Assessment of Adult Diabetes Mellitus Patients' Experience and Knowledge about Hypoglycaemia and its Management in Saudi Arabia

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ABSTRACT

Introduction: Hypoglycemia is common complication of diabetes mellitus therapy.

Objective: To evaluate the experience and knowledge of diabetes patients about hypoglycemia and its treatment.

Method: An online cross-sectional survey was conducted from September to October 2022 to assess the knowledge of hypoglycemia and its treatment among adult diabetes patients. The factors impacting adult diabetes mellitus patients' knowledge regarding hypoglycaemia and its care were determined using binary logistic regression analysis, with the patients' mean knowledge score (9.2) serving as the dummy variable.

Results: There was a total of 305 participants in this research. 56.4% of the patients reported having been diagnosed with type 1 diabetes mellitus. Almost 65.0% of them reported requiring help during a hypoglycemic episode in the past. The patients' understanding of hypoglycemia was moderate (57.5% of the total score). The percentage of patients who correctly answered the knowledge questions varied from 15.4% to 71.1%. At least 32.0% of the patients were able to identify at least one method to lower their risk of experiencing low blood glucose. Older patients (aged 41-45 years and over 51 years), those working in the healthcare field or having retried, those with a higher level of education, and those who are widowed were more likely to be aware of hypoglycemia than others (p≤0.05).

Conclusion: In Saudi Arabia, diabetic individuals had a moderate level of knowledge of hypoglycemia. Patients should be educated on the symptoms and management of hypoglycemic episodes. High-risk populations, such as elderly patients and those treated with insulin, should get special consideration.

Keywords: Awareness; Diabetes mellitus; Hypoglycemia; Knowledge; Saudi Arabia

INTRODUCTION

Hypoglycemia is one of the acute complications of diabetes mellitus [1], and it has a substantial influence not only on the quality of life of the patient, but also on the quality of life of the patient's family and community. It is crucial to increase patient awareness and understanding of hypoglycemia symptoms in order to prevent severe outcomes such as loss of consciousness and even death [2,3].

Type 2 diabetes is the most prevalent kind of diabetes, and it occurs when the body improperly utilizes insulin. Some individuals may regulate their blood glucose levels via proper nutrition and exercise, others may need medication or insulin [4]. Diabetes is diagnosed when the A1C is at or above 6.5%. Additionally, diabetes is diagnosed with a fasting blood glucose level of 126 mg/dL or above [5]. Type 1 and type 2 diabetes have distinct origins, although they share two significant risk factors. A genetic propensity to the illness is followed by an environmental trigger. In many cases, the onset of type 1 diabetes seems to take many years. Type 2 diabetes is more strongly linked to family history and genetics than type 1, and twin studies have shown that genetics play a significant role in the development of type 2 diabetes. A previous research has shown a correlation between diabetes patients' awareness of hypoglycemia and their chance of suffering a hypoglycemic episode [3]. More than half of the respondents (68%) in the study had never examined their blood glucose level annually, therefore, the results may not be typical of the broader population [6]. In Dammam, Kingdom of Saudi Arabia, a cross-sectional research revealed that around one-half of diabetic patients lack understanding of hypoglycemia symptoms, with approximately one-third of respondents having a low knowledge score [6]. Male gender, low education, noncompliance with treatment, and lack of information about hypoglycemia were the main characteristics substantially linked with a low knowledge score; the author stated that health education regarding hypoglycemia symptoms is important for these patients [7]. Knowledge of hypoglycemia symptoms have not been extensively examined or evaluated sufficiently in Saudi Arabia [1]. The purpose of this research was to evaluate the experience and knowledge of diabetes patients about hypoglycemia and its treatment.

METHODS

Study design and settings

From September to October 2022, an online cross-sectional survey was undertaken to measure adult diabetes patients' awareness of hypoglycemia and its management.

Sampling procedure

Convenience sampling technique was employed to recruit the sample for this investigation. This method of sampling falls under the classification of non-probability sampling. This research comprised eligible patients who met our inclusion criteria and were willing to participate. On the first page of the questionnaire, patients were presented with an informed consent form and given the option to continue or discontinue. To ensure that the patients understood the significance of their involvement, the study's objectives were presented

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in detail. In the invitation letter for the study, the inclusion criteria were specified.

Study population and recruitment

This study's population consisted of patients with diabetes mellitus who were 18 years or older. There were no exclusion criteria based on gender, age, diabetes type, or disease duration. The survey link was shared on social media platforms to invite those with diabetes to participate.

