Original Article

Incidence of hypoglycemia and its risk factors among diabetics during Ramadan in Abha city, Aseer Region, KSA

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Abstract

Background and Aims: This study aims to explore the incidence of hypoglycemia and its risk factors among diabetic patients attending primary health care center during Ramadan Abha city, Aseer region, Saudi Arabia. **Methods:** This cross-sectional study was conducted among adult diabetic patients attending Primary health care centers (PHCCs) in Abha city, southwest of KSA. A questionnaire in Arabic language was used. It consisted of five parts that covered patients demographic and DM relevant profile, hypoglycemia attacks during Ramadan, compliance with drug, diet, exercise and glucose monitoring. Four PHCCs in Abha city were selected randomly to conduct this study. All diabetic patients who attended the selected PHCCs during the month of Shawwal 1439 (corresponding to June-July 2018) were interviewed by the investigators. Data were coded, entered and analyzed using SPSS version 22. Appropriate statistical tests were used accordingly and *P* value was considered as significant if it was less than 5%. **Results:** The total patients participated in this study was 378. The mean age was 45 years, males represents 51%, mean duration of DM was 12 years, type-1DM constitutes about one third. Most of type-1 DM patients used act rapid and long acting insulin (65%), while in type-2 DM, more than one third (38%) used OHA, 8% were on insulin alone. More than half of patients (52%) reported at least one attack of hypoglycemia during Ramadan, (29%) out of them had more than four attacks. About two third of attacks (67%) occurred in the morning and evening while less than one fourth have hypoglycemia at night (17%), (2%) visited ER or PHC and 1% were admitted to hospital for further management. **Conclusion:** This study revealed that the incidence of hypoglycemia among diabetics was high. Many Risk factors were identified; young age, type-1 DM, long duration of DM, insulin use. More attacks occurred during Ramadan day period and led to breaking the fasting among all affected patients. Most of patients were not given instructions regarding self-care immediately before or during Ramadan. Structured health education program for diabetics attending PHCC should be constructed and implemented before beginning of Ramadan in order to minimize the incidence of acute complications particularly hypoglycemia.

Keywords: Aseer region, diabetes, hypoglycemia, primary care, Ramadan, Saudi Arabia

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Introduction

Diabetes Mellitus (DM) is one of the most common chronic health problems in the worldwide. In Saudi Arabia, the DM affects about 20% of adult population.[1-4]

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DM is known to have acute and chronic complications, one of the most serious complications is hypoglycemia.[4,5]

During Ramadan, most of Saudi diabetics fasting the holy month (Ramadan) for at least 13-15 hours per day. This long period of fasting may lead to short-term diabetes complications such as hypoglycemia and diabetic keto-acidosis.[6]

Despite the seriousness of hypoglycemia and its bad consequences among diabetics during Ramadan, it still needs more research as few studies were conducted in Saudi Arabia to explore this subject.[7-11] To our current knowledge, there was no single study conducted on this topic in southern region of KSA. This study aims to explore the incidence of hypoglycemia and its risk factors among diabetic patients during Ramadan in Abha city, Aseer region, Saudi Arabia.

