Original Article :

Hypoglycemia Associated Factors and Prevention Practices among Diabetic Patients in Makkah, Saudi Arabia .

Abdulaziz Fahad Albarakati[1], Mokhtar Mahfouz Shatla[2], Abdullah Yasser Fakieha[1], Faisal Ahmed Alshehri[1], Mohammed Hassan Alqarni[1], Husam Samer Algurashi[1]

1. Faculty of Medicine, Umm Al-Qura University, Makkah city, Saudi Arabia

2. Assistant professor, Department of Medicine, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

Received on 27/02/2022 Accepted for Publication on 09/04/2022 dx.doi.org/10.5455/mjhs.2022.03.007

Corresponding Author:

Name: Abdullah Yasser Fakieha

Address: College of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

Mobile phone: +966555025688

E-mail address: Abdullah.fakiha@hotmail.com

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Abstract

Background & Aims:

Hypoglycemia is a serious medical crisis requiring immediate recognition and action to avoid morbidity and mortality. It happens when blood glucose level drops less than 70 mg/dl. Understanding the prevention practice of hypoglycemia, particularly in diabetic patients is a significant element to have a better hypoglycemia prognosis and treatment. Therefore, the current study aimed to assess the knowledge and prevention practice of hypoglycemia and its associated factors among DM patients in Makkah region, Saudi Arabia.

Methods:

A cross-sectional study was conducted using a structured questionnaire in Makkah city population, Saudi Arabia. A total of 600 diabetic patients were collected by using an online version. The collected data and variables were measured by SPSS version 23.

Results:

A total of 600 diabetic patients, the predominant age group was above 45 years 285 (47.5%). Regarding gender, the majority were females 303 (50.5%). Most of the participants were urban citizens 480 (80%). Approximately half of the patients had type 1 diabetes 301 (50.2%) and 346 (57.7%) of the participants had the illness for more than 5 years. Concerning, the knowledge about hypoglycemia, most of the subjects reported good knowledge 410 (68.3%) like the hypoglycemia prevention practice which revealed that 371 (61.8%) documented good practice.

Conclusion:

Despite diabetic patients with sufficient knowledge of hypoglycemia and the strong correlation with good prevention practice. There was a knowledge gap in hypoglycemia prevention. Therefore, we recommend offering consultation for diabetic patients during their visits regarding hypoglycemia. For the significant points to improve their prevention practice.

Keywords:

Hypoglycemia, prevention, Diabetes, Makkah, Saudi Arabia.

Introduction:

Diabetes mellitus (DM) consider is one of the most common chronic diseases globally [1]. There are two types of diabetes Mellitus, type 1 diabetes is a genetic disorder that frequently shows up early in life, and type 2 is mainly diet-related and develops over time. Both types of diabetes are associated with a wide range of problems, including cardiomyopathy, nephropathy, and neuropathy [2]. There are significant variances between type 1 and type 2 diabetes (T1D and T2D), reflecting the changes in endogenous insulin production between the two subtypes. T1D patients develop significant insulin deficit quickly, resulting in high glycemic instability, necessitating precise insulin replacement (many injections and carbohydrate tracking) and a poor response to non-insulin therapy. Patients with T2D nevertheless produce significant amounts of insulin and, as a result, respond well to non-insulin therapy, have more stable glycemia, and, if insulin treatment is required, can achieve good control with non-physiological insulin regimens [3]. The prevalence of DM is expanding and is predicted to increase in 2019 from 463 million to 578 million cases by 2030 [4]. In the middle east, the DM prevalence is expected to increase in 2019 from 54.8 million to 76 million by 2030 [5]. In Saudi Arabia, DM considers the main public health crisis [6]. In 2019, 4.27 million patients were reported and expected to reach 6.05 million by 20307.

