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ORIGINAL ARTICLE

General public awareness of adult population toward hypoglycemic attacks in Saudi Arabia

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ABSTRACT

Background: Hypoglycemic attack refers to a medical condition in which blood glucose level decreases to a dangerous level (less than 40 mg/dl), resulting in the appearance of a physiological shock in the body. This study was aimed to assess the level of awareness of the general population in Saudi Arabia toward hypoglycemic attacks and to explore the relationship between the level of awareness and various socio-demographic factors.

Methodology: In this cross-sectional study, 420 participants were randomly enrolled. A pre-tested questionnaire was used in data collection. Statistical Package for the Social Sciences (SPSS) was used to analyze the collected data.

Results: This study comprises 50.7% females and 49.3% males; most of them were graduated (49.5%), married (49.8%), and of Saudi nationality (74.3%). The findings of this study indicated that there was a high level of awareness about hypoglycemic attacks among the general population in Saudi Arabia, where most of the participants (n = 335, 79.8%) were identified with a good level of awareness, while 85 (20.2%) had a poor level of awareness. No significant difference was observed between nationality and level of awareness (p = 0.812). On contrary, there were significant differences between gender, age, marital status, and level of education concerning the level of awareness, as the calculated p values were recorded as <0.001 for all these parameters, and 0.046 for the age parameter.

Conclusion: The level of awareness of the general population in Saudi Arabia toward hypoglycemic attacks was sufficient. There was a significant relationship between gender, age, marital status, and level of education in relation to the level of awareness.

Keywords: Hypoglycemic attack, cross-sectional study, physiological shock.

Introduction

Hypoglycemic attack refers to a medical condition in which blood glucose level decreases to a dangerous level (less than 40 mg/dl), resulting in the appearance of a physiological shock in the body. By definition, a body is said to be under the condition of hypoglycemia when blood glucose level decreases to less than 70 mg/dl. Under such conditions, the human body responds by built-in natural mechanisms to manifest warning signs, including hunger, weakness, dizziness, drowsiness, shivering, or anxiety. Severe hypoglycemic attacks are commonly observed in type 1 and type 2 diabetic patients during intensive therapies with anti-diabetic drugs including insulin or sulfonylureas, also termed as iatrogenic hypoglycemia [1]. Brain cells are not capable to synthesize glucose or to store glycogen for more than

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a few minutes, thus, they require a continuous supply of glucose via blood for normal functioning as brain cells [2]. Low blood glucose levels around 60-65 mg/dl may affect brain functioning due to a shortage of glucose required by brain cells leading to a symptomatic condition known as glycopenia. To overcome such glucose shortage, the brain starts responding by stimulating different body organs to show warning signs. However, sometimes the body may not be able to exhibit warning signs leading to secretion of blood sugar regulatory hormones such as adreno-medullary adrenaline and neurotransmitter norepinephrine, as stimulated by the central nervous system [3]. However, if there is a repetition of such hypoglycemic events, there is a possibility that the brain may adapt to lower glucose levels and start taking it as a normal body condition by setting a lower than normal threshold of blood glucose level. As a result, natural regulatory responses of the body to adjust blood glucose level and to trigger warning signs are set to be activated at a very lower level of the blood glucose, i.e., <50 mg/dl, ignoring the mild hypoglycemic episodes in early phases which is referred as hypoglycemia unawareness [4]. Consequently, hypoglycemic unawareness may lead to more frequent episodes of hypoglycemia with longer duration of each event. This situation may lead to a vicious cycle of hypoglycemic episodes resulting in a further decline in the normal threshold level for blood glucose. Ultimately, the situation gets worsened with severe hypoglycemic attacks leading to insulin shock, diabetic coma, and brain dysfunction [1,5]. Hypoglycemic attacks are more frequently observed in patients with diabetes type 1. It is also observed in type 2 patients getting a treatment based on insulin or sulfonylureas (Francois 2018). Moreover, population-based studies depict that frequency of hypoglycemic events in type 2 diabetic patients with insulin-based therapy is almost one third as compared to hypoglycemic attacks in type 1 diabetic patients [6,7]. There is no defined frequency for a patient to observe hypoglycemic events as it differs from person to person based on individual health status; however, on average, a diabetic patient may encounter multiple mild hypoglycemic events and at least one severe hypoglycemia attack per year as reported by some studies [8]. Incidence rate of hypoglycemia reported in different studies is quite variable. This might be due to the reason that definition, standardization, and classification of hypoglycemia had been conflicted among researchers impacting the global incidence rate reports. Furthermore, all hypoglycemia events do not get reported as most cases are self-treated and self-resolved, hindering the estimation of the exact incidence rate. The most recent definition of hypoglycemia involves three factors, including lower than normal plasma glucose (PG) level (<4.0 mmol/l), a manifestation of autonomous or neuroglycopenic symptoms, and effective response of carbohydrate administration on alleviation of symptoms [9].

