons of SMBG in type 2 diabetes

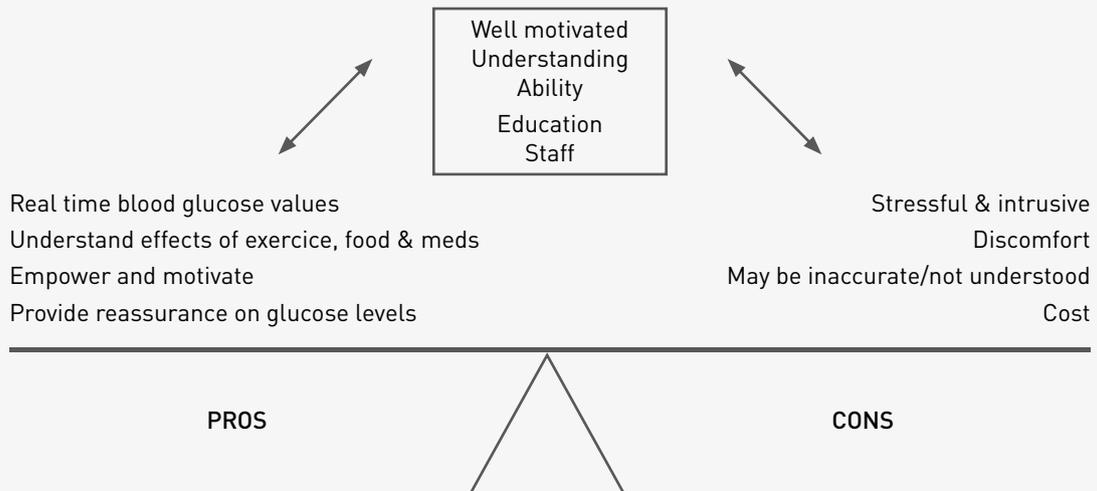


Table 1: Randomised controlled trials examining HbA_{1c} reduction with SMBG (details of the references for these are given in reference 3)

Study	For	Against
SMBG Study Group (Schwedes et al, 2002)	↓HbA _{1c} (1.0% v 0.54%) ↓ depression (6 months)	X
King-Drew MC trial (Davidson et al, 2005)	X	↓HbA _{1c} NS
ESMON study (O’Kane et al, 2008)	X	↓HbA _{1c} NS 6% ↑ depression (6 months)
DiGEM (Farmer et al, 2007)	X (But HbA _{1c} : 8.6 to 6.9% in controls)	↓HbA _{1c} NS (12 months)
DINAMIC-1 study (Barnett et al, 2008)	↓HbA _{1c} , ↓Hypos (27 weeks) (HbA _{1c} : 8.1 to 7.2% in controls/ 7.0% intervention)	X

NS: non-significant

younger people and those with a level >10%. In a Cochrane literature review by Melanda and colleagues,³ the reduction in HbA_{1c} associated with SMBG was 0.26%. Furthermore, studies have shown no difference in treatment satisfaction, a decrease in well being associated with SMBG and a 6% increase in depression score.

There is evidence supporting the use of structured SMBG. A US study in 483 poorly controlled insulin-naïve type 2 patients (mean HbA_{1c} 8.9%) compared a comprehensive, structured SMBG intervention to usual care. The result was a greater reductions in mean HbA_{1c} at 12 months with structured SMBG v usual care (1.2% vs. 0.9%, P=0.04).⁴ However, it is unclear whether 0.3% difference in HbA_{1c} is clinically significant and enough to justify the additional resources needed to provide the intervention. This supports the International Diabetes Federation’s view (Table 2) that SMBG should be part of an ongoing supported structured education programme.

Conclusion

In conclusion, for patients with established well controlled type 2 diabetes receiving oral medication who monitor blood glucose infrequently, little is to be gained in promoting SMBG, even with an

Table 2: International Diabetes Federation consensus on SMBG in Non-Insulin Treated Type 2 Diabetes (IDF 2009)

SMBG should only be used:
With knowledge/skills/willingness to incorporate into behavioural and therapy change demonstrated by person with diabetes, carer/ HCP to attain agreed targets
At diagnosis as part of education to facilitate timely treatment initiation and optimisation
Part of on-going education and self-management
Protocols should be individualised
Purpose agreed between individual and carer/health care professional
Monitor performance and accuracy of their glucose meter

education programme. Evidence suggests that SMBG fails to reach a reduction of 0.5% HbA_{1c} (which is accepted to be of clinical relevance) and the costs of self-monitoring remain high. Therefore, current evidence does not support the routine use of SMBG for people with non-insulin treated type 2 diabetes except in educated and motivated patients at risk of hypoglycaemia during inter-current illness, fasting or when using sulphonylureas. As observed by Blonde et al in a recent *Diabetes Care* publication: “...it is not the collection of blood glucose data but rather the effective use of blood glucose information for making clinical decisions that leads to improvement in diabetes control.”