DM Individuals are at higher risk for morbidity and mortality due to its complications which include macrovascular, microvascular, and acute complications. The macrovascular involve Coronary heart disease, heart failure, and peripheral artery disease [8]. The Microvascular include end-stage renal disease (ESRD), diabetic retinopathy, and neuropathy [9]. While Hypoglycemia, Diabetic ketoacidosis (DKA), and Hyperglycemic Hyperosmolar State (HHS) consider acute complications [10]. Hypoglycemia is a preventable complication but it considers a leading cause of morbidity and mortality [10]. The diabetic mortality rates approximated to participate in 11.3% of global death rates and higher reported rates in the Middle East and North Africa 16.2% [11]. Hypoglycemia is the most prevalent acute diabetic complication among diabetes patients [12]. The definition of hypoglycemia is a serum glucose level less than 70 mg/dL (3.9 mmol/L) [12]. Hypoglycemia symptoms are divided into 2 wide groups. The automatic symptoms include sweating, heart palpitations, trembling, dizziness, and hunger, and neuroglycopenic symptoms which include confusion, drowsiness, speech difficulty, odd behavior, incoordination.

Unfortunately, the symptoms differ between individuals, complicating our attempts to diagnose hypoglycemia and counsel patients who experience these symptoms. The mainstay of hypoglycemia prevention is a healthy lifestyle. These include eating a well-balanced diet, eating small meals regularly, self-monitoring blood glucose at regular intervals, always carrying a source of rescue carbohydrates such as fruit or sweets, and avoiding defensive overeating to avert hypoglycemia crisis [13].

Hypoglycemia causes a serious economic concern on the health care process through continuous ambulance service, hospitalizations costs and emergency room visits. 2-4% is considered the estimated number of death from hypoglycemia every year [14]. Hypoglycemia considers the major cause for increased numbers of adult emergency visits with an estimated number of 300,000 in 2009 in the USA [15]. The rate of hypoglycemic attacks in Saudi Arabia was found to be elevated 68.9% among DM patients [16].

A study conducted among type 2 DM patients revealed the prevalence of mild/ moderate 45% and severe hypoglycemia 6% [17]. An additional study aimed to evaluate hypoglycemia rates documented that 83.0% of type I DM patients and 46.5% of patients with type II DM encountered hypoglycemia 18. The hypoglycemia incidence among DM cases is very high and inadequate hypoglycemia awareness can provoke severe hypoglycemia among diabetic patients [19]. It is extremely important to recognize the association between hypoglycemia and relevant factors, like the perception of glycemic control, and hypoglycemia itself. This knowledge can prevent the possible damage to diabetic patients receiving either insulin treatment or oral hypoglycemic agents.

A Saudi Arabian study showed that diabetic patients have a knowledge gap on significant aspects of hypoglycemia, about 50% of patients have a shortage of knowledge about hypoglycemia symptoms and prevention methods 20. Therefore, the current study aimed to assess the knowledge and practice towards the prevention of hypoglycemia and its complications among DM patients in Makkah region.

Subjects and Methods

This cross-sectional study was conducted using a structured questionnaire in Makkah city population, Saudi Arabia. The study was carried out over six months starting in February 2022 after obtaining ethical approval from UQU's research ethics committee (HAPO-02-K-012-2022-02-965).

The inclusion criteria were any diabetic age group with current residency in Makkah. Participants who were unwilling to partic-

ipate, diabetic patients outside Makkah, and women with gestational diabetes were excluded. An online informed consent was collected from all participants. Any questioning about the survey from participants was answered by the researchers. The required sample size was calculated according to Epi Info™ 7.1.5 (Center for Disease Control and Prevention; Atlanta, Georgia, USA); therefore, the smallest sample size to achieve the research is 341.

This structured questionnaire was adopted from a previously published article conducted in Ethiopia in English [21]. The questionnaire was distributed to Makkah city population between Jan and Feb in Arabic version through Google platforms in an online version due to COVID-19 preventive measures. The questionnaire was translated to Arabic, validated by back translation into English, and then both questionnaires were compared to each other.

The questionnaire had 3 parts. The first part included data regarding socio-demographic. The second part included data regarding knowledge and the last part was practices related to the prevention of hypoglycemia. The knowledge part had 10 questions; each question was given one point. Good knowledge for those with a score equal or above the mean on the knowledge assessment questions and poor knowledge for those with a score below the mean. The practice part had 13 questions; each question was given one for each correct response. Good practice for those with a score equal or above the mean on the practice assessment questions and poor practice for those with a score below the mean.