With regards to the spectrum of severity, hypoglycemic events can be categorized into three types: mild, moderate, and severe. Mild hypoglycemia refers to the presence of autonomic symptoms such as tingling, trembling, anxiety, palpitations, nausea, sweating, and hunger in the patient, but the ability of the patient to treat himself is retained. In moderate hypoglycemia, the patient may observe some neuroglycopenic symptoms, including dizziness, headache, drowsiness, concentration loss, weakness, confusion, and difficulty in vision/speech along with primary autonomous symptoms. However, the patient remains conscious and retains the ability to self-treat the symptoms. Severe hypoglycemia defines the condition of a very low PG level, i.e., less than 2.8 mmol/l accompanied by loss of consciousness and requirement of a third party to manage the condition of the patient [10]. Risk factors of hypoglycemic attacks vary from person to person depending upon age and preliminary health conditions. For instance, patients diagnosed with diabetes (especially type 1 diabetes) may be at risk of hypoglycemic attack if they had a previous history of a severe hypoglycemic episode, a lower amount of glycated hemoglobin (A1C < 6.0%), autonomic neuropathy, hypoglycemia unawareness, long-term diabetic history, pregnancy, adolescence, and younger children who cannot assess and treat mild hypoglycemic events themselves. Similarly, in patients with diabetes type 2, certain factors such as increasing age, lack of education, unhealthy eating habits/lifestyle, cognitive abnormalities, kidney problems, and duration of insulin therapy may play a role in an increased risk of hypoglycemia attacks [10,11]. Individuals at risk of developing hypoglycemia attacks must be provided with proper awareness and training sessions such as continuous blood glucose monitoring and insulin infusions for the management of hypoglycemia to avoid unwanted outcomes such as driving/work-related accidents and exhibition of hypoglycemia associated complications including renal failure, prolonged coma, cardiovascular diseases, cognitive disorders, and other life-threatening conditions [10,12]. Hypoglycemia attacks can be managed by prompt emergency response initiated by trained attendants or emergency healthcare staff. Hypoglycemia can occur randomly at any time in patients with previously identified risk factors. If this condition is not treated immediately, it can lead to severe outcomes including permanent neurological abnormalities or even death in young individuals. For mild hypoglycemia, carbohydrate-rich oral administration may help sufficiently. However, sever hypoglycemia attacks require special attention as patients may not be able to take oral administration due to loss of consciousness. The respiratory airway should be secured to avoid breathing issues in unconscious patients or patients affected with seizures. The patient should be laid on side and glucagon tablets (1 mg for age 5 years or more, 0.5 mg for age <5 years) or any other available sweetened edible such as honey, and jam dates shall be placed in buccal mucosal membranes to achieve near to the safe level of blood glucose [13]. Glucose dose of 20 g may be given orally to conscious patients with severe hypoglycemia, as it is reported to increase blood

glucose level by 3.6 mmol/l units within 45 minutes of administration. The condition must be re-evaluated every 15 minutes and the dose of carbohydrate may be repeated if required after 15 minutes [10,14]. Also, 1 mg glucagon subcutaneous or intramuscular injection is recommended to be given to unconscious hypoglycemic attack patients as it can increase blood glucose level from 3.0 to 12.0 mmol/l within 1 hour [15]. Moreover, 10-25 g of glucose shall be given intravenously to unconscious patients with a severe hypoglycemic attack over 1-3 minutes [10]. However, the rapid increase in blood glucose is recommended only in very serious conditions as over usage of these treatments may lead to hyperglycemia and weight gain. Recommended sources for blood sugar increment at a slower pace include milk, orange juice, honey, or glucose gel which increase the blood glucose level by 1.0 mmol/l in 20 minutes [10,16].