Methods

This cross-sectional study was conducted among adult diabetic patients attending Primary health care centers (PHCCs) in Abha city, southwest of KSA. To achieve the objectives of this study, the investigators constructed a questionnaire in Arabic language based on relevant studies.[8-15] The questionnaire consisted of five parts as following: the first part was about the demographic variables (age, sex, educational status, marital status. The second part dealt with patient health data (type of DM, duration, history of chronic health problems, types of drugs in use). The third part contained the doctor's advices before/during Ramadan and history of drug adjustment by patients during Ramadan. Part four dealt with history of hypoglycemia which was defined as blood glucose was less than 70mg/dl or patient reported classical symptoms of hypoglycemia that resulted in breaking the patient's fasting. It included number of attacks, symptoms, and self-management during attack. The last part was about the compliance of patients with drug, diet and physical activities and checking blood glucose during Ramadan. To test the reliability and feasibility of the questionnaire a pilot study was made on 20 participants who were excluded from analysis. Ethical approval was obtained from regional ethical committee under (No2017-03-35 dated 1st June 2017). Out of eight PHCCs in Abha city, four centers were selected randomly to conduct this study. According to local statistics, the total diabetic patients registered at PHCCs in Abha is about ten thousands patients. Sample size was calculated using Raosoft electronic calculator based on the following factors: acceptable margin of error (5%), confidence interval (95%), population size = 10,000 patients and estimated prevalence of hypoglycemia = 50%, giving sample size of 370 patients.[16] After obtaining the informed consent from the participants, the investigators interviewed all diabetic patients who attended the selected PHCCs during the month of Shawwal 1439 (corresponding to June-July 2018. Data were coded, entered and analyzed using SPSS version 22. Appropriate statistical tests were used accordingly and *P* value was considered as significant if it was less than 5%.

Results

The total patients participated in this study was 378. Table 1 shows the socio-demographic characteristics of the participants. The mean age was 45 years, males represents 51%, most of them were Saudi (95%), more than 90% were educated, more than 70% were married, mean duration of DM was 12 years, type-1DM constitutes about one third and 22% were having hypertension.

Table 2 depicts type of drugs that were used by the diabetic patients. Most of type-1 DM uses act rapid and long acting insulin (65%), while in type-2 DM, more than one-third (38%) used OHA, 8% were on insulin alone while the rest were using OHA and insulin. About 41% of patients on act rapid insulin were advised to change the dose compare to 25% of patients on mixed insulin and 19% on long acting insulin while less than 10% of patients on OHA were advised to change the dose.

Table 3 depicts the incidence of hypoglycemia, its symptoms and consequences among the participants. More than half of patients (52%) reported at least one attack of hypoglycemia during Ramadan, 29% out of them had more than four attacks.

More than one third of patients (39%) detected hypoglycemia by symptoms, while 48% had symptoms and confirmed

Table 1: Sociodemographic characteristics of participants under the study, Abha, KSA, 2018

Age (mean±SD)	**45.5 year±19**
Sex	*n*=378 (%)
Male	192 (51)
Female	186 (49)
Nationality	*n*=378)
Saudi	360 (95)
Non-Saudi	18 (5)
Educational status	*n*=378 (%)
Non Educated	36 (9)
Primary	32 (9)
Intermediate	48 (13)
Secondary	95 (25)
University	151 (40)
High Educated	16 (4)
Marital status	*n*=378 (%)
Married	272 (72)
Single	106 (28)
Duration of DM (mean±SD) year	12 Year±9 (%)
1-5	129 (34)
6-10	77 (20)
11-15	60 (16)
≥16	112 (30)
Type of DM	*n*=378 (%)
Type-1	130 (34)
Type-2	248 (66)
Associated Morbidities	*n*=139 (%)
Hypertension (HTN)	85 (22)
Ischemic Heart Diseases (IHD)	7 (2)
Chronic Kidney Diseases (CKD)	4 (1)
Bronchial Asthma (BA)	15 (4)
More than 1 morbidity	28 (7)

Table 2: Types of drugs used by the participant diabetics under the study before and during Ramadan, Abha, KSA, 2018

Type 1 DM	*n*=130
Act rapid insulin	13 (10%)
Mixed Insulin	32 (25%)
Act rapid insulin + Long Acting Insulin (Lantus)	85 (65%)
Type 2 DM	*n*=248 (%)
OHA only	57 (23)
OHA+Metformin	37 (15)
OHA+Metformin+ Long acting insulin (lantus)	40 (16)
OHA + Act rapid insulin	2 (1)
OHA + Mixed insulin	3 (1)
OHA + Long acting insulin (lantus)	5 (2)
Metformin + Act rapid insulin	9 (4)
Metformin + Mixed insulin	24 (10)
Metformin + Long acting insulin (lantus)	52 (21)
Act rapid insulin + Long acting insulin (lantus)	19 (8)
Advices by doctor to change dose during Ramadan	*n* (%)
Metformin	16/248 (6%)
OHA	6/248 (2%)
Act rapid insulin	46/112 (41%)
Mixed insulin	18/73 (25%)
Long acting insulin (lantus)	29/151 (19%)

