Type 2 Diabetes and its characteristics during Ramadan in Dhahira region, Oman

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Abstract

Objective: The main objective of this study is to illustrate the various characteristics including care of patients and changes in lifestyle of type 2 diabetics during Ramadan in Dhahira region, Oman. ***Methods:*** This was a hospital-based study conducted during the month of Ramadan in 2006. Of the 453 recruited, 334 (73.7%) with complete data were analyzed. Student t test was used for comparison of means and Chi-square test for proportions. ***Results:*** We analyzed 334 patients with type 2 diabetes. The common complication associated with diabetes was coronary artery disease (19.5%) and nearly 60% of the study subjects had hypertension as co-morbidity. There was little or no change in the lifestyle activities and Insulin/Oral AntiDiabetic Drug (OAD) doses during Ramadan. Majority of diabetics had poorly controlled Fasting Blood Sugar (FBS) and Body Mass Index (BMI). The overall mean weight change was -0.49 ± 1.54 SD. There was a significant weight loss during Ramadan ($p<0.05$). ***Conclusion:*** The large proportions of uncontrolled type 2 diabetes patients in our region represent a challenge to our physicians during Ramadan. There is a need to improve diabetic management and intensive education before fasting. Clear guidelines for diabetic management including uncontrolled diabetics during Ramadan are essential in Oman.

Keywords: Ramadan, fasting, Diabetes mellitus, lifestyle changes, weight, Oman

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Introduction

Most religions around the world advocate a period of fasting or abstinence from certain foods. Majority of the Muslims around the world perform fasting from dawn to dusk during the holy lunar month of Ramadan to fulfill the religious obligation. Management of chronic serious illnesses is a challenge to the treating physician during Ramadan and diabetes is not an exception.

The prevalence of diabetes for all age-groups, worldwide, was estimated to be 2.8% (171 million) in 2000 and is expected to be 4.4% (366 million) in 2030.[1] The prevalence of diabetes in several countries with large Muslim populations appears to be similar to the rates observed in western countries and increasing by 10% per year as a result of urbanization and socioeconomic development.[2] Much of the diabetes burden will be in developing countries where resources are scarce. In Oman, the 1991 National Health Survey reported that the prevalence of diabetes (Fasting Blood Sugar (FBS) ≥ 6.1 mmol/L) in subject's ≥20 years was 8.3%, which increased to 11.6% in the year 2000.[3] A recent study has indicated that diabetes was associated with the classic risk factors rather than urbanization in Oman,[4] but later disproved by others and reported that the prevalence of diabetes (FBS ≥ 7 mmol/l) in the capital region of Muscat was 17.7% compared to 10.5% in rural areas.[5]

Although the sick are exempted from fasting, a significant number of patients carry out fasting during Ramadan against the advice of their doctors and the permission of religious authorities. A population-based study conducted in 13 countries reported that 42.8% of type 1 and 78.7% with type 2 diabetics fasted during Ramadan.[6] Physicians face the difficult task of advising diabetic patients whether it is safe to fast and in recommending dietary and drug regimens if they decide to fast. The lack of adequate literature on this subject makes it difficult to answer these questions.[7] The physiological effects of fasting include lowering of blood sugar, lowering of cholesterol and lowering of the systolic blood pressure which is an ideal advice for the treatment of mild to moderate, stable, type 2 diabetes, obesity and essential hypertension. Proper dietary control has shown to stabilize the fasting blood glucose levels,[7-9] and type 2 diabetes can be prevented by changes in lifestyle.[10] The current recommendations for the treatment of hyperlipidemia (one of the risk factor for diabetes) include restriction of dietary fat to less than 30% of calorie intake, saturated fat to less than 10%, and dietary cholesterol to less than 300 mg/day.[11, 12]

The first International Congress on Health and Ramadan, held in Casablanca, concluded that there is no major change in the baseline health during Ramadan, however, patients who are suffering from severe diseases, whether diabetes or coronary artery disease, kidney stones, etc., should not try to fast.[13] For these reasons, it is encouraged to fast in the month of Ramadan, but under medical supervision. To support this theory, most of the studies have reported that there is little or no change in the physiological and biochemical findings during Ramadan fasting in diabetics.[7-9, 14-16] However, blood lipid levels, energy intake and body weight have been shown to be reduced in normal,[17] as well as diabetes individuals.[9, 18-19]

