

Knowledge of hypoglycemia and its associated factors among type 2 diabetes mellitus patients in a Tertiary Care Hospital in South India

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ABSTRACT

Introduction: Hypoglycemia being the rate limiting complication in the attainment of strict glycaemic control in diabetes management, in this study, we intended to study the knowledge of its symptoms, target blood levels during treatment and ways of prevention among type 2 diabetes patients attending Outpatient Department (OPD) of a medical college hospital. **Materials and Methods:** Every fifth patient attending the OPD during the 4 months between March and June 2013 was interviewed using a questionnaire. **Results:** The study included 366 type 2 diabetic patients, of which 76.5% were females. The target fasting and postprandial blood glucose levels while on treatment was known to 135 (36.9%) and 126 (34.4%) patients, respectively. The common symptoms of hypoglycemia known to the study subjects were dizziness (81.4%), weakness (73.8%), and drowsiness (72.1%). Overall, 242 (66.1%) diabetic patients had good knowledge on hypoglycemia (knowledge of at least three symptoms of hypoglycemia together with at least one precipitating factor and at least one remedial measure). Higher age, illiteracy, low socioeconomic status were associated with poor knowledge whereas treatment with insulin along with oral hypoglycemic agents was associated with good knowledge on hypoglycemia. Sex and duration of disease were not associated with knowledge on hypoglycemia. **Conclusion:** Although the knowledge on symptoms of hypoglycemia, precipitating factors, remedial measures are high in this study, the target blood levels, complications were known to just a third of them. There is a knowledge gap on important aspects of hypoglycemia among type 2 diabetic patients.

Key words: Hypoglycemia, knowledge, symptoms, type 2 diabetes mellitus

INTRODUCTION

Hypoglycemia is the rate limiting complication in the achievement of strict glycaemic control in diabetes management. Significant episodes of hypoglycemia and its attendant counter-regulatory hormonal response lead to poor glycaemic control. The former may also be associated

with cardiovascular and cerebrovascular morbidities.^[1] Large trials (action to control cardiovascular risk in diabetes, Veterans affairs diabetes trial) have shown that there were a higher mortality in the group that had hypoglycemia (intensively treated arm).^[2,3] Hence, the American Diabetes Association (ADA) guidelines emphasize on individualizing targets and reducing risk of hypoglycemia in patients with long duration of diabetes and comorbidities.^[4]

The symptoms of hypoglycemia are varied. The symptoms may be nonspecific with intensity decreasing with increasing age. Thus, it is very important that the subjects are able to recognize and identify the symptom onset at an early stage in order to manage the episode effectively and take steps to prevent the recurrence.

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In a survey conducted by the American Association of Clinical Endocrinology among 2530 type 2 diabetic patients in America, it was revealed that though more than half of the study population experienced hypoglycemic episodes in the past, many patients were unaware of the precipitating factors or causes of such episodes. There was definitely a knowledge gap which needed to be addressed.^[5] In a study done in Erode district in the state of Tamil Nadu in India, that blood sugar levels can drop below normal while on drugs was known to around 40% of the diabetic subjects only.^[6]

In this background, the knowledge and awareness about the varied presentations of hypoglycemia and the possible preventive strategies for the same would go a long way in type 2 diabetes management. There is a need for shared responsibility in the prevention of hypoglycemia. We proposed to study the knowledge about hypoglycemia among type 2 diabetes patients attending a Large Diabetes Clinic in a Teaching Hospital from Chennai.

MATERIALS AND METHODS

This study was done among type 2 diabetes mellitus patients attending the Diabetes Clinic of the Endocrinology Department in a Medical College in South India. Sample size calculation was done based on the study from Erode wherein 40% of the diabetic patients had knowledge about hypoglycemia.^[6] For 95% confidence level and 5% precision, the sample size was arrived at 370. The average outpatient (OP) attendance of type 2 diabetic patients in the OP department (OPD) of Endocrinology Department is 60–80. A random number was selected between 1 and 5. Systematic random sampling was done with a sampling interval of 5. Every fifth patient coming to the OPD was selected starting from that random number. Data collection was conducted for 4 months between March and June 2013. Patients were interviewed only once during the 4 months even if they came for follow-up visits regularly. The study was approved by the Institutional Ethics Committee of the University.

Inclusion and exclusion criteria

Patients with a diagnosis of type 2 diabetes mellitus who were on treatment with either oral hypoglycemic agents or insulin were included. Patients with type 1 diabetes mellitus, pregnant women with gestational diabetes mellitus, diabetes secondary to other systemic diseases were excluded from the study.