The problem of glycemic control is challenged by iatrogenic hypoglycemia events in patients diagnosed with diabetes in all parts of the world. In the US, a study reported that hypoglycemic events were claimed to be experienced by 71% of diabetic patients being treated with anti-diabetic therapies [17]. In another study from the US, medical students were observed to have a significantly improved knowledge after giving a short educational session about hypoglycemia [18]. Moreover, it was observed in a study from the Netherlands that type I diabetic patients tend to regularly monitor their blood glucose level via self-monitoring blood glucose protocols as compared to type II diabetic patients with knowledge and awareness of hypoglycemia as a relevant factor [19]. Furthermore, hypoglycemic attacks have been reported as a triggering factor for a specific type of cardiomyopathy known as Takotsubo cardiomyopathy in a report from Japan [20]. Also, impaired awareness of hypoglycemia was observed in 48% of type I diabetic patients and 36.9% of type II diabetic patients in the Malaysian cohort [21]. Besides, showed a lack of knowledge about the hypoglycemia attack was observed in 52% of the enrolled diabetic patients in a study from Sudan [22]. Likewise, only 37.7% of the diabetic patients enrolled from Peshawar city of Pakistan were aware of hypoglycemia suggesting inadequate knowledge and perception level in the studied population [23]. Conversely, a study reported two-third of the enrolled Ethiopian diabetic patients practicing sufficient hypoglycemia attack knowledge and was found to practice proper preventive measures to avoid hypoglycemia attacks [24]. Similarly, relatively better awareness of diabetic patients about diabetes and risk of hypoglycemia attack was observed in a study from Iraq, where the improved knowledge was correlated positively with age group and with the type of treatment along with previous guidance from the treating physician [25].

In the kingdom of Saudi Arabia, multiple studies have been conducted to report various hypoglycemic aspects of diabetic patients. In a study conducted in Riyadh Saudi Arabia, it was observed that 69.7% of the diabetic coma cases were due to hypoglycemia attacks where the majority of them were treated in the emergency room [26]. Likewise, another study from Arar, Northern region of Saudi Arabia, observed 70.7% of the enrolled cases reported with a hypoglycemic coma where the majority (58.7%) were managed at home while only a small fraction (6.5%) [27]. Additionally, a study from Makkah reported 50% of the enrolled diabetic patients lacked knowledge about hypoglycemic symptoms. The majority of the patients had very poor knowledge and a significant correlation was observed between poor knowledge and male gender, low education level, and non-compliance with treatment protocols [28].

Moreover, preparedness for the diabetic residents as well as tourists was emphasized in a study, during dessert visits considering the hot climate of Saudi Arabia. Especially, diabetic tourists must be informed with all aspects of traveling to dessert and wild areas in summers. Researchers also recommended to prepare and train tour leaders and guiding staff with an efficient management plan to deal with hypoglycemic attacks while paying special attention to hot climate [29]. Furthermore, therapeutic doses of hyperglycemia and diabetes were assessed during the period of Hajj in a study conducted in Najran, Saudi Arabia. Incidentally, it was observed that due to excessive movement and exertion during the Hajj rituals, diabetic patients need lesser doses of insulin and other diabetic drugs. Therefore, if diabetic patients continue to use routine, the risk of hypoglycemic attacks will increase. Thus, the Hajj participants must be guided better about their therapeutic doses and frequent monitoring of their blood glucose level shall be recommended [30]. The present study primarily targeted to explore the level of general public awareness of adult population toward hypoglycemic attacks in Saudi Arabia. The present study also looked into the relationship between the level of awareness and different socio-demographic factors.