The conclusion of an International Consensus Meeting held in Morocco in 1995 offers guidelines on diagnostic criteria for allowing

fasting, monitoring diabetes and health education before, during, and after Ramadan.[20] Comprehensive recommendations for the management of diabetes during Ramadan have been illustrated by Azizi F and others.[7, 21] It is unclear, to what extent these guidelines are being followed in Dhahira region, Oman, additionally, lifestyle changes, the frequency of complications and changes in treatment during Ramadan among diabetics remain largely unknown in Dhahira region, Oman. Our main objective was to present data on diabetic patients and their various characteristics during Ramadan in Dhahira region, Oman.

Methods

The 207,015 inhabitants of Al Dhahira region are being served by 2 major hospitals and 17 other primary health care institutions including Ibri Polyclinic (IPC). IPC caters the Ibri wilayat (district) which is one of the five wilayats with a population of 103,340 (census 2003). The diabetologists at IPC are involved in the care of patients with diabetes in Ibri wilayat.

This was a hospital-based follow-up study conducted at IPC during the Ramadan month of year 2006. All the consecutive registered diabetic patients attending diabetology clinic during early Ramadan, who gave oral consent to participate in the study, were included. The same patients were followed after Ramadan. A total of 453 patients were initially enrolled in the study. Of these, 343 (75.7%) completed the follow-up and data. Only 10 (2.9%) patients with type 1 diabetes completed the study, because of the very small number they were excluded from the later analysis. Thus, 334 (73.7%) patients with type 2 diabetes were available for analysis. The data was collected in a pretested Performa filled by the clinicians posted in Diabetic clinic out patient department at IPC. The methodology of the study was briefed to the clinicians. The details on socio-demographic data, disease, treatment, change in lifestyle and Body Mass Index (BMI) were noted. Weight and height were recoded to the nearest 0.5 kg and 0.5 cm respectively. BMI was calculated by using the formula weight (kg)/ height^2 (meters). Blood sugar was recorded by using calorimetric method and noted as mmol/L. The cut off points used to name as diabetes was, FBS $\geq$6 mmol/L. The data was fed into the excel spreadsheet and discrepancies were edited. The data was analyzed using Statistical Package for Social Sciences (SPSS-version 9.0). The results were expressed as mean $\pm$ Standard Deviation (SD). Frequencies and proportions were calculated. Student t test was used for comparison of means and Chi-square test for proportions. Confidence interval (95%) and a probability level of less than 0.05 were considered significant.

Results

A total of 453 patients were registered during the study period, complete data of 334 (73.7%) patients with type 2 diabetes were available for analysis.

Table 1 shows the frequency distribution of various characteristics of study subjects. Majority of the study subjects were females (56.3%). The mean age was 54.3 with a wide standard deviation (SD) of 11.7. The age ranged from 24 years to 95 years and the median age was 55 years. The mean height, weight and BMI were 156.0 $\pm$ 8.4 SD, 70.6 $\pm$ 16.1 SD and 29.0 $\pm$ 6.0 SD respectively. The mean duration of diabetes illness was 5.8 $\pm$ 5.1 SD. Majority of the patients were non-smokers (99.4%), manual workers (56.1%) and with no formal or primary education (53.0%). The overall frequency of diabetes complications and co-morbidities was somewhat high. The most frequently reported complications were coronary artery disease (19.5%), neuropathy (10.2%), retinopathy (9.3%), and nephropathy (6.0%). Approximately 60% of the study subjects had hypertension as co-morbidity.

Most of the type 2 diabetes patients in our study (93.1%) fasted 30 days during Ramadan. It was noticed that nearly 83% of the type 2 diabetes patients in our study had poorly controlled FBS levels (83.2%) and BMI (36.8%) with female predominance and aged less than 55 years. The poorly controlled FBS levels and BMI among gender and various age groups significantly varied (Table 2).