Study tool

This questionnaire was used to assess adult diabetes patients' understanding of hypoglycemia and its treatment. Using a standardized questionnaire to collect baseline data on diabetic patients' knowledge and habits regarding hypoglycemia in adult diabetes patients with low blood glucose [8]. In addition, the questionnaire took information regarding the respondent's age, gender, level of education, employment, type of diabetes mellitus, disease duration, and diabetes treatment. Patients were questioned about their disease history and hypoglycemic experience. In addition, participants were asked about their blood glucose practices and how they handle hypoglycemic episodes if they occur. In the knowledge part, there were seven multiple-choice and yes/no questions. Each correct response is worth one point, and each incorrect response is worth 0 points. The greater your level of knowledge, the higher the score. Some questions had multiple correct responses, resulting in a total of 16 correct responses on the knowledge part; the highest attainable score is expected to be 16.

Piloting of the questionnaire tool

The questionnaire instrument was evaluated and verified by clinical pharmacists from the College of Clinical Pharmacy at King Faisal University. They were questioned on the questions' clarity, comprehensibility, and face validity, as well as whether any were difficult to comprehend. They were also questioned about any questions they found offensive or irritating. They remarked that the questionnaire was simple to comprehend and complete. In addition, a pilot study was conducted with a small group of diabetes mellitus patients to assess comprehension prior to using the questionnaire on a broader scale, and the results verified that it is easy and straightforward.

Ethical approval

The study was approved by the Research Ethics Committee at King Faisal University, Saudi Arabia (KFU-REC-2022- JUN - ETHICS46).

Statistical analysis

This study's data were analyzed using version 27 of the SPSS program. Normality measurements and a histogram indicated that the knowledge score followed a normal distribution. Therefore, we presented it using the mean (standard deviation (sd)). The factors impacting adult diabetes mellitus patients' knowledge regarding hypoglycaemia and its care were determined using binary logistic regression analysis, with the patients' mean knowledge score (9.2) serving as the dummy variable. Statistical significance was determined as a two-sided p-value less than 0.05.

RESULTS

A total of 305 patients participated in this study. More than half of them were females (56.7%). Almost half of them were aged 35 years and below. Almost half of the patients were working outside the healthcare sector (47.2%). More than half of the patients reported that they have

bachelor degree (59.7%). Almost 40.0% of the patients reported that their monthly income is 7500 SAR and over. Around 53.0% of the patients reported that they are married. A total of 41.0% of the patients reported that they have other comorbidities. More than half of the patients reported that they are diagnosed with type 1 diabetes mellitus (56.4%). Around one-third of the patients (31.5%) reported that they have been diagnosed with diabetes mellitus since five to ten years. For further details on the demographic characteristics of the patients refer to Table 1.

Table 1. Demographic characteristics of the patients

Demographic variable	Frequency	Percentage
Gender		
Female	173	56.7%
Age category		
18-25 years	67	22.0%
26-30 years	51	16.7%
31- 35 years	39	12.8%
36-40 years	46	15.1%
41-45 years	23	7.5%
46-50 years	37	12.1%
51 years and above	42	13.8%
Employment status		
Work outside the healthcare area	144	47.2%
Unemployed	60	19.7%
Student	56	18.4%
Retired	31	10.2%
Work inside the healthcare area	14	4.6%
Education		
Secondary school level or lower	111	36.5%
Bachelor degree	182	59.7%
Higher education	12	3.9%
Monthly income		
2500 SAR and lower	66	21.6%
2500-5000 SAR	45	14.8%
5000-7500 SAR	73	23.9%
7500 SAR and over	121	39.7%
Marital status		
Single	76	24.9%
Married	162	53.1%
Divorced	32	10.5%
Widowed	35	11.5%
Do you have other comorbidities?		
Yes	125	41.0%
What type of diabetes mellitus do you have?		
Type 1 diabetes mellitus	172	56.4%
Type 2 diabetes mellitus	133	43.6%
Duration of diabetes mellitus:		
Less than 5 years	47	15.4%
5-10 years	96	31.5%
11-15 years	66	21.6%
More than 15 years	96	31.5%

SAR: Saudi Arabia riyal

Patients experience and practices with hypoglycemia

Table 2 below presents patients experience and practices with hypoglycemia. More than one-third of the patients reported they have neuropathy (35.4%). Almost 56.0% of them reported that they are currently on insulin therapy. The vast majority of the patients

(91.5%) reported that they have previously experienced hypoglycemia symptoms. Around 45.0% of the patients reported that they measure their blood glucose level once a day. Almost 60.0% of them reported that they had encountered an episode of hypoglycemia with symptoms during the last month. Around 50.0% of them reported that they do not carry a snack or glucose tablets with them to treat low blood glucose. Around 65.0% of them reported that they needed assistance in the past during a hypoglycemic episode. 75.0% of them reported that they have a spouse, relative, or other person close to them know how to deal with your episodes.