Subjects and Methods

A cross-sectional study was carried out among adult (male and female) populations conducted in the main five regions of Saudi Arabia during the year 2020. Participation was voluntary after proper consent being taken. Children and non-Saudi residents were excluded from the study. Total enumeration method was used for including male and female adult population after agreeing to answer the questionnaire in this study. The sample size was calculated according to this formula with significance adopted at $p > 0.05$ [= ² (1 −) / (² + ² (1 −)], the total respondent were 382. Pre-tested questionnaire was used in data collection. The questionnaire included questions about socio-demographic factors and general public awareness of the adult population toward hypoglycemic attacks. A non-probability sampling technique was employed to collect the data from the participants. Data were coded, entered, and analyzed using the Statistical Package for Social Science (SPSS) version 23. The level of awareness of the

general population in Saudi Arabia toward hypoglycemic attacks was assessed using a scoring system. A score of 1 was given to correct responses and 0 was used for incorrect/do not know responses. Participants were categorized into two categories; scores less than 8 out of 16 were considered as a poor level of awareness, while scores equal or greater than 8 were considered as a good level of awareness. Furthermore, the relationship between socio-demographic factors of participants and their level of awareness was calculated using the chi-square test. A statistical significance was determined at $p < 0.05$. The study protocol was submitted to the University research committee for ethical approval. Data were collected after the ethical clearance.

Results

In this study, 420 voluntary participants were enrolled, classified based on their socio-demographic information (as summarized in Table 1). It is evident from the given data that 213 (50.7%) of the participants were females and 207 (49.3%) were males. The age distribution of the sample showed that 121 (28.8%) of the participants were in the age group (36-45) years, 106 (25.2%) were in the age group (26-35) years, 84 (20%) were in the age group (46-65) years, whereas a few were younger than 25 years or older than 66 years of age. Most of the participants were Saudi nationals (74.3%). Concerning the marital status, most of the participants (49.8%) were married, 108 (25.7%) were single, 54 (12.9%) were divorced, and 49 (11.7%) were widowed. Regarding the level of education, most of the participants ($n = 208$, 49.5%) were graduated, 77 (18.3%) were secondary educated and 66 (15.7%) had an intermediate education.

To assess the awareness toward hypoglycemic attacks while focusing on the first aim of our study, data analysis summarized in Table 2 revealed that 390 (92.9%) out of 420 of the participants have heard of hypoglycemia, while 30 (7.1%) did not. 361 (86%) of the participants know that hypoglycemia is referred to low blood glucose and few participants think that hypoglycemia is referred to high blood glucose or low blood pressure (5%). 105 (25%) of the participants had hypoglycemic attacks, 212 (50.5%) witnessed it in someone else. About the history of chronic disease, 171 (40.7%) of the participants had diabetes, while 78 (18.6%) did not. Participants were asked about the level of blood glucose depicting hypoglycemia, 358 (85.2%) of the participants knew that it was less than 70 mg/dl, and 279 (66.4%) knew that the blood glucose level that depicts severe hypoglycemia was less than 40 mg/dl. Iatrogenic hypoglycemia refers to hypoglycemia due to anti-diabetic drugs, 331 (78.8%) of the participants knew that while few participants thought that it was hypoglycemia due to unhealthy eating habits (6.9%) or alcohol & narcotic drugs (6.4%). 215 (51.2%) of the participants knew that hypoglycemia unawareness refers to lack of sense for low blood glucose warning signs on 3 while 123 (29.3%) thought that it was lack of sense for ethical responsibilities toward patients, and 65 (15.5%) thought that it was lack of knowledge about health & fitness.