Table 3 depicts the various characteristics practiced by the type 2 diabetic patients. Largely reported that they had decreased (49.4%) or no change (45.2%) in the physical activity during Ramadan. Though there was no change in the food intake practice among 67.4% of patients, 50.9% stated decrease intake of sugar. Approximately 43% of the patients reported increase in fluid intake. Greater part of our patients lost weight (59%). Even though 27% of the patients gained weight, the overall mean weight change was -0.49 $\pm$ 1.54 SD. The mean weight change among patients who gained weight and who lost weight was more or less similar. Insulin/Oral Anti Diabetic Drug (OAD) doses were unchanged in 51.5% of diabetic patients during Ramadan.

Table 4 shows that the body weight and BMI both decreased during Ramadan in both genders significantly.

Before Ramadan 10.7% and as high as 42 % of the patients with type 2 diabetes experienced at least one episode of hypoglycemia and hyperglycemia respectively.

During Ramadan the number of hypoglycemic and hyperglycemic episodes decreased to 1.8% and 24% respectively. The mean number of episodes reduced significantly during Ramadan compared to early Ramadan.

There was no significant association between decreased reported

Table 1: Frequency distribution of various characteristics of the study subjects, Dhahira region, Oman. (N= 334)

Category		Type 2 diabetes
Sex	Men	146 (43.7)
	Women	188 (56.3)
Age in years		54.3 ± 11.7
Duration of diabetes (years)		5.8 ± 5.1
Age at diagnosis		48.5 ± 11.8
Height (cm)		156.0 ± 8.4
Weight (kg)		70.6 ± 16.1
BMI (kg/m^2)		29.0 ± 6.0
Smoking	Current smokers	2 (0.6)
	Nonsmokers	332 (99.4)
Education level	No formal or primary education	274 (82.0)
	Secondary education	41 (12.3)
	Higher education or university level	19 (5.7)
Occupation	Manual worker	311 (56.1)
	Office employee	23 (43.9)
Daily physical activity	Sedentary light activity	269 (53.0)
	Moderate activity	64 (46.7)
	Heavy Vigorous activity	1 (0.3)
Diabetes complication	Neuropathy	34 (10.2)
	Retinopathy	31 (9.3)
	Nephropathy	20 (6.0)
	Coronary artery disease	65 (19.5)
	Peripheral arterial disease	3 (0.9)
	Cerebrovascular disease	1 (0.3)
	Amputation of limb	2 (0.6)
Co-morbidity	Hypertension	198 (59.3)

Data are means ± SD or Number (%), unless otherwise stated; SD = standard deviation.

Table 2: FBS and BMI target values [3] compared with the observed values among type 2 diabetes patients, Dhahira region, Oman. (N= 334)

Category		Good	Borderline	Poor	Total
Fasting Blood Sugar (FBS)	Target (mmol/L)	4.4-6.1	6.2-7.0	>7	-
	Observed FBS (overall) Mean-10.4 ± 3.7	27 (8.1)	29 (8.7)	278 (83.2.)	334
	Gender *				
	Male	17 (11.6)	14 (9.6)	115 (78.8)	146
	Female	10 (5.3)	15 (8.0)	163 (86.7)	188
	Age group†				
	< 45	14 (20.0)	21 (30.0)	35 (50.0)	70
	45-55	18 (21.2)	32 (37.6)	35 (41.2)	85
	55-65	31 (27.0)	49 (42.6)	35 (30.4)	115
	≥ 65	24 (37.5)	22 (34.4)	18 (28.1)	64
Body Mass Index (BMI)	Target (kg/m^2)	18.0-24.9	25.0-29.9	≥ 30	
	Observed BMI (overall) Mean-28.8 ± 6.0	87 (26.1)	124 (37.1)	123 (36.8)	334
	Gender **				
	Male	45 (30.8)	59 (40.4)	42 (28.8)	146
	Female	42 (22.3)	65 (34.6)	81 (43.1)	188
	Age group††				
	< 45	5 (7.1)	5 (7.1)	60 (85.7)	70
	45-55	3 (3.5)	4 (4.7)	78 (91.8)	85
	55-65	11 (9.6)	14 (12.2)	90 (78.3)	115
	≥ 65	8 (12.5)	6 (9.4)	50 (78.1)	64

