

## Self monitoring blood glucose and quality of care

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**Abstract.** Studies like the DCCT and the UKPDS showed that prevention of Type 1 diabetes mellitus complications can be obtained if glucose level is maintained as close as possible to normal. Consequently management of diabetes has significantly changed in the last two decades since the aim of maintaining a good metabolic control has been pursued through intensive insulin therapy and self-monitoring blood glucose (SMBG). However, although SMBG is extremely helpful in preventing and treating hypoglycaemia and ketoacidosis, its role in maintaining a good metabolic control is controversial. Both the American Diabetes Association and the International Society for Paediatric and Adolescent Diabetes recommend the use of SMBG to maintain specific glycaemic levels but suggest that this is possible only if the patient achieves good skills in interpreting self-monitored data and consequently in self-adjusting insulin therapy and modifying eating and activity. Few studies have addressed this question and almost no data is available on SMBG and metabolic control in children with T1DM. However it can be stated that SMBG, although considered a cornerstone in diabetes care, is a necessary but not sufficient tool for the patient to achieve self-management and that only self-management leads to a good metabolic control. Paediatric diabetologists have a crucial role in providing long-term, continuative education in the use of SMBG and in self-management of diabetes. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** Self-monitoring blood glucose, quality of care, Type 1 diabetes

Self-monitoring blood glucose (SMBG) is a milestone (1) in the treatment of type 1 diabetes mellitus (T1DM), however its impact on the quality of care in children with T1DM is still debated (2-4). The progress in technology has a great role in the increased use of SMBG; today patients are greatly encouraged to use SMBG thanks to the characteristics of the available devices. These are small, discreet, accurate and need very low amount of blood (5). Indeed, SMBG has become crucial in preventing and treating hypoglycaemia and it's helpful also in preventing diabetic ketoacidosis, but its role on metabolic control is controversial.

The most important scientific societies have expressed their opinions on this topic through statements or guidelines.

According to the American Diabetes Association (ADA), SMBG is a cornerstone in T1DM care and during the last two decades has significantly changed management of diabetes (6). As shown by studies like the DCCT and the UKPDS, prevention of complications of T1DM is possible if glucose levels are maintained as close as possible to normal. Today this goal can be pursued through SMBG; however this is true only if SMBG is used not as a tool to make medical prescriptions but as a tool for patients to achieve, through the interpretation of the data, a disease self-management.

It is impossible to state which is the number of daily glucose level tests necessary to achieve a good metabolic control; however in paediatric patients at

least three daily glucose level tests are recommended. In addition, ketone testing is considered an important part of monitoring T1DM, particularly during acute illness or when blood glucose levels are elevated.

The International Society for Paediatric and Adolescent Diabetes (ISPAD) in its guidelines (7) does not mention the number of glucose tests recommended, but as well as the ADA strongly suggests the use of SMBG with the aim to achieve self-management of the disease. Indeed, the ISPAD advises the use of SMBG for insulin dose self-adjustment, modification of life-style, coping with new situations, in addition to management of illness and hypoglycaemia. In this perspective it is important to assess, as part of routine care, self-test techniques, interpretation of self-monitored information and consistency of self-monitored results with acute results obtained at consultations and results of glycated haemoglobin.

The Metabolic Control of Diabetes in Children (MCDC) (8) is a multicentric study planned to collect data on clinical characteristics and metabolic control in a large population of Italian children and adolescents with T1DM. Fifty three units of paediatric diabetes, representing the entire Italian territory, collected, during a 4-month period, clinical data and capillary blood samples of 3577 subjects (1709 females) with T1DM. The age range was 1.6-18 years and the duration of the disease was at least 1 year. Glycosylated haemoglobin (GHb) has been measured with HPLC method in a central, certified laboratory. Data obtained show that 2/3 of the population examined was on intensive insulin therapy; insulin was administered three or more times a day and blood glucose tests were performed at least three times daily; nevertheless GHb was lower than 8% in only 32% of the patients.

Collected data suggest that we still should evaluate and verify the following points:

1. frequent glucose blood test is not by itself indicative of a good metabolic control;
2. SMBG is only a tool for T1DM patients to achieve self-management;
3. paediatric diabetologists have the task to provide educational tools to reach this goal.

Very few studies, including those on T2DM, can give evidence based answers to these questions. Karter et al. (9) used the Northern California Kaiser Perma-

nente Diabetes Registry to assess the importance of strip utilization in a large group of T1DM and T2DM patients and found that frequent blood monitoring was associated with a better metabolic control expressed as GHb level; however the authors concluded that this correlation could be improved only increasing the ability of the patients to modify insulin therapy according to blood glucose test results.

In a multicenter Italian study (10) the correlation between SMBG and metabolic control was found only in T2DM patients on insulin therapy; the patients who benefited from SMBG were only those capable of modifying their insulin therapy. This paper, though, confirmed that SMBG is helpful when used for self-management, strengthening the concept that SMBG has a role in improving metabolic control, also confirmed that this is possible only if SMBG is a part of an educational strategy which should lead the patient to self-management.

Norris et al. (11) published a meta-analysis on self-management education (DSME) and T2DM, providing evidence of the efficacy of DSME on glycaemic control. They showed that GHb improves with an average change of -0.76% in the immediate follow-up after DSME. The authors found that duration of contact time was the only significant predictor of DSME effect, in addition they quantified the amount of time, spent in DSME, needed to obtain an improvement of GHb and found that 23.6 hours of contact time is needed for each 1% absolute decrease of GHb. The efficacy of DSME with longer follow-up interval after the end of the intervention is reduced and it appears that long-term interventions may be required to maintain the improved glycaemic control.

## Conclusions

The statement according to which SMBG is a cornerstone of diabetes care cannot be confuted. However, if SMBG is not associated to the ability of the patient to interpret the data and modify therapy and behaviour it cannot induce a better glycaemic control. Therefore, SMBG is a necessary but not sufficient tool to achieve self-management and consequently a good metabolic control. Providing continua-

tive, long-term education to reach self-management should be considered part of routine care and a specific and extremely important task of the paediatric diabetologist. The best educational strategies are still to be defined. Scientific literature on this topic is really scarce and limited to adult patients; research contributions in the paediatric area are needed.

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