Table 3: Rate of hypoglycemia and its associated symptoms during Ramadan among participants, Abha, KSA, 2018

Number Of Attacks	*n*=378 (%)
No	181 (48%)
Yes	197 (52%)
1 time	67 (34%)
2 times	46 (23%)
3 times	27 (14%)
≥4 times	57 (29%)
Perception of hypoglycemia	*n*=197 (%)
Symptoms	76 (39%)
Blood sugar testing	27 (14%)
Both	94 (48%)
Timing of occurrence	*n*=197 (%)
Morning	71 (36%)
Afternoon	61 (31%)
Night	33 (17%)
At more one occasions (morning/afternoon/evening)	32 (16%)
Symptoms	*n*=197 (%)
Headache	13 (7%)
Dizziness	17 (9%)
Blurring of vision	62 (31%)
Sweating	96 (49%)
Palpitation	94 (48%)
Hunger	6 (3%)
Fatigability	91 (46%)
Action taken to manage attack	*n*=197
Breaking fast and intake sweet drinks or dates	142 (72%)
Take sweet but did not break fasting as attacks were at night	55 (28%)
Breakfasting + sweet intake and attending PHC or Hospital	3 (1.5%)
Breakfasting during Ramadan	*n*=142 (%)
1 day	50 (35)
2 days	34 (24)
3 days	18 (13)
≥4 days	40 (28)
Admission to hospital	*n*=197 (%)
Yes	3 (1.5%)
No	194 (98.5%)

hypoglycemia by glucometer. About two third of attacks (67%) occurred in the morning and evening while less than one fourth have hypoglycemia at night (17%). The most common reported symptoms were: sweating (49%), palpitation (48%), fatigue (46%) and blurring of vision (31%). About (98%) of patients exposed to hypoglycemia broke their fasting while (2%) visited ER or PHC and 1% were admitted to hospital for further management. More than one-third broke their fasting for one day while more than one quarter broke their fasting for more than three days.

Table 4 showed self-care among diabetics during Ramadan. Most of diabetics were compliant with drugs (83%) while 23% were having good compliance with diet and 61% had poor compliance with physical activity, and more than one quarter (27%) did not check their blood glucose at all during Ramadan. Table 5 demonstrate the association between hypoglycemia and some patients variables. Hypoglycemia was significantly higher among younger, females, Saudis, intermediate and university educated, singles, type 1 DM, long duration of DM, and patient on insulin therapy. Those who were given advice before Ramadan reported more attacks of hypoglycemia during Ramadan compared to those who did not receive health education.

Discussion

This study aims to find out the incidence of hypoglycemia and its risk factors among diabetics fasting during Ramadan in Abha City, Aseer region, KSA.

This study included 378 participants, more than half of them (52%) experienced hypoglycemia. This figure is higher than reported from population based study that was carried out in 13 countries in middle east region in 2001 and revealed 9% among type-1 diabetes and 2% among type-2 diabetes.[8] Another study conducted in Pakistan and included 388 diabetics the incidence of hypoglycemia was 23.7% with more episodes among type-1 (35.3%) compared to type-2 (23.2%).[12] In another study conducted in 16 countries and included 1021 diabetic patients, hypoglycemia occurred among 8.5% of patients on Sitagliptin and 17.9% among patients on suphonylureas.[13] In Malaysia, Loke *et al.*, found that the rate of hypoglycemia during Ramadan was 20%.[14] Another study which included 3250 individuals from three continents reported different incidences of hypoglycemia (5.6% in Europe, 6.1% in middle east regions, 8.7% in Asia and 38% in north Africa).[15] The difference in the incidence of hypoglycemia in this study and those studies could be due to different in sample size, tools to measure hypoglycemia and definition of hypoglycemia in addition to period of fasting which differs from country to another. This study found that 39%