Amongst the common autonomous symptoms of hypoglycemia, the tingling was the most selected (81.2%) followed by anxiety (77.6%), nausea (64%),

Table 1. *Socio-demographic characteristics of participants (n=420).*

Characteristics		Frequency	Percent
Gender	Male	207	49.3%
	Female	213	50.7%
Age (years)	≤25	51	12.1%
	26-35	106	25.2%
	36-45	121	28.8%
	46-65	84	20%
	≥66	58	13.8%
Nationality	Saudi	312	74.3%
	Non-Saudi	108	25.7%
Marital status	Singe	108	25.7%
	Married	209	49.8%
	Divorced	54	12.9%
	Widow	49	11.7%
Educational level	Primary school	47	11.2%
	Intermediate school	66	15.7%
	Secondary school	77	18.3%
	Bachelors	208	49.5%
	Other	22	5.2%

Table 2. *Detailed awareness of the general public in Saudi Arabia toward hypoglycemic attacks.*

Questions						
1. Have you ever heard of hypoglycemia?					Yes	No
					390 (92.9%)	30 (7.1%)
		Low blood glucose		High blood glucose	Low blood pressure	I don't know
2. Hypoglycemia refers to?		361 (86%)		21 (5%)	21 (5%)	17 (4%)
				Yes, myself	Yes, someone else	No
3. Have you ever had/witnessed anybody affected with hypoglycemia attack?				105 (25%)	212 (50.5%)	103 (24.5%)
4. Do you/someone in your close circle have diabetes?				171 (40.7%)	171 (40.7%)	78 (18.6%)
	< 70 mg/dl			70-150 mg/dl	150-200 mg/dl	I am not sure
5. What is the level of blood glucose depicting hypoglycemia?	358 (85.2%)			36 (8.6%)	18 (4.3%)	8 (1.9%)
	< 40 mg/dl			50-70 mg/dl	> 70 mg/dl	I am not sure
6. What level of blood glucose depicts severe hypoglycemia?	279 (66.4%)			88 (21%)	43 (10.2%)	10 (2.4%)
	Anti-diabetic drugs	Unhealthy eating habits		Alcohol & narcotic drugs	All of them	I don't know
7. What do you think iatrogenic hypoglycemia refers to? Hypoglycemia due to	331 (78.8%)	29 (6.9%)		27 (6.4%)	23 (5.5%)	10 (2.4%)
8. What do you think hypoglycemia unawareness refers to?						
Knowledge about health & fitness (15.5%)				Sense for low blood glucose warning signs on 3 (51.2%)		
Sense for ethical responsibilities toward patients (29.3%)				I don't know (4%)		
9. What are common autonomous symptoms of hypoglycemia?						
Anxiety (77.6%)	Trembling (62.9%)		Nausea (64%)		Joint pain (4.3%)	
Tingling (81.2%)	Sweating (61.2%)		Loss of appetite (6.2%)		I don't know (4.8%)	
10. What are common neuroglycopenic symptoms of hypoglycemia?						
Headache (79.5%)	Drowsiness (80%)		Difficulty breathing (3.1%)		Flu (23.6%)	
Weakness (40.5%)	Chest pain (2.1%)		Concentration loss (48.1%)		I don't know (2.9%)	
	PG <2.8 mmol/l	Unconsciousness	Muscle rupture	Skin rash	I am not sure	
11. What are symptoms of severe hypoglycemia attack?	276 (65.7%)	332 (79%)	29 (6.7%)	92 (21.9%)	19 (4.5%)	
			Type I diabetic	Type II diabetic	I am not sure	
12. Hypoglycemic attack is most commonly observed in patients with?			282 (67.1%)	93 (22.1%)	45(10.7%)	
13. What are the major risk factors for hypoglycemic attack?						
History of severe hypoglycemic (64.5%)			Long term orthopedic history (3.6%)			
Autonomic neuropathy (64%)			Lower amount of minerals (2.6%)			
Hypoglycemia unawareness (58.3%)			Loss of hairs and skin (23.3%)			
Lack of education (59.5%)			Increasing height (20%)			
Pregnancy/adolescence (57.1%)			I don't know (4.8%)			
	Prolonged coma	Cardiovascular diseases	Skeletal disorders	Liver failure	I don't know	
14. What are the major complications of hypoglycemic attack?	296 (70.5%)	301 (71.7%)	52 (12.4%)	64 (15.2%)	25 (6%)	
	Oral administration of CHO	Glucagon 1 mg I/M or subcutaneous	10-25 g of glucose I/V	I am not sure		
15. What are basic management strategies for mild hypoglycemia in a fully awake patient?	313 (74.5%)	61 (14.5%)	12 (2.9%)	38 (9%)		
	Oral administration of sweet edible	Glucagon tablets	Glucagon 1 mg I/M or subcutaneous	10-25g of glucose I/V	I am not sure	
16. What are the basic management strategies for severe hypoglycemic attack?	267 (63.6%)	188 (44.8%)	236 (56.2%)	207 (49.3%)	54 (12.9%)	