The received data was analyzed by SPSS v23. Mean and standard deviation are obtained to demonstrate continuous variables while frequency and percentage are obtained to show categorical variables. The relationship between categorical variables is tested by using the chi-square test. The level of significance is established at 5%.

Results

Sociodemographic characteristics of study participants

A total of 600 Diabetes Mellitus study subjects participated in this study. The mean age of respondents was 2.0550 (SD±1.02976) years the (less than 18 Year's old) age group was predominantly represented (8.3%). Rather, the (more than 45 years old) age group was (47.5%). All the age groups were shown in "Table 1" The participant's responses showed more than half (50.5%) of them were female. However, male respondents were (49.5%). On the other hand, Three-hun-

dred and sixteen (52.7%) participants were married and Two-hundred and six were unmarried (34.3%). Moreover, four hundred and eighty (80%) of them were urban citizens. The prevalence of type II DM was three-hundred and one (50.2%) of the total participants. While the type I DM was two-hundred and ninety-nine (49.8%). Concerning the duration with DM three-hundred and forty-six (57.7%) were diagnosed with DM in more than five years. Furthermore, Two-hundred and fifty-four (42.3%) were diagnosed with DM in less than five years. Regarding the availability of a glucometer at home, Five-hundred and nine (84.8%) of participants reported having a glucometer at their home.

Table 1: Socio-demographic characteristic of study participants (N = 600).

Variables	Classification	Frequency (%)
Age	Less than 18	50 (8.3%)
	18-25	152 (25.3%)
	26-45	113 (18.8%)
	More than 45	285 (47.5%)
Gender	Female	303 (50.5%)
	Male	297 (49.5%)
Residence	Urban	480 (80%)
	Rural	120 (20%)
Marital status	Unmarried	206 (34.3%)
	Married	316 (52.7%)
	Divorced	38 (6.3%)
	Widowed	40 (6.7%)
Occupation	Unemployed	159 (26.5%)
	Employed	160 (26.7%)
	Retired	144 (24%)
	Student	137 (22.8%)
Income per month	Less than 2500 SAR	224 (37.3%)
	2500-5000 SAR	102 (17%)
	More than 5000 SAR	274 (45.7%)
Types of diabetes	Type I	299 (49.8%)
	Type II	301 (50.2%)
Duration with illness (DM) in year	Less than 5 years	254 (42.3%)
	More than 5 years	346 (57.7%)
Having a glucometer at home	No	91 (15.2%)
	Yes	509 (84.8%)
History of hypoglycemia in the last month	No	319 (53.2%)
	Yes	281 (46.8%)

Knowledge regarding hypoglycemia prevention

Among the subjects, 410 (68.3%) of them had good knowledge regarding hypoglycemia prevention. The majority of participants 437 (72.8%) were unaware of the hypoglycemia blood glucose level. Most of the subjects 368 (61.3%) had poor knowledge about the main cause of hypoglycemia. More than half of the study participants 434 (72.3%) recognized the symptoms of hypoglycemia while 397 (66.2%) of the participants had poor knowledge about the ways of hypoglycemia prevention. As shown in "Table 2"

Table 1: Socio-demographic characteristic of study participants (N = 600).

Variable	Good knowledge N (%)	Poor knowledge N (%)
low blood glucose level (Hypoglycemia)	163 (27.2%)	437 (72.8%)
The normal blood glucose level	553 (92.2%)	47 (7.8%)
The main cause of hypoglycemia	232 (38.7%)	368 (61.3%)
Risk factor for hypoglycemia	241 (40.2%)	359 (59.8%)
Symptoms of hypoglycemia	434 (72.3%)	166 (27.7%)
Symptoms of nighttime hypoglycemia	493 (82.2%)	107 (17.8%)
Complication of hypoglycemia	167 (27.8%)	433 (72.2%)
Ways to Prevent hypoglycemia	203 (33.8%)	397 (66.2%)
Prevent nighttime hypoglycemia	260 (43.3%)	340 (56.7%)
Prevent repeated hypoglycemia	529 (88.2%)	71 (11.8%)
Total Knowledge assessment	410 (68.3%) Good Knowledge	190 (31.7%) poor knowledge

