



SMBG AND GLYCAEMIC PARAMETERS (FBS, PPBS AND HbA1C) IN DIABETIC SHIFT WORKERS

Internal Medicine

Dr Bikram Raja Sharma

Resident, Department of Medicine, SGRRIM&HS

Dr Amit Varma

Professor and Head, Department of Medicine, SGRRIM&HS

Dr Neeru Garg

Professor, Department of Physiology, SGRRIM&HS

ABSTRACT

Introduction: Diabetes is a metabolic disease characterized by worsening of glycemic control and hyperglycemia. Landmark trials have shown that strict control of blood sugar levels leads to slower progression of complications. Continuous Glucose Monitoring (CGM) offers close monitoring but is costly and invasive. Self-Monitoring of Blood Glucose (SMBG) is a useful tool for glucose monitoring at home and helps in achieving glycemic control. Shift workers face challenges in glycemic control due to irregular work schedules. **Objective:** To estimate 7-point SMBG and glycemic parameters (FBS, PPBS, and HbA1c) in diabetic shift workers. **Methods:** A cross-sectional study was conducted at Shri Mahant Indires Hospital in Dehradun. Fifty subjects with type 2 diabetes attending the outpatient and inpatient departments were enrolled. Inclusion criteria included age > 18 years, type 2 diabetes, and being a shift worker. Exclusion criteria included specific diabetic emergencies and secondary diabetes. Clinical history, examination, and relevant investigations were conducted. **Results:** The mean age of the participants was 59.4±11.93 years. Baseline characteristics and glycemic parameters were measured. Shift workers accounted for 50% of the cases. Random blood sugar levels at 7 different time points were measured over a 10-day period. Statistical analysis showed significant differences in blood sugar levels based on shift work and shifting duration. **Conclusion:** This study evaluated 7-point SMBG and glycemic parameters in diabetic shift workers. The findings suggest that SMBG values at specific time points can be useful for integrating day-to-day glycemic targets. Shift workers may require targeted preventive strategies for managing diabetes and reducing the risk of complications.

KEYWORDS

INTRODUCTION

Diabetes is a metabolic disease characterized by worsening of glycemic control and hyperglycemia. In Diabetes there is relative/complete deficiency of insulin as per type of diabetes [1]. Landmark trials like DCCT, EDIC and VADT trials have convincingly showed that hyperglycaemia is directly proportional to baseline complications both microvascular and macrovascular; and strict control of blood sugar levels leads to slower progression of these complications [2,3,4].

The Continuous Glucose Monitoring (CGM) in the present date offers fairly close monitoring of blood glucose levels and thereby delivering insulin accordingly through the insulin pump. However, the cost and fixture of this device on patient's body is a barrier for their application.

SMBG (Self-Monitoring of Blood Glucose) is a useful tool for glucose monitoring at home. It is an important component of modern therapy for diabetes mellitus. SMBG has been recommended for people with diabetes in order to achieve specific level of glycemic control and to prevent hypoglycaemia. Regular SMBG testing results in a reduction in the HbA1C levels [5]. Lower HbA1C levels maintained over long term are associated with lower risks of diabetes related complications.

Further to highlight this, this study has targeted the Shift diabetic workers to be evaluated with the 7 Point SMBG Scale. Glycemic variability offers a bigger challenge in Shift workers, which involves irregular or unusual hours of work compared with those of normal day time work schedule. It includes regular evening, night, rotating shifts and irregular schedules. Previous studies have suggested that most of Shift workers were not able to adjust their circadian rhythm to a typical time table when they first started to work [6]

With regards to risk of diabetes some studies reported an impairment of glucose tolerance in shift workers, with increased insulin resistance at night and higher prevalence of type 2 diabetes in relation to rotating shift work, which appears to increase with years spent doing shift work [7]. Hence with the increasing prevalence of type 2 diabetes understanding the aspects of shift work schedule is required for designing targeted primary and secondary preventive strategies.

Hence this study was conducted to estimate 7 POINT SMBG and glycemic parameters (FBS, PPBS and HbA1c) in diabetic shift workers.

OBJECTIVES

To estimate 7 POINT SMBG and glycemic parameters (FBS, PPBS and HbA1c) in diabetic shift workers.