Self-monitoring of blood glucose needs to be an integral part of the care package for people with type 2 diabetes

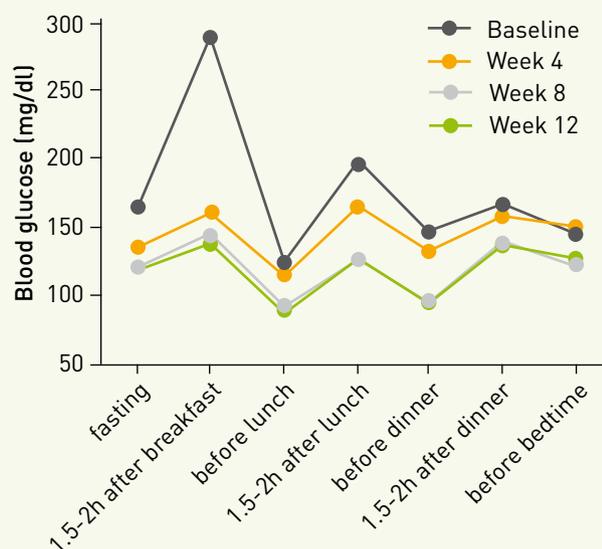
Kerstin Kempf, Lutz Heinemann and Stephan Martin

The ongoing discussion about the benefit of self-monitoring of blood glucose (SMBG) in the therapy of patients with type 2 diabetes not treated with insulin is in a sense a part of the discussion about lifestyle intervention or early pharmaceutical therapy in type 2 diabetes. There are no official claims against therapy intensification for type 2 diabetes patients with poor metabolic control although it might be questionable if high doses of insulin or combinations of oral anti-diabetic drugs really might be useful if patients still on a “diet and exercise regime” remain overweight and badly controlled. By going the “pharmaceutical way” patients may hand over responsibility to their healthcare professionals and stay passive and undedicated. Such behaviour seldom results in a more active lifestyle, weight loss, and improved glucometabolic control. Rather, it forces a vicious cycle of weight gain and the intensification of pharmaceutical treatment.

In contrast, lifestyle modification offers the possibility to patients to become an active partner in their diabetes therapy and SMBG is the only credible possibility for monitoring immediate

effects on blood glucose concentration of diet, physical activity or medication. Therefore, SMBG should be an integral opportunity for all patients with diabetes, especially for newly diagnosed and overweight patients, who are willing to change their lifestyle and to lose weight. SMBG is only useful if the results lead to therapeutic or behavioural changes. It should only be used when patients and their healthcare providers have the knowledge, skills, and cooperativeness to integrate SMBG and SMBG-based adjustments into therapy. Thus, early investigations did not find beneficial effects because at that time SMBG had just been added to standard care without structured SMBG protocols or SMBG-based therapy adjustment algorithms.⁵ When education modules for patients and care providers concerning the interpretation of SMBG data and decision making were included, these skills helped not only patients to understand the relationship between their diet and physical activity and blood glucose values (Figure 2) but also the physician to adapt treatment.⁶ Meta-analyses of subsequent studies suggested that structured SMBG was associated with significant HbA_{1c} reductions of 0.2-0.4%.⁷

Figure 2. Self-monitoring of blood glucose during 12 weeks of lifestyle intervention



Shown are four 7-point diurnal blood glucose profiles of a 51 year old white male, who lost 8 kg of weight during a SMBG-structured 12-week lifestyle intervention.⁶

Economic discussion considers the costs for saved medication versus the costs for SMBG. Much of the published evidence does not take into account the longer term risks of diabetic complications. However, when these factors were taken into account, real-time SMBG was associated with a reduced incidence of cardiovascular events and mortality as shown by the retrospective observational ROSSO study.⁸ Economic analyses suggested that the additional costs for SMBG are worthwhile because of reduced costs of complications together with increased quality of life.⁹ Further gains with regard to diabetes self-management and patient empowerment have yet to be assessed.

In summary, SMBG should not be performed according to the principle of “the more, the merrier” but the optimum structure of SMBG (viz. frequency, timing and intensity in special situations) should be integrated into national and

international diabetes guidelines. Also patients as well as care providers should be educated as to how to perform, interpret and react on measured values. Then, for interested and dedicated patients, SMBG could be a very helpful diagnostic tool for self-monitoring of diabetes control and lifestyle management.

Jeffrey Stephens, Kerstin Kempf, Lutz Heinemann and Stephan Martin

Jeffrey Stephens is Clinical Professor of Diabetes at Swansea University, UK and Consultant in Diabetes and Endocrinology at Morrision Hospital, Abertawe Bro Morgannwg Health Board, South Wales, UK.

Kerstin Kempf is Scientific Project Manager and Leader of the study centre of the West-German Centre of Diabetes and Health, Düsseldorf Catholic Hospital Group, Düsseldorf, Germany.

Lutz Heinemann is Partner and Scientific Consultant of the Profil Institut für Stoffwechselforschung GmbH, Neuss, Germany and Profil Institute for Clinical Research Ltd, San Diego, USA.

Stephan Martin is Director of the study centre of the West-German Centre of Diabetes and Health, Düsseldorf Catholic Hospital Group, Düsseldorf, Germany.

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