More than half of them (55.0%) reported that they measure their HbA1c every three months. Almost one-quarter of them (24.0%) reported that they have a glucagon injection at home for hypoglycemia emergency. Almost one-third of them (35.0%) reported that they needed emergency care or visited the emergency department because of hypoglycemia. The most commonly reported source of information about hypoglycemia was the internet (49.0%). Around 51.0% of them reported that they have experienced hypoglycemic symptoms when their blood glucose level was low. A total of 53.0% of them reported that during the past six months they have experienced hypoglycemic episode, for which they were not able to manage yourself once or twice and 46.0% of them experienced hypoglycemic episode, for which they were unconscious, needed glucagon, or intravenous glucose administration one to three times.

A total of 51.0% of them reported that their blood glucose level was less than 3.9 mmol/L with hypoglycemic symptoms one to three times. Almost 59.0% of them reported that their blood glucose level before feeling symptoms was 2.2-2.7 mmol/L. A total of 42.0% of them reported that they think that they are always able to know their blood glucose level from their symptoms. The majority of them reported that they drink juice when they feel hypoglycemia symptoms.

Participants' knowledge of hypoglycemia

The proportion of patients who answered the knowledge questions right ranged between 15.4% and 71.1%. Around 42.0% of them defined 70 mg/dL as a blood glucose level of less than. More than half of them (58.0%) identified that elderly patients have higher risk of hypoglycemia. A proportion between 43.3% and 45.9% of them identified that chronic kidney diseases, cardiovascular diseases, and chronic liver diseases as risk factors of hypoglycemia. A total of 57.0% of them identified that unconsciousness as a sign of severe hypoglycemia. 71.1% of them identified that sugary drink is used to manage low blood glucose level. Around 68.0% of them identified that one tablespoon of sugar, honey, or corn syrup can help in raising your blood glucose. At least 32.0% of the patients were able to identify one approach to reduce their chance of getting a low blood glucose level. Table 3 below presents patients response to knowledge of hypoglycemia questions.

Table 2. Patients experience and practices with hypoglycemia

Variable	Frequency	Percentage
Do you suffer from any of the following complications related to diabetes mellitus?		
Neuropathy	108	35.4%
Cardiovascular diseases	33	10.8%
Retinopathy	33	10.8%
Nephropathy	23	7.5%
Cerebrovascular disease	2	0.7%
Type of medications used to manage diabetes mellitus?		
Insulin	172	56.4%
Oral antidiabetic agents	133	43.6%
Have you ever felt of hypoglycemia symptoms?		
Yes	279	91.5%
How many time do you measure your blood glucose level per day?		
Once	137	44.9%
Twice	74	24.3%
I don't measure it on daily basis	74	24.3%
Three times	14	4.6%
I don't know	6	2.0%
How often did you have an episode of hypoglycemia with symptoms during the last month?		
Once a month	180	59.0%
Twice or more weekly	60	19.7%
Once a week	48	15.7%
I don't know	12	3.9%
Once a day	3	1.0%
Twice or more daily	2	0.7%
How often do you carry a snack or glucose tablets with you to treat low blood glucose?		
Not every day	149	48.9%
Everyday	87	28.5%
I don't carry a snack or glucose tablet	69	22.6%
Have you needed assistance in the past during a hypoglycemic episode:		
Yes	198	64.9%
Does a spouse, relative, or other person close to you know how to deal with your episodes:		
Yes	228	74.8%