Table 4: Self Care among diabetics during Ramadan, Abha, KSA, 2018

Compliance with drug	*n*=378 (%)
always	312 (83%)
usually	53 (14%)
rarely	13 (3%)
Compliance with diet	*n*=378 (%)
always	86 (23%)
usually	155 (41%)
rarely	137 (36%)
Compliance with physical activity	*n*=378 (%)
always	53 (14%)
usually	93 (25%)
rarely	232 (61%)
blood sugar check	*n*=378 (%)
No	101 (27%)
1 time	7 (2%)
2 times	11 (3%)
≥3 times	259 (69%)
Change of dose during Ramadan	
Metformin	18/248 (7%)
OHA	5/248 (2%)
Insulin (All Types)	**13/378 (3%)**

of those developed hypoglycemia had classical symptoms while 48% whose had symptoms were confirmed by glucose self-check. These findings emphasize the importance of familiarity of DM patients with the classical symptoms and appropriate action such as glucose check and immediate breaking the fasting which was reported by all diabetics who had hypoglycemia during days of Ramadan. Most of patients with hypoglycemia developed the attacks either in the morning (36%) or after noon (31%), compared to (17%) had attacks at night, with a total of 468 attacks and mean of 2.4 attacks per patient. In one study from Pakistan, the authors found that 47% of patients who developed hypoglycemia during Ramadan discontinue fasting and 80% checked their blood glucose when developed hypoglycemia.[12] These hypoglycemic events led to breaking of fasting during Ramadan for many days among the victims (average 2.3 days per patient) with a range of 1-4 days), and a total of 332 days of breaking fasting by all affected participants. In EPIDIAR study, the average of fasting by type-1 DM was 23 days while 27 days among type-2 DM.[8]

Admission to hospitals was reported by three patients (1.5%) in this study which was lower than that reported elsewhere (9% among type-1 and 2%) among type-2 DM.[8]

The most frequent hypoglycemia symptoms reported by participants were palpitation, sweating, blurring of vision and headache. Similar findings were reported by Al Sifri *et al.*[7]

Association between hypoglycemia and patients and disease factors were explored in this study. Regarding age, it was found that the young patients had hypoglycemia as compared to older age (P = 0.000). This association could be due that younger patients are type-1 DM who were on insulin therapy compared to older patients who use oral anti-DM drugs.

Table 5: Association between hypoglycemic attacks and some variables, Abha, KSA, 2018

Variables	Had attacks	X^2	p
Age group (year)	n=197 (%)		
12-20	44/54 (81%)	58.93	0.000
21-40	72/99 (73%)		
≥40	81/225 (36%)		
Sex	n=197 (%)	6.17	
Male	88/192 (46%)		0.009
Female	109/186 (59%)		
Nationality	n=197 (%)	6.76	0.008
Saudi	193/360 (54%)		
Non Saudi	4/18 (22%)		
Education status	n=197 (%)		
Non educated	15/36 (42%)	13.94	0.016
Primary	10/32 (31%)		
Intermediate	28/48 (58%)		
Secondary	45/95 (47%)		
University	87/151 (58%)		
High educated	12/16 (75%)		
Marital status	n=197 (%)		
Married	114/272 (42%)	40.47	0.000
Single	83/106 (78%)		
Type of DM	n=197 (%)		
Type 1	107/130 (82%)	72.37	0.000
Type 2	90/248 (36%)		
Duration of DM (year)	n=197 (%)		
1-5	52/129 (40%)	13.92	0.003
6-10	39/77 (51%)		
11-15	39/60 (65%)		
≥16	67/112 (60%)		
Drugs			
Act rapid insulin (am)	18/19 (95%)	14	0.000
Act rapid insulin (pm)	96/112 (86%	71	0.000
Long acting insulin (am)	117/151 (77%)	64.8	0.000
Advice to change drug	n=197 (%)		
Yes	66/88 (75%)	24.069	0.000
No	131/290 (45%)		
Timing	n=197 (%)		
Morning	71 (36%)	378.00	0.000
Evening	61 (31%)		
Night	33 (17%)		
More than one occasion	32 (16%)		