Data collection tools

After obtaining informed consent, a questionnaire was administered to the subjects by the investigator. The

classification of subjects into different socioeconomic groups was based on Prasad's criteria of per capita income (2013 updated version).^[7] All the patients attending the OPD are given free oral medications fortnightly, and therefore, all included patients were on oral hypoglycemic agents (OHAs) with or without insulin. Therefore, the patients are classified as those who are taking only OHAs (mainly sulfonylureas [glipizide] and biguanides [metformin]) and those taking insulin along with OHAs. The target levels for fasting and postprandial blood glucose were asked in an open-ended question, and the correct response was adopted from ADA guidelines 2014.^[4] The knowledge of the diabetic patients on the symptoms of hypoglycemia (both neurogenic and neuroglycopenic), the precipitating factors of such attacks, the immediate remedial measures which need to be adopted by them, the complications and how to prevent further episodes were asked to them. For each of the above question, multiple responses were given, and the patients were asked to give a "yes or no" response. Multiple responses were accepted. Some of the questions also had wrong responses to confuse the study subjects. Finally, proportions were calculated for the right responses and are given under the results section. If the diabetic patients had the knowledge of at least three symptoms together with at least one precipitating factor and at least one remedial measure, they were considered as having good knowledge on hypoglycemia.

RESULTS

The study included 370 diabetic patients of whom four refused to participate. The study results are presented for 366 type 2 diabetic patients (response rate – 98.9%). Three-quarters (76.5%) of the study subjects were females. The mean age (standard deviation [SD]) of the study participants was 59.6 (\pm 9.7) years and the age ranged from 29 to 85 years. Majority of the patients (81%) were more than 50 years of age and were belonging to III to V socioeconomic class (80%). The mean (SD) duration of diabetes was 10.9 (5.9) years with a duration ranging from 6 months to 40 years [Table 1].

The target fasting (70–130 mg/dl) and postprandial (100–180 mg/dl) blood glucose levels while on treatment was known to 135 (36.9%) and 126 (34.4%) patients, respectively. The knowledge of the blood glucose level at which one starts having symptoms of hypoglycemia (<70 mg/dl) was 11.2%.^[4]

The common symptoms of hypoglycemia known to the study subjects were dizziness ("feeling gare" in local language) (81.4%), weakness (73.8%), and drowsiness (72.1%). It may be seen from Table 2 that a lesser proportion

of patients had knowledge on the neuroglycopenic symptoms of hypoglycemia. Headache (19.7%) and seizures (2.7%) as symptoms were known to less number of patients only [Table 2]. Three or more symptoms were known to 303 (82.8%) patients and 38 (10.4%) patients were not known even one symptom of hypoglycemia.

More than two-thirds (68.6%) of the patients knew that hypoglycemia may be precipitated by missing or delaying of meals. Exertion as a precipitating factor was known to 35.2% of patients [Table 3]. At least one precipitating factor was known to 285 (77.9%) patients and remedial

measure, anyone, to be taken during an episode was known to 329 (89.9%) of patients. Half of the patients (49.7%) did not know even one complication of hypoglycemia.

Around 80% of the patients knew that they must consume some sweets or chocolates or biscuits during an episode of hypoglycemia (whenever they feel “gare” or “drowsy”). Many of them (61.5%) answered that they must drink coffee or tea or some juice during an episode. Eating food which is either missed or delayed as a measure to be taken during an episode of hypoglycemia was known to <40% of the study population.

Upon questioning their knowledge on prevention of further attacks, most of the patients (92%) mentioned “taking timely meals” as a measure and 87%, to take medications as per prescriptions of the doctor. Only a fifth of the patients were aware of “self-monitoring of blood glucose (SMBG) by glucometers” as a means to prevent further attacks as this will help them to identify hypoglycemia at an early stage, correlate with symptoms and take preventive measures [Table 3].

Thus, overall 242 (66.1%) diabetic patients had knowledge of at least three symptoms of hypoglycemia together with at least one precipitating factor and at least one remedial measure and therefore were considered to have good knowledge on hypoglycemia.