Practice regarding hypoglycemia prevention

Of all the respondents, 371 (61.8%) had good practice towards hypoglycemia prevention. Approximately 493 (82.2%) of participants were unaware of having simple sugar while traveling. Conversely, 485 (80%%) participants documented the self-monitoring of blood glucose level at home. Similarly, 478 (79.9%) re-tested their blood glucose after hypoglycemia treatment. Nearly 404 (67.3%) of patients were coming to regular appointments, and the predominant 409 (68.2%) of subjects documented hypoglycemia events to their doctors. As represent in "Table 3"

Table 3: Practice regarding hypoglycemia prevention among study subjects (N = 600).

Variable	Good knowledge N (%)	Poor knowledge N (%)
Have table sugar while travelling	107 (17.8%)	493 (82.2%)
Self-management of hypoglycemia	413 (68.8%)	187 (31.2%)
When did you experience hypoglycemia	294 (49%)	306 (51%)
Safe exercise to avoid hypoglycemia	147 (24.5%)	453 (75.5%)
Effect of weightlifting in a hypoglycemic patient	396(66%)	204 (34%)

Variable	Good knowledge N (%)	Poor knowledge N (%)
Self-blood glucose monitoring at home	485 (80.8%)	115 (19.2%)
Measure blood glucose when you think hypoglycemic	491 (81.8%)	109 (18.2%)
Retest blood glucose after treatment of hypoglycemia	478 (79.7%)	122 (20.3%)
Taking snacks	425 (70.8%)	175 (29.2%)
Irregular carbohydrate diet	341 (56.8%)	259 (43.2%)
Coming in regular appointment	404 (67.3%)	196 (32.7%)
Adjust medication based on blood glucose level	384 (64%)	216 (36%)
Report hypoglycemia episodes to a physician	409 (68.2%)	191 (31.8%)
Total practice assessment	371 (61.8%) Good practice	229 (38.2%) Poor practice

Factors associated with practice on hypoglycemia prevention

Crosstab Chi-square analysis showed that gender (P = 0.48), having a glucometer at home (P = 0.002), occupation (P = 0.44), duration of the illness (P = 0.34), history of hypoglycemia (P = 0.000), and the level of knowledge about prevention of hypoglycemia (p = 0.14) were factors possibly associated with the practice of hypoglycemia prevention. Regardless, only the history of hypoglycemia and having a glucometer were statistically significant association. See "Table 4"

Table 4: Factors associated with hypoglycemia prevention practice among study participants (N = 600).

Variables	Good 371 (61.8%)	Poor 229 (38.2%)	P-value
Age	371	229	0.020
Less than 18	38	12	
18-25	97	55	
26-45	71	42	
More than 45	165	120	
Gender	371	229	0.486
Female	192	111	
Male	179	118	
Residence	371	229	0.366
Urban	292	188	
Rural	79	41	
Marital status	371	229	0.506
Unmarried	126	80	
Married	195	121	
Divorced	21	17	
Widowed	29	11	
Occupation	371	229	0.890
Unemployed	94	65	
Employed	103	57	

Variables	Good 371 (61.8%)	Poor 229 (38.2%)	P-value
Retired	82	62	
Student	92	45	
Income per month	371	229	0.143
Less than 2500 SAR	140	84	
2500-5000 SAR	67	35	
More than 5000 SAR	164	110	
Types of diabetes	371	229	0.106
Type I	195	104	
Type II	176	125	
Duration with illness (DM) in year	371	229	0.345
Less than 5 years	151	103	
More than 5 years	220	126	
History of hypoglycemia in the last month	371	229	0.000
No	170	149	
Yes	201	80	
Having a glucometer at home	371	229	0.003
No	43	48	
Yes	328	181	

Discussion

The current study revealed that 410 (68.3%) of the participants had good knowledge about hypoglycemia prevention, in line with Muche EA study which found (72.7%) and a study of South Africa (66.1%) [21,22]. While the study of South Gondar, Ethiopia showed that the result was lower than previous studies (25.5%)[23]. The knowledge about hypoglycemia level was good (72.8%) slightly lower than Muche EA study which found that most of the participants were aware of hypoglycemia level (82.2%). An additional Indian study showed lower results (60%) [21,23].