Data are means ± SD or Number (%), unless otherwise stated; SD = standard deviation.
*Gender - * $X^2 = 3.7$, p value = 0.05; ** $X^2 = 7.24$, p value = 0.007*
Age group - † $X^2 = 10.02$, p value = 0.01, df = 3; †† $X^2 = 7.9$, p value = 0.04, df = 3

Table 3: Frequency distribution of changes in various practices during Ramadan among study subjects, Dhahira region, Oman. (N= 334)

Category		Type 2 diabetes
Physical activity	Increased	18 (5.4)
	Decreased	165 (49.4)
	No change	151 (45.2)
Sleeping duration	Increased	131 (39.2)
	Decreased	44 (13.2)
	No change	159 (47.6)
Food intake	Increased	54 (16.2)
	Decreased	55 (16.5)
	No change	225 (67.4)
Fluid intake	Increased	143 (42.8)
	Decreased	51 (15.3)
	No change	140 (41.9)
Sugar intake	Increased	67 (20.1)
	Decreased	170 (50.9)
	No change	97 (29.0)
Weight	Gained weight	90 (27.0)
	Lost weight	197 (59.0)
	No change	47 (14.0)
Weight change (kg)	Overall	-0.49 ± 1.54 CI
	Patients who reported weight gain	+1.26 ± 0.91 CI
	Patients who reported weight loss	-1.30 ± 1.02 CI
Insulin/OAD dose	Increased	11 (3.3)
	Decreased	151 (45.2)
	Maintained	172 (51.5)
	Stopped	0

Data are means ± SD or Number (%), unless otherwise stated.

Table 4: Changes in body weight and BMI of type 2 diabetics according to gender, Dhahira region, Oman. (N= 334)

Body weight	Gender	Before Ramadan	After Ramadan	Mean Difference	SE of Mean difference (C1)	t value (p value)
Weight (kgs)	Male	74.4 ± 16.9	74.0 ± 16.9	0.4 ± 1.4	0.12 (0.2 – 0.7)	3.5 (0.01)
	Female	67.6 ± 14.7	67.1 ± 14.6	0.4 ± 1.4	0.10 (0.2 – 0.6)	4.0 (< 0.05)
	Total	70.6 ± 16.0	70.1 ± 16.0	0.4 ± 1.4	- (0.3 – 0.6)	5.3 (< 0.05)
BMI (kgs/mts^2)	Male	27.9 ± 5.5	27.7 ± 5.6	0.1 ± 0.5	- (- – 0.2)	3.2 (0.01)
	Female	29.7 ± 6.1	29.5 ± 6.0	0.2 ± 0.6	- (- – 0.2)	4.0 (< 0.05)
	Total	28.9 ± 5.9	28.7 ± 5.9	0.2 ± 0.6	- (0.1 – 0.2)	5.2 (< 0.05)

Data are means ± SD, unless otherwise stated.

Table 5: Number of hypo and hyperglycemic episodes per month of type 2 diabetics, Dhahira region, Oman. (N= 334)

	Before Ramadan (means ± SD)	After Ramadan (means ± SD)	X^2 value (p value)
Hypoglycemic episodes experienced	0.14 ± 0.51	0.01 ± 0.16	4.30 (<0.05)
Hyperglycemic episodes experienced	0.62 ± 1.10	0.25 ± 0.48	5.49 (<0.05)

hypoglycemic episodes (at least one) and change in the lifestyle, such as physical activity, sleep, food, fluid and sugar intake, table 5. Change in the insulin/OAD dose was not significantly associated with reported hypoglycemic episodes. On the other hand, a reported hyperglycemic episode (at least one) was significantly decreased in relation with the change in insulin/OAD dose ($p < 0.001$) and food ($p=0.03$) during Ramadan (Pearson Chi-square test).

Discussion

Diabetes is a cause for growing public health concern in Oman. Type 2, the most common form of diabetes has shown increasing trend in Oman.[3, 22] The vast majority of the studies around the world indicate that fasting in Ramadan is safe for the majority of diabetic patients with proper education and diabetic management. Almost all (99.1%) who visited the diabetic clinic during the study opted to fast during Ramadan on our study. This proportion was high when compared to other studies.[6] The probable reason could be good health seeking behavior of Omani diabetics before fasting and/or due to the limitations of hospital-based study protocol. The proportion of diabetes complications were less and hypertension as co-morbidity was more compared to studies conducted in Oman and elsewhere.[5, 6, 23] Hypertension is one of the risk factor

for diabetes,[5] and hypertension was co-existed in roughly 60% of the patients in our study. Obesity was associated with 36.8% of diabetics in our study. A study indicated that almost one-fifth of the adult Omani population were obese and the rates are of increasing trend.[24, 25] The high proportion of cardiac disease complications among diabetics can be explained by the poorly maintained FBS, BMI and hypertension as co-morbidity in our study.