MATERIAL AND METHODS

The subjects so included were subjected to a detailed clinical history with special emphasis on duration of illness and treatment history and a thorough clinical examination was done in each case. The diagnosis of Diabetes was based on ADA guidelines (2014).

An informed written consent from the patient and/or legal guardian was taken from all the patients included in the study.

Night Shift Worker: "defined as subject whose waking period /active duty hours are at least 12 :00 am to 6 :00 am"

Study Site: Shri Mahant Indires Hospital , Patel Nagar, Dehradun

Study Design: Cross sectional study

Study Population: There would be minimum 50 subjects suffering from type 2 DM attending both outpatient department (OPD) and inpatient department (IPD).

These subjects were enrolled in the study only be if they satisfy the following inclusion and exclusion criteria:

Inclusion Criteria

- Age > 18 years
- Patients with Type 2 DM
- Both sexes
- Shift workers i.e. defined as subject whose waking period /active duty hours are at least 12 :00 am to 6 :00 am.
- Non-shift workers i.e. defined as subjects those who are not working between 12:00 am to 6:00 am

Exclusion Criteria

- Diabetic Emergencies (DKA, Septicemia, Hyperglycemic Hyperosmolar Nonketotic Coma)
- Type 1 DM
- Gestational Diabetes Mellitus
- Recently diagnosed T2DM patients (<3 months)
- Secondary Diabetes

Study Planning:

A thorough history was taken with special emphasis on mean duration of illness and their working hours especially shift workers. They were clinically examined and investigated especially for any existing diabetes complications. These subjects were investigated as per the diabetic screening protocol. FBS, PPBS, HbA1c and serial RBS monitoring was done in each case. Additional investigations were done as per requirements.

Ethical Clearance

Ethical clearance was obtained before conducting the study from the Institutional Ethical Committee of SGRRIM&HS Dehradun.

Statistical Analysis

The data was collected and entered into MS Excel for analysis. SPSS was used to analyze the data. Quantitative data was represented by mean and standard deviation, and the difference between means was observed using t-tests. Qualitative data was expressed as percentages, and the difference between proportions was observed using appropriate tests. A 95% confidence level was used to determine at-risk values and factors. Significant factors were identified using multivariate logistic regression, with p<0.05 considered statistically significant.

RESULTS

Table 1:- Baseline Characteristic of the study participants. (n = 50)

Characteristic	Mean±SD
Age	59.4±11.93
Duration of Diabetes	10.92±5.95
FBS	149.76±14.71
PPBS	222.26±75.83
HbA1c	9.462±2.45

The average age, duration of diabetes, FBS, PPBS and HbA1c of study participants were 59.4±11.93, 10.92±5.95, 149.76±14.71, 222.26±75.83 and 9.462±2.45 respectively.

Table 2:- Distribution of study participants according to age group. (n=50)

Age Group	No.	%
≤40yrs	2	4%
41 – 60rs	23	46%
>60yrs	25	50%

Table 2 shows that 4% subjects are in age group ≤40years, 46% subjects in age group of 41-60 years and 50% in the age group of > 60 years

Table 3:- Baseline characteristics of Diabetic Shift workers

Characteristic	Mean±SD
Age	58.08±12.72
Duration of Diabetes	10.4±6.55
FBS	161.68±9.99
PPBS	255.8±80.7
HbA1c	11.23±2.11
Shift years	16.12±5.85

50% of the studied case were shift workers. The mean of baseline characteristics of diabetic shift workers like age, duration of diabetes, FBS, PPBS, HbA1c and shift years were 58.08±12.72, 10.4±6.55, 161.68±9.99, 255.8±80.7, 11.23±2.11 and 16.12±5.85 respectively.

Table 4: Mean Random blood sugar among shift diabetic workers

	RBS (4am) Point 1	RBS (BBF) Point 2	RBS (ABF) Point 3	RBS (BL) Point 4	RBS (AL) Point 5	RBS (BD) Point 6	RBS (AD) Point 7
DAY 1	171.52 ±16.48	180.56±12.72	252.6±8.04	251.88±35.2	263.92±29.65	248.48±24.75	269.24±34.69
DAY 2	167.64 ±18.25	176.08±12.75	245.56±29.92	242.64±33.73	271.68±28.66	245.76±29.05	274.48±32.09
DAY 3	173.32 ±18.49	176.28±14.13	248±27.91	248.52±27.29	277.48±31.88	255.64±32.14	270.76±28.76
DAY 4	171.68 ±19.48	177.04±13.48	250.04±33.33	241.12±29.57	271.92±30.78	251.52±31.74	273.04±31.35
DAY 5	165±16.04	174.56±13.56	246.96±27.23	262.64±26.5	275.32±32.73	248.24±28.54	273.32±31.12