This study showed that more than half of the participants (59.8%) were aware of hypoglycemia risk factors in conflict with Muche EA study which revealed that less than half (42%.4) were unaware of the risk factors of hypoglycemia similar to an Indian study (43.4%) and another study in the same region (32%) [21,24,18]. Regarding the knowledge of hypoglycemia symptoms, the current study showed that (56.7%) of participants recognized the hypoglycemia symptoms in line with Muche EA study which demonstrated the majority of participants (83.9%) knew the symptoms [21]. The South African study showed that (66%) had good knowledge of symptoms nearly to the Indian study (65%). Respecting the knowledge of hypoglycemia complications most of the participants had good

knowledge (72.2%) in agreement with Muche EA study which demonstrated that (92.4%) were aware of the them 21. Hence, A South Indian study documented satisfactory knowledge for only one-third of the participants [29%].

This study reported that 371 (61.8%) of the participants had good practice towards hypoglycemia prevention. This result was higher than two Ethiopian studies, the South Gondar study, showed (21.4%) while the Tigray study documented (63.2%) [25,22].

Regarding the hypoglycemia prevention practice while traveling, this study reported (82.2%) had a good practice in consonance with Muche EA study which revealed that (87.2%) had a good method[21]. In contrast, the study of south Gondar Ethiopia (36.3%) had a good strategy [22].

The self-management knowledge in the current study was poor (31.2%) of the participants were aware of management by consumption of simple sugar. While in Muche EA study the majority of subjects (81.5%) had good self-management practices for hypoglycemia [21]. A Nigerian study reported (67.6%) had good self-management knowledge of hypoglycemia [26].

This study reported (57.7%) of subjects has diabetes for more than 5 years. The result is higher than Muche EA study which demonstrated (46%) of subjects were diabetic for more than 5 years [21].

For the Self-monitoring of blood glucose, the current study participants had good practice (80.8%). On the other hand, Muche EA study, an Indian study, and a South African study had poor practice (17.5%),(15%), and (34%) [21,27,28].

Considering adhering to appointment periods, this study reported (67.3%) had a good practice. The results are lower than Muche EA study which revealed (95.5%) of subjects had a good practice with similar findings reported in Ethiopia (93.3%)[21.]

According to the practice of Self-adjustment of medications, this study showed that (64%) of participants had poor practice compared to Muche EA study which was documented by (57.6%) and to that of the South African (43%) and Indian (17%) studies [21,28,24].

For the current study reporting hypoglycemic episodes to their doctors was reported by (68.2%). Therefore, Muche EA study revealed that most of the study subjects (93.3%) had a good practice compared to the South Indian study which had lower results (48.6%)[21,27].

Regarding having a glucometer at home, the current study demonstrated that (84.8%) of study participants had a glucometer at their homes like the study of Qatar which showed slightly lower results (60.5%) [29]. In contrast, Muche EA study had a small number (17.5%) in line

with the South Indian study which reported (5%), and the Gondar, Ethiopian study which had (7.7%)[21,27,22].

Conclusion

In conclusion, an adequate understanding of hypoglycemia prevention was strongly correlated with its prevention practice. Knowledge of hypoglycemia prevention practice considers a vital component for the management of hypoglycemia. Diabetic patients should be taught about the important elements of hypoglycemia such as the sings, symptoms, and prevention strategies to increase their awareness for improving the prognosis.

Limitations

This study aimed to assess hypoglycemia prevention, practice, and its associated factors among diabetic patients in Makkah city population, Saudi Arabia. Due to COVID-19 preventive measures, future work needs an improvement of the way of data collection. Interviewer survey instead of the online version to better coverage of the population including those with no internet access and those unable to write or read.

Acknowledgments

We would like to thank all the participants.

Funding Statement

No specific funding was received for this study.

Data Availability

All data are available within the article.

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