Similar to EPIDIAR study, the duration of diabetes was shorter when compared to other European countries (mean duration of diabetes of 9.3 years was reported).[26]

Like other studies, most of diabetic patients did not change their lifestyle during Ramadan. However, when patients did change their lifestyle, the tendency was to decrease physical activity, food, sugar and in contrast increased sleep duration and fluid intake in our study. In contrast to other studies nearly half of diabetics changed their insulin/OAD doses during Ramadan.[6]

Despite poorly controlled diabetes, 93.1% fasted 30 days in our study. Many studies have shown that there is no or little change in the biochemical and physiological changes among diabetics during Ramadan,[7-9, 13-15] but, none of the studies have stated that whether it is safe to fast with uncontrolled diabetes and at what biochemical and physiological levels. Though, it has been recommended that poorly controlled type 2 diabetics should avoid fasting,[7] further research is needed in this area.

Biochemical, physiological, anthropometric and hematological changes among diabetics and in healthy individuals during Ramadan although significant, they do not reach pathological proportions. These results are at variance.[14, 15, 17, 27-31] Some studies have suggested no fasting for type 2 diabetics, if the patient wants to fast; a change in the medical therapy has been recommended, Repaglinide has shown better glycaemic control and low frequency of hypoglycemia than patients using glibenclamide during Ramadan.[28, 32]

The weight changes among diabetics in Ramadan are controversial. Similar to other studies,[6, 10, 27] there was a net decrease in weight in our study, but no change or increase body weight has also been observed.[14, 15, 16] This was true for normal subjects also during Ramadan,[33] and in contrast no change,[28, 30] as well as net weight gain has been observed in some.[34]

The overall incidence of hyperglycemic episodes was higher than the hypoglycemic in our study and higher proportions when compared to the EPIDIAR study.[6] This should be interpreted with caution because the episodes were recorded as per the patients experience of particular symptoms of hyper or hypoglycemia. However, higher hyperglycemic episodes coincide with the large number of uncontrolled diabetics in our study.

Majority of the type 2 diabetes patients can fast safely during Ramadan with adjustment in Drug regimen, Diet control and Daily activity (Ramadan 3D Triangle).[7] These changes are considered necessary because Ramadan directly influences the control of diabetes and maintaining good metabolic control in this situation requires great ingenuity.[35] Several recommendations for the management of diabetes during Ramadan have been illustrated by many but, universal authentic guidelines are lacking.[7, 21, 36] However, the large proportion of poorly controlled type 2 diabetic patients who fasted during Ramadan is a cause of concern in Dhahira region, Oman. It necessitates the need for universal guidelines including biochemical, physiological and anthropometric for diabetics especially for those poorly controlled who insist on fasting during Ramadan in Dhahira region, Oman. The quality of care also ought to be improved towards diabetic patients as it has been observed that overall interaction of doctors and nurses with type 2 diabetes patients was not optimal in Oman,[37] and only 62% of the type 2 diabetics received recommendations from their health care providers about fasting.[6]

Limitations

Since it was a hospital-based study the results cannot be generalized to general population. A community based study would give a broad picture of practices of diabetics in Ramadan in Oman. The various characteristics recorded in our study were subjective for example lifestyle changes, diet and hypo/hyperglycemic episodes were from patients' statements, which may not be completely dependable.

Conclusion

The study provides reasonable information on the lifestyle practices of type 2 diabetics in Dhahira region, Oman. The large proportions of poorly controlled type 2 diabetes patients represent a cause of concern. There is a need to improve the diabetic management and intensive education before fasting in the region. Clear guidelines for diabetic management including uncontrolled diabetics during Ramadan are essential in Oman. Further research on long term effects of fasting are considered necessary.

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