trembling (62.9%), and sweating (61.2%). While few participants thought that loss of appetite and joint pain are the common symptoms of hypoglycemia. About the common neuroglycopenic symptoms of hypoglycemia, drowsiness was the most selected (80%) followed by headache (79.5%), concentration loss (48.1%), and weakness (40.5%). Participants were going more with unconsciousness as the most common symptom of severe hypoglycemic attack (79%) followed by PG less than 2.8 mmol/l while few participants (4.5%) were not sure or did not have any opinion on it. The hypoglycemic attack was most commonly observed in patients with type I diabetes, 282 (67.1%) of the participants knew that while 93 (22.1%) thought that it was most commonly observed in patients with type II diabetes and 45 (10.7%) was not sure about it. Concerning the major risk factors for the hypoglycemic attack, it included a previous history of the severe hypoglycemic episode (64.5%), autonomic neuropathy (64%), lack of education (59.5%), hypoglycemia unawareness (58.3%), and pregnancy/adolescence (57.1%). About the complications of a hypoglycemic attack, participants knew that cardiovascular diseases and prolonged coma were the major complications of hypoglycemia which represented (71.7%) and (70.5%), respectively. About the management of hypoglycemia, 313 (74.5%) of the participants knew that the basic management strategies for mild hypoglycemia in a fully awake patient was oral administration of carbohydrates, while basic management strategies for the severe hypoglycemic attack included oral administration of edible sweets, e.g., honey, dates table sugar (63.6%), glucagon tablets (44.8%), glucagon 1 mg subcutaneous or intramuscular injection (56.2%), and intravenous administration of 10-25 g of glucose (49.3%).

The level of awareness toward hypoglycemic attacks was classified based on the response of the participants into either poor or good awareness level. There was a high level of awareness about hypoglycemic attacks among the general population in Saudi Arabia where most of the participants (n = 335, 79.8%) were recognized with a good level of awareness while 85 (20.2%) had a poor level of awareness (as shown in Figure 1).

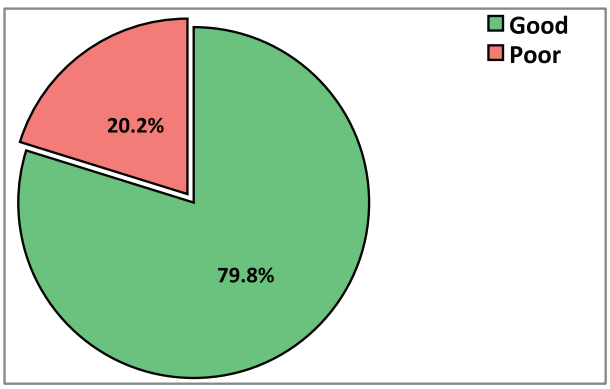

Figure 1. *Level of awareness of general public about hypoglycemic attacks.*

The obtained data was also analyzed to cover the second aim of this study which is to determine the significance of differences between the level of awareness and the socio-demographic data of the participants (presented in Table 3). No significant difference was observed between nationality and level of awareness (p = 0.812). On contrary, there were significant differences between gender, age, marital status, and level of education in relation to the level of awareness, as the calculated p values were recorded as <0.001 for all these parameters, and 0.046 for the age parameter. Our results showed that a good level of awareness was associated with male gender, 66 years of age or older participants, married, and secondary educated participants.