How often do you measure your HbA1c?		
Every three months	167	54.8%
Every six months	62	20.3%
Every month	33	10.8%
Once a year	3	1.0%
I don't measure it	40	13.0%
Do you have a glucagon injection at home for hypoglycemia emergency?		
Yes	73	23.9%
Have you ever needed emergency care or visited the emergency department because of hypoglycemia?		
Yes	108	35.4%
Source(s) of information about hypoglycemia? (More than one answer can be chosen)		
Internet	149	48.9%
Physician	143	46.9%
Pharmacist	135	44.3%
Relatives	133	43.6%
Friends	106	34.8%
Social media	87	28.5%
Television	51	16.7%
Which of the following statements apply to you?		
Sometimes I experience hypoglycemic symptoms when my blood glucose level is low	154	50.5%
I always have hypoglycemic symptoms	143	46.9%
I don't experience hypoglycemic symptoms when my blood glucose level is low	8	2.6%
During the past six months, how many times did you experience hypoglycemic episode, for which you was not able to manage yourself?		
Once or twice	160	52.5%
Once a month	60	19.7%
Never	51	16.7%
More than one time per month	22	7.2%
Every two months	12	3.9%
During the past year, how many times did you experience hypoglycemic episode, for which you was unconscious, needed glucagon, or intravenous glucose administration?		
One to three times	141	46.2%
Never	97	31.8%
Four to seven times	61	20.0%
Eight to eleven times	6	2.0%
During the past month, how many time your blood glucose level was less than 3.9 mmol/L with hypoglycemic symptoms?		
One to three times	156	51.1%
Never	122	40.0%
Four to five times per week	27	8.9%
What was your blood glucose level before feeling symptoms?		
Less than 2.2 mmol/L	27	8.9%
2.2-2.7 mmol/L	179	58.7%
3.3-3.8 mmol/L	99	32.5%
To which extent do you think that you are able to know your blood glucose level from your symptoms?		
Never	4	1.3%
Rarely	66	21.6%
Sometimes	106	34.8%
Always	129	42.3%
When you feel the symptoms what do you usually do:		
Drink juice	259	84.9%
Drink water	34	11.1%
Take insulin	12	3.9%

Table 3. Participants' knowledge of hypoglycemia

Variable	Frequency	Percentage
Hypoglycemia is defined as a blood glucose level of less than:		
70 mg/dL*	128	42.0%
120 mg/dL	64	21.0%
100 mg/dL	59	19.3%
I don't know	54	17.7%
Elderly patients have higher risk of hypoglycemia?		
Yes*	176	57.7%
What are the diseases that increase the risk of hypoglycemia? (More than one answer could be chosen)		
Chronic kidney diseases*	140	45.9%
Cardiovascular diseases*	137	44.9%
Chronic liver diseases*	132	43.3%
Psychological disorders	67	22.0%
Infections	62	20.3%
Allergy	19	6.2%
I don't know	121	39.7%
When do we consider hypoglycemia as a severe event?		
Having unconsciousness*	175	57.4%
Excessive sweeting and palpitation*	47	15.4%
High body temperature	34	11.1%
Vomiting	27	8.9%
I don't know	22	7.2%
How do you treat a low blood glucose level by yourself?		
Have a sugary drink*	217	71.1%
Have a snack*	69	22.6%
Take insulin	11	3.6%
Drink water	4	1.3%
I don't know	4	1.3%
One tablespoon of sugar, honey, or corn syrup can help in raising your blood glucose:		
Yes*	207	67.9%
You can reduce your chance of getting a low blood glucose level if you (More than one answer could be chosen)		
Always carry a sugary snack or drink with you*	186	61.0%
Have a carbohydrate snack*	164	53.8%
Adjust antidiabetic therapy dose*	137	44.9%
Eating a carbohydrate snack before exercise can help to reduce the risk of a hypoglycemia*	105	34.4%
Check your blood glucose level regularly*	102	33.4%
Managing other comorbidities*	98	32.1%
Drink water	96	31.5%
I don't know	23	7.5%

Predictors of knowledge of hypoglycemia

The mean score was 9.2 (3.9), out of 16, representing a moderate level of knowledge of hypoglycemia (57.5% of the total score). Elderly patients (aged 41-45 years and 51 years and over), those who are working inside the healthcare sector or retried, those who have higher education, and those who are widowed were more likely to be knowledgeable of hypoglycemia compared to others ($p \leq 0.05$), Table 4.

DISCUSSION

Hypoglycemia is a frequent problem among diabetic patients, especially those who are treated with insulin, sulfonylureas, or glinide. The primary risk factors for severe hypoglycemia are deficiencies in counterregulatory responses and unawareness of hypoglycemia [9]. The purpose of this research was to evaluate the experience and knowledge of adult diabetes patients about hypoglycemia and its management. Our key findings are as follows: 1) patients with diabetes mellitus showed moderate level of knowledge of hypoglycemia and its management, 2) majority of the patients were able to identify proper way of managing low blood glucose level, 3) the vast majority of patients with diabetes mellitus reported that they have experience hypoglycemic events before, 4) almost half of the patients reported that they measure their blood glucose level and carry a snack or glucose tablets with them to treat low blood glucose,5) one-third of patients reported needing emergency treatment or visiting the emergency room due to hypoglycemia, and 6) the internet was the most frequently cited source of information on hypoglycemia.