Table 1: Background characteristics of type 2 DM patients (original)

Background characteristics	Number (%)
Age in years	
Up to 50	70 (19.1)
51-60	131 (35.8)
Above 60	165 (45.1)
Sex	
Male	86 (23.5)
Female	280 (76.5)
Education	
Illiterate	98 (26.8)
Primary	139 (38.0)
High school	99 (27.0)
HSC/diploma/college	30 (8.2)
Standard of living [^] (n=357)	
Class I (Rs. 5156 and above)	14 (3.8)
Class II (Rs. 2578-5155)	50 (13.7)
Class III (Rs. 1547-2577)	92 (25.1)
Class IV (Rs. 773-1546)	116 (31.7)
Class V (< Rs. 773)	85 (23.2)
Duration of DM	
<5 years	56 (15.3)
5-10 years	168 (45.9)
>10 years	142 (38.8)
Type of treatment	
Only OHAs	291 (79.5)
Both OHAs and insulin	75 (20.5)

[^]9 study patients were not able to tell their per capita income. DM: Diabetes mellitus, OHA: Oral hypoglycemic agent

Table 2: Knowledge of symptoms of hypoglycemia among type 2 DM patients (original)

Knowledge of symptoms of hypoglycemia*			
Neurogenic symptoms	Number (%)	Neuroglycopenic symptoms	Number (%)
Dizziness	298 (81.4)	Weakness	270 (73.8)
Drowsiness	264 (72.1)	Loss of consciousness	145 (39.6)
Excessive hunger	218 (59.6)	Confusion	117 (32.0)
Sweating	209 (57.1)	Irritability	101 (27.6)
Tremors of hands	142 (38.8)	Blurred vision	99 (27.0)
Palpitation	123 (33.6)	Aggression	91 (24.9)
Shaking	120 (32.8)	Slurred speech	29 (7.9)
Prickly skin	90 (24.6)	Seizures	10 (2.7)
Headache	72 (19.7)		

*Multiple responses allowed. DM: Diabetes mellitus

Table 3: Knowledge of precipitating factors of hypoglycemia and its remedial and preventive measures among type 2 DM patients* (original)

	Number (%)
Precipitating factors	
Missing or delaying food	251 (68.6)
Exertion	129 (35.2)
Wrong dose	104 (28.4)
Alcohol ingestion	28 (7.7)
Complications of hypoglycemia	
Paralytic attack	134 (36.6)
Heart attack	132 (36.1)
Coma	129 (35.2)
Death	121 (33.1)
Fits	56 (15.3)
What to do during an episode of LBS	
Eat sweets/chocolates/biscuits	285 (77.9)
Drink sugary syrup/juices/milk	225 (61.5)
Eat food	145 (39.6)
Drink glucose	128 (35.0)
How to prevent further attacks	
Take timely meals	338 (92.3)
Take medications as advised by the doctor	318 (86.9)
Report low sugar episode to the doctor	178 (48.6)
make adjustment in the medications	
Self-monitoring of blood sugars	74 (20.2)

*Multiple responses allowed. DM: Diabetes mellitus, LBS: Low blood sugar

The association of the knowledge of hypoglycemia with certain important background characteristics is shown in Table 4. As seen from the table, age is an important determinant of the knowledge and as age increases, the knowledge decreases ($P < 0.05$), and this difference is statistically significant. But there is no significant difference in knowledge of hypoglycemia between males and females. Literacy of a person has a statistically significant association with the knowledge of a patient on low blood sugars ($P < 0.05$). A patient from class V socioeconomic status has a very low knowledge compared to those from class I to IV socioeconomic status and as socioeconomic status improves the knowledge on hypoglycemia also increases ($P < 0.01$).

The duration of the disease (diabetes mellitus) had no association with the knowledge, but the type of treatment did have. Those patients who took insulin along with OHAs were better informed about hypoglycemia, the cut-offs, the symptoms, measures to prevent, etc., when compared with those patients who took only OHAs.

More than 50% of the patients attributed their knowledge of hypoglycemia to the doctor who treated them. A little lesser proportion (42.6%) attributed their knowledge to their friends and relatives. A quarter learnt about hypoglycemia from the fellow patients who get treatment from the OP clinic [Figure 1].

Table 4: Association of good knowledge on hypoglycemia of type 2 DM patients with certain background variables (original)

Background characteristics	Number (%)	P
Age in years		
Up to 50	53 (75.7)	0.032*
51-60	91 (69.5)	
Above 60	98 (59.4)	
Sex		
Male	55 (64.0)	0.627
Female	187 (66.8)	
Education		
Illiterate	55 (56.1)	0.015*
Literate	187 (69.8)	
Standard of the living		
Class I (Rs. 5156 and above)	11 (78.6)	0.007*
Class II (Rs. 2578-5155)	36 (72.0)	
Class III (Rs. 1547-2577)	65 (70.7)	
Class IV (Rs. 773-1546)	82 (70.7)	
Class V (<Rs. 773)	42 (49.4)	
Duration of DM		
<5 years	37 (66.1)	0.783
5-10 years	114 (67.9)	
>10 years	91 (64.1)	
Type of treatment		
Only OHAs	183 (62.9)	0.010*
Both OHAs and insulin	59 (78.7)	