Females reported significant hypoglycemia than males. This association is difficult to explained, however it could be due to that females were more aware about seriousness of hypoglycemia during Ramadan compared to male patients. Patient with intermediate/university education reported more hypoglycemia than other educational levels (P = 0.016), such findings could be explained by that those with high educational level were having good knowledge and awareness about this issue compared to the patients with low educational level. Single participants reported more hypoglycemia than married patient (78% VS 42%)(p =/000). This significant finding could be due to that single patients were younger, type- 1 DM on insulin therapy.

It was found that type-1 DM have more hypoglycemia (82%) compared with type-2 (36%), (2.3 folds) such association is

expected as all patients who were on insulin and have long duration of fasting at least for (15 hours) as reported in previous studies.[8,14]

Long duration of DM was associated with high rate of hypoglycemia especially those with DM for 10 years or more. This findings could be explained by that most of patients with long duration of DM are usually on insulin therapy which was found to have high predict of having hypoglycemia. Most of hypoglycemia attacks was reported by patients on insulin particularly those on long acting and rapid acting. These finding are in agreement with other studies.[5,8,13,14]

In this study, rate of hypoglycemia occurred during day period (67%), compared to (17%) at night. This findings confirm that the risk of hypoglycemia is more frequent with fasting compared to non-fasting period. However, the risk of hypoglycemia is still a common problem even at night despite of breaking fasting. These findings should be taken in consideration while adjusting drug dose at night.

Although most of DM patients in this study were not given instructions before Ramadan to modify their drugs, it was found that the hypoglycemia was more prevalent among those given instructions. Such odd findings could be due to that patients with high risk of developing hypoglycemia were instructed regarding self-management including reporting such events and to adjust their medications if any serious event took place. In one study conducted in Riyadh, it was found that the rate of hypoglycemia was high despite that 54% of patients were instructed on DM management during Ramadan.[10]

Most of diabetics were found to have good compliance with drugs (83%) compared to compliance with diet (23%) and physical activities (39%) and glucose self-monitoring (73%) during Ramadan. Mussa *et al.* reported that more than 50% of diabetic patients (58.5%) checked their blood glucose at least once a day but about 80% did not perform any physical activity during Ramadan.[10] A study conducted by Al-Musally *et al.* in Dammam showed that most of the diabetic participated in that study had self-monitoring during Ramadan with high percentage among those who had received health education before Ramadan.[9] In CREED study, it was found that most of patients either perform light (64%) or no physical activity during Ramadan at all (26%).[14] In this regard, diabetic should be instructed by health care providers to have regular glucose self-monitoring particularly those on insulin or have high risk to develop hyper or hypoglycemia or have poor control before Ramadan.

Despite adequate sample in this study, there are some limitations. The recall bias by participants is on the top "even we check such bias by asking about breaking fasting which is important event that is difficult to forget", and the study was conducted in one city of the region.

Conclusions

This study revealed that the incidence of hypoglycemia among diabetics in abha city was high. Many contributing factors were identified, such as young age, type-1 DM, long duration of DM, insulin use. More attacks occurred during day period and led to breaking the fasting by all affected patients. Most of patient were not given instructions regarding self-care immediately before or during Ramadan.

Recommendations

Based on the results of this study we suggest that all DM patients at PHCCs should be given adequate and comprehensive structured health education regarding self-management particularly for those with high risk to develop hypoglycemia (type-1 DM, on insulin therapy, long duration of DM, younger and elderly patients). Further studies are recommended to explore this important topic and impact of structured health education on incidence of hypoglycemia and hyperglycemia during Ramadan.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflict of interest

There is no conflict of interest.

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