Hypoglycemia is a life-threatening adverse event associated with intensive antidiabetic therapy [10]. In addition, hypoglycemia is associated with high economic burden on the patients themselves [11]. In our study, patients with diabetes mellitus showed level of knowledge of hypoglycemia. The proportion of patients who answered the knowledge questions right ranged between 15.4% and 71.1%. Around 42.0% of them defined 70 mg/dL as a blood glucose level of less than. More than half of them (58.0%) identified that elderly patients have higher risk of hypoglycemia. In order to detect, manage, and prevent hypoglycemia, it is necessary to have enough

Table 4. Predictors of knowledge of hypoglycemia

Demographic variable	Odds ratio of being more knowledgeable about hypoglycemia	P-value
Gender		
Female (Reference group)	1.00	
Male	1.47 (0.93-2.32)	0.096
Age category		
18-25 years (Reference group)	1.00	
26-30 years	0.53 (0.29-0.99)	0.045*
31- 35 years	0.74 (0.38-1.45)	0.380
36-40 years	0.59 (0.31-1.12)	0.107
41-45 years	3.92 (1.41-10.85)	0.009**
46-50 years	0.83 (0.41-1.64)	0.584
51 years and above	5.14 (2.29-11.53)	≤0.001***
Employment status		
Student (Reference group)	1.00	
Retired	3.85 (1.61-9.24)	0.003**
Work outside the healthcare area	0.61 (0.39-0.97)	0.035*
Unemployed	0.71 (0.40-1.26)	0.239
Work inside the healthcare area	3.85 (1.05-14.08)	0.042*
Education		
Secondary school level or lower (Reference group)	1.00	
Bachelor degree	1.44 (0.91-2.28)	0.118
Higher education	5.25 (1.13-24.35)	0.034*
Monthly income		
2500 SAR and lower (Reference group)	1.00	
2500-5000 SAR	1.29 (0.68-2.44)	0.434
5000-7500 SAR	0.77 (0.45-1.31)	0.332
7500 SAR and over	1.41 (0.89-2.24)	0.141
Marital status		
Single (Reference group)	1.00	
Married	1.35 (0.86-2.13)	0.189
Divorced	0.56 (0.26-1.19)	0.134
Widowed	2.77 (1.28-6.00)	0.010*
Do you have other comorbidities?		
No (Reference group)	1.00	
Yes	1.16 (0.73-1.83)	0.529
What type of diabetes mellitus do you have?		
Type 1 diabetes mellitus (Reference group)	1.00	
Type 2 diabetes mellitus	0.72 (0.45-1.13)	0.147
Duration of diabetes mellitus:		
Less than 5 years (Reference group)	1.00	
5-10 years	1.12 (0.69-1.81)	0.650
11-15 years	0.92 (0.53-1.58)	0.758
More than 15 years	1.19 (0.73-1.93)	0.484

information about hypoglycemia [12]. Nevertheless, patients with DM lack awareness about crucial elements of hypoglycemia [13]. A reduction in hypoglycemic episodes was associated with an increase in diabetes patients' understanding of hypoglycemia [3,14]. A previous study in Saudi Arabia reported that 50% of diabetic patients in Saudi Arabia lack understanding of hypoglycemia symptoms [7]. Several sociodemographic factors, including DM type, duration of insulin therapy in years, total daily insulin doses, and hypoglycemia knowledge, are correlated with experiencing hypoglycemia in T1DM patients [14].

In our study, almost 56.0% of them reported that they are currently on insulin therapy. The vast majority of the patients (91.5%) reported

that they have previously experienced hypoglycemia symptoms. Around 45.0% of the patients reported that they measure their blood glucose level once a day. Almost 60.0% of them reported that they had encountered an episode of hypoglycemia with symptoms during the last month. Hypoglycemia is characterized as a state when the plasma glucose concentration is low, putting patients at risk for potential injury. People with type 1 diabetes often experience severe hypoglycemia, with yearly incidence rates ranging from 3.3% to 13.5% [15]. While type 2 diabetes patients are less likely to have severe hypoglycemia than those with type 1 diabetes, those who are using insulin or insulin secretagogues are often at increased risk [16]. Except when combined with insulin or insulin secretagogues, glucose-

lowering medications that do not result in uncontrolled insulin secretion include metformin, dipeptidyl peptidase-4 inhibitors, glucagon-like peptide-1 receptor agonists, sodium-glucose cotransporter-2 inhibitors and thiazolidinediones [9].