DAY 6	168.96 ±17.52	182.12±13.17	246±28.08	250.64±27.12	266.2±0.58	249.16±29.16	276.52±32.42
DAY 7	167.8±19.44	176.16±10.86	250.84±32.84	252.48±24.45	264.56±29.08	253.48±32.44	274.84±32.49
DAY 8	171.16 ±19.97	178.52±13.15	246.68±30.15	245.08±30.93	280.44±30.9	255.36±26.88	269.36±32.52
DAY 9	169.08 ±18.82	177.6±13.98	252.36±29.66	244.52±27.41	263.8±2.01	247.88±31.06	263.72±28.72
DAY 10	167.6±16.55	175.52±11.68	252.36±29.66	240.56±23.05	264.36±26.77	245.44±30.38	256.88±30.94

DISCUSSION

It is relevant to point out that the results of the two landmark trials, UKPDS and DCCT trials, were extrapolated for the 7 Point glucose measurements and its correlation with the progress of micro & macro vascular complications of diabetes. The concept of conventional Continuous Glucose Monitoring(CGM) analysis of Time In Range(TIR), Time Above Range(TAR) and Time Below Range(TBR) is already in practise but with above mentioned limitations and in a very limited subset. This concept with the replacement of CGM with SMBG has been applied in the present study.

In a crosssectional study conducted by El Tayeb et al. (2014),⁸ 152 diabetic patients from the outpatient clinic of diabetes and endocrinology at Dar El Chefa hospital who were receiving insulin therapy were randomly assigned to two shift work groups (76) and one day work group (76). Every subject has had a microvascular complications of diabetes assessment. The fasting, postprandial, glycated haemoglobin (HbA1c), albumin creatinine ratio (ACR), and fasting blood glucose levels were all measured.

The study found that the shift work group has a higher body mass index (BMI) of 32.2(3.2) compared to 28.2(2.4) (P 0.05), poor sleep quality of 54(71.1%) compared to 6(7.9%), and a higher HbA1c of 9.8(1.2) compared to 8.1(1.3) (P 0.05). Although there were more cases of diabetic retinopathy and nephropathy, only diabetic neuropathy showed a meaningful difference. Shift work adversely affect diabetic control and deteriorate measured HbA_{1c}; and increase the incidence of microvascular complication.

According to Ghazawy et al. (2014), working a rotating night shift, particularly a night shift, is bad for your health. It was discovered to be linked to the onset of type 2 diabetes mellitus and to the inability of night shift diabetic workers to control their blood surgar levels [9].

The study we have conducted has a great significance in the ongoing urbanization where there is increasing need for shift work owing to increase work demand and increasing productivity. It is important to understand the underlying neurohormonal mechanisms which may have a long term bearing. Secondly those living in hill areas especially at higher altitude have a significant day and night (light and dark phase variation) and the neurohormonal mechanism may act similarly, especially in type 2 diabetics. These observations would prompt to suggest alternative life styles, finer changes in work adjustment and therapeutic modalities for management of disease.

CONCLUSION

A total of 50 research volunteers, 24 males and 26 females, were recruited for this observational study to evaluate the 7-point SMBG in shift and non-shift workers with type 2 diabetes mellitus. The average age of subjects was 59.4±11.9 years. The age range 40-60 years accounted for 46% of the overall cases. The mean HbA1c, FBS, and PPBS for males were 8.78 ± 2.21, 147.92 ± 15.22, and 208.29 ± 70.87, respectively, and 10.096 ± 2.52, 151.46 ± 14.3 and 235.15 ± 79.3 for female, respectively,

Random blood sugar levels at 7 different times (4am, before and after breakfast, before and after lunch and before and after dinner) of the day showed insignificant differences with respect to gender and duration of disease and significant differences with respect to shift or non-shift work and shifting duration. These findings suggest that SMBG values at specific time points can be a useful clinical tool to integrate day-to-day glycemic targets.

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