* $P < 0.05$: Statistically significant. DM: Diabetes mellitus, OHA: Oral hypoglycemic agent

DISCUSSION

This study done among 366 type 2 diabetic patients in the out-patient clinic of Endocrinology Department of a teaching hospital shows that two-thirds of the patients had good knowledge on hypoglycemia. Higher age, illiteracy, and low socioeconomic status were associated with poor knowledge whereas treatment with insulin along with OHAs was associated with good knowledge on hypoglycemia. Sex and duration of disease were not associated with knowledge on hypoglycemia.

The knowledge on the target fasting and postprandial blood glucose levels among the diabetic patients was low (39% and 34%, respectively). This was low compared to the study done in CMC, Ludhiana (60%).^[8] The knowledge on blood glucose level at which one starts having symptoms of hypoglycemia was very low (11.2%).

With respect to the knowledge on symptoms of hypoglycemia, dizziness, weakness, and drowsiness were the ones known to most patients and headache and seizures, the least. Hypoglycemia may manifest with any symptom, and common symptoms may not always be the first to appear.^[9] Therefore, the patients must be aware of every symptom in order to recognize early and take immediate corrective measures.

Missing meals as a precipitating factor was known to two-thirds of the patients and exertion to a third of the patients only. It is very important that the patients are well aware of the precipitating factors/causes so that they may take appropriate precautions such as taking toffees or packed food before planning to travel or exercise.

Only a third of the patients had knowledge on the complications, and $< 1/2$ knew that they have to report

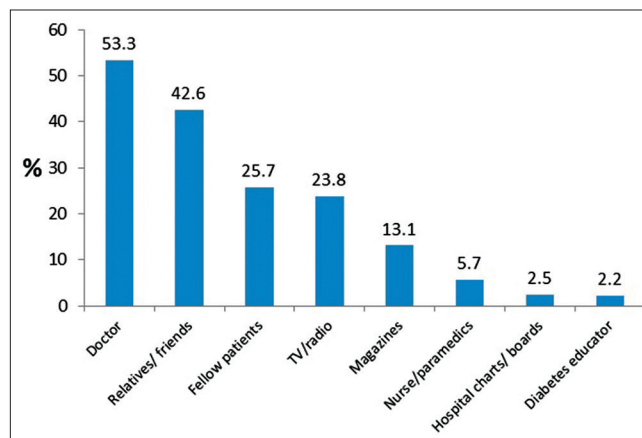


Figure 1: Source of knowledge on hypoglycemia among type 2 diabetes patients (original)

such episodes to the doctor. Awareness about the complications would induce the patients to take this condition seriously and report any such episodes to the physician immediately.

Even though 85% of the study population are diabetic for more than 5 years, SMBG as a way to prevent future episodes was known to a fifth of the patients only. It is well-known that SMBG aids in better glycemic control and prevention of hypoglycemia in type 2 diabetes patients by allowing for adjustments in diet, physical activity, and pharmacotherapy in response to test results.^[10,11]

In this study, the knowledge on hypoglycemia decreased as age increased [Table 4]. This finding is shown in other studies too.^[12-14] This might have been because of age-related cognitive decline insisting the importance of periodical educational programs to reinforce their knowledge.

This study emphasizes the role of health care workers-doctors, nurses, diabetes educators, lab technicians in providing health education to the patients during every visit. They must educate on target levels, importance of SMBG, symptoms of hypoglycemia, the ways of preventing it and immediate remedial measures to be adopted during every visit. Furthermore, periodical educational reinforcement programs need to be conducted for all diabetic patients which must include topics on hypoglycemia.

This is one of the few studies in India to study exclusively about the knowledge on hypoglycemia in detail among the type 2 diabetic patients. In India, which has the second largest number of diabetes patients, there is negligible data on the epidemiology of hypoglycemia.^[15] The limitation of the study is that the knowledge is assessed among patients attending a diabetes free Clinic in a Medical College Hospital and may not be accurately representing that in a community comprising both affordable and poor patients.

CONCLUSION

Although the knowledge on the symptoms, remedial measures, and prevention of hypoglycemic episodes was good among the type 2 diabetic patients in the study, there were gap in knowledge on important aspects like precipitating factors, target levels etc., which need to

be addressed by health care workers through regular educational programs.

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