In our study, around 50.0% of them reported that they do not carry a snack or glucose tablets with them to treat low blood glucose. Around 65.0% of them reported that they needed assistance in the past during a hypoglycemic episode. In our study, a total of 71.1% of the patients identified that sugary drink is used to manage low blood glucose level. In addition, 32.0% of the patients were able to identify one approach to reduce their chance of getting a low blood glucose level. The majority of self-monitoring diagnoses of episodes of symptomatic or asymptomatic hypoglycemia may be adequately treated with rapid-acting carbohydrates, with clinical improvement expected within 20 minutes [17]. The significance of administering long-acting carbs following glucose level correction should be highlighted, since the benefits of oral glucose persist less than two hours in patients with sustained hyperinsulinemia [17].

In our study, more than half of them (55.0%) reported that they measure their HbA1c every three months. Almost one-quarter of them (24.0%) reported that they have a glucagon injection at home for hypoglycemia emergency. Almost one-third of them (35.0%) reported that they needed emergency care or visited the emergency department because of hypoglycemia. Self-monitoring of blood glucose (SMBG) and continuous glucose monitoring are critical techniques for the early diagnosis of hypoglycemia. SMBG is a crucial component of hypoglycemia prevention measures. For the majority of patients on intensive insulin regimens (multiple daily injections (MDI) or pump), the American Diabetes Association (ADA) recommends glucose monitoring prior to meals and occasionally post-prandially, prior to sleep and physical activity, when there is a suspicion of low blood glucose, after treatment of hypoglycemia, and prior to certain activities requiring high concentration, such as driving [18].

To avoid hypoglycemia, substantial effort must be devoted to patient education on risk factors, warning symptoms, and treatment of hypoglycemia at an early stage, as well as the establishment of individualized glycemic control goals [9]. The strategy for preventing hypoglycemia include patient education, suitable food and exercise regimes, glucose monitoring, medication modification, and constant clinician supervision [19]. The patients and people around them should be informed about the signs of hypoglycemia, and they should get prompt treatment. Common causes of hypoglycemia include skipped meals/prolonged fasting, physical exercise, alcohol intake, and injection of a high insulin dosage.

A previous study in Saudi Arabia examined physicians' perspectives regarding treatment de-intensification, HbA1c goals individualisation, and factors affecting their treatment choice for patients with type 2 diabetes mellitus (T2DM) [20]. In this study, the authors concluded that only 66.3% of doctors usually implement the concept of HbA1c target individualization. In addition, only 58.5% of the doctors indicated that they would not commence discussions regarding de-intensifying antidiabetic medication even if their patients' HbA1c levels remained stable for a year. Doctors gave more weight to objective patient clinical data and their judgment of the patient's health state, whereas patient-related variables received less attention [20]

Patients engagement and involvement in deciding their treatment plan is an important element that should be considered due to its important influence on patients' adherence and compliance to their therapy. A previous multinational study examined patients' hypoglycaemia

problem-solving ability of patients who have diabetes mellitus and found that they showed average hypoglycemic problem-solving abilities overall [21]. The patients' problem-solving abilities exceeded their problem-orientation. The patients' understanding of detection control, defining problem-solving objectives, and assessing techniques was adequate. In addition, their understanding was restricted in terms of problem-solving perspective and immediate management [21].

CONCLUSION

In Saudi Arabia, patients with diabetes indicated a modest degree of understanding regarding hypoglycemia. Greater effort should be devoted to educating patients about the signs and treatment of hypoglycemia episodes. Particular attention should be paid to high-risk groups, such as elderly patients and those controlled with insulin treatment.

Author Contributions

A.K.A supervised this study in term of methodology, statistical analysis and rafting. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Ethics Approval and Informed Consent:

The study was approved by the Research Ethics Committee at King Faisal University, Saudi Arabia (KFU-REC-2022- JUN - ETHICS46). This study was performed in accordance with the principles stated in the Declaration of Helsinki. All participants gave their consent before being involved in this study.

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Competing Interest: None

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