Discussion

This study involved a random selection of 420 participants in Saudi Arabia to assess their level of awareness toward hypoglycemic attacks and to analyze if there is a significant relationship between demographic data of the participants and their level of awareness. In this study, the participant's awareness of hypoglycemic attacks was assessed. There was a high level of awareness where most of the participants (79.8%) were recognized with a good level of awareness. Similarly, in a study carried out among patients with Diabetes Mellitus by Sharma et al. [31] who stated that overall (64.4%) diabetic patients had good knowledge of hypoglycemia. A lower level of awareness was reported in the study conducted by Thenmozhi et al. [32] who found that (20%) of the participants had moderately adequate knowledge, and 16.67% of them had adequate knowledge. About the common neuroglycopenic symptoms of hypoglycemia, drowsiness was the most selected by the participants (80%) followed by headache (79.5%), concentration loss (48.1%), and weakness (40.5%), while in a study conducted by Sharma et al. [31] the common symptoms of hypoglycemia known to the study subjects were dizziness (84.4%), weakness (74.1%), and drowsiness (68.1%). In a study that carried out by Abeyaratne [33] among diabetic population admitted to a tertiary care hospital with a hypoglycemic episode, the commonest symptoms of their current episode were loss of consciousness (82%), confusion (18%), while most had associated other symptoms such as sweating (43%) and oral numbness (5%). Concerning the management of hypoglycemia, 74.5% of the participants knew that the basic management strategies for mild hypoglycemia in a fully awake patient was oral administration of carbohydrates, similarly in a study that was conducted by Sharma et al. [31] who stated that regarding the management of hypoglycemia, 49% patients preferred taking glucose powder or sugar with water as an immediate measure.

The significance of differences between the level of awareness and the socio-demographic data of the participants was determined. No significant difference was observed between nationality and level of awareness (p = 0.812). On contrary, there were significant differences

Table 3. *The relationship between socio-demographic characteristics of participants and their level of awareness.*

Character	Level of Awareness				*p*-value
	Good		Poor		
	count	%	count	%	
Gender					
Male	189	91.3%	18	8.7%	<0.001
Female	146	68.5%	67	31.5%	
Age (years)					
≤ 25	43	84.3%	8	15.7%	0.046
26 - 35	90	84.9%	16	15.1%	
36 - 45	88	72.7%	33	27.3%	
46 - 65	63	75%	21	25%	
≥ 66	51	87.9%	7	12.1%	
Nationality					
Saudi	248	79.5%	64	20.5%	0.812
Non-Saudi	87	80.6%	21	19.4%	
Marital Status					
Single	68	63%	40	37%	<0.001
Married	182	87.1%	27	12.9%	
Divorced	47	87%	7	13%	
Widowed	38	77.6%	11	22.4%	
Educational Level					
Primary	38	80.9%	9	19.1%	<0.001
Intermediate	51	77.3%	15	22.7%	
Secondary	69	89.6%	8	10.4%	
Bachelors	174	83.7%	34	16.3%	
Other	3	13.6%	19	86.4%	

between age (p = 0.046) and level of education (<0.001) about the level of awareness, the results showed that the good level of awareness is associated with 66 years of age or older participants and secondary educated participants, which is contrary to the findings of the study that conducted by Sharma et al. [31] who found that higher age and illiteracy were associated with poor knowledge. While a similar result was reported by Thenmozhi et al. [32] who stated that there is a significant association between the age at the level of p<0.05 with the level of knowledge on hypoglycemia.

Conclusion

The level of awareness of the general population in Saudi Arabia toward hypoglycemic attacks was sufficient. There was a significant relationship between gender, age, marital status, and level of education in relation to the level of awareness.

Conflict of interest
The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication
Informed consent was obtained from all the participants.

Ethical approval
The study is based on a survey conducted among general public and no personal information has been compromised. Hence, Ethics approval is not required.

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