Effects of Fasting Ramadan on Glycemic Control and Lipid Profile in Patients with Type 2 Diabetes

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Abstract

This study was designed to investigate the effects of fasting the month of Ramadan on the blood glucose levels, glycosylated hemoglobin (HbAlc), and lipid profile among diabetic patients.

Patients and Methods: An observational Longitudinal study was conducted on diabetic patients inout patients department in the National Diabetic & Endocrine Center located in Tripoli Libya from May 2017 to July 2017 (i.e. Ramadan 1437).   During this time, Ramdan fasts were approximately 16 hours per day. Data on socio-demographic characteristics (age, sex, educational level, and occupation), blood pressure, and anthropometric measurements were collected. The data was obtained using a face-to-face interview, the measurement were using a structured questionnaire, and, blood samples were collected for testing glucose, glycosylated hemoglobin (HbA1c), Lipid profile, urea, and Creatinine (using the Integra 400 Pulse). Result: This study included 46 type 2 diabetic participants (27 men and 19 women). The mean participant age was 53.10 ± 13.33 years. The mean body mass index (BMI) of the participants was 32.49 ± 6.19 kg/m^2. 26 participants were treated with insulin. The mean number of days fasted was 28.80 ± 2.45 days. Among both male and female participants, the average levels of blood glucose, HbA1c, total cholesterol, low density and high density lipoprotein cholesterol, triglycerides, systolic and diastolic blood pressures were all significantly lower during Ramadan as compared with before Ramadan ($p < 0.05$).

Conclusion: The results revealed that fasting the month of Ramadan has a significant impact on the decrease in blood sugar, HbAlc level, lipid profile, BMI, and blood pressure among diabetic participants. Fasting Ramadan may prove to be beneficial to the health of type 2 diabetic patients.

KEY WORDS: Blood glucose, Diabetes mellitus, HbAlc, Ramadan fasting

Introduction

Ramadan is the ninth month of theIslamic Lunar Hijri Calendar[1]. It is estimated that 50 million people suffering from diabetes fast in this holy month each year. It is obligatory on all healthy Muslim adults to fast the month of Ramadan [2]. The fast starts from early dawn (Suhor) and ends at sunset (Iftar). During this period one must abstain from eating or drinking, but also from taking oral medications, smoking, as well as taking intravenous fluids and nutrients. The length of the fast varies from as little as 11 hours to as many as 20 hours, depending on the season and the geographical location. Those who are ill, especially those who can be adversely affected by fasting, are exempt from fasting.

Diabetic patients are more prone to hyperglycemia, hypoglycemia, dehydration, and thrombosis, as proven in a large, multi-centered, retrospective study: the EPIDIAR study. The EPIDIAR study found that fasting increased the frequency of severe hypoglycemic events by up to 7.5-folds. It also found that the frequency of severe hyperglycemic events increased up to 5 folds in patients with diabetes [3]. There is also evidence that the biochemical variables of diabetics are affected by fasting [4]. Many studies revealed that fasting during Ramadan has a significantassication with decrease in blood lipid profile, blood pressures, blood glucose, and HbA1C levels among diabetic patients [5, 6]. The objective of this study was to investigate the effects of Ramadan fasting

on the blood glucose levels, glycosylated hemoglobin (HbA1c), and lipid profile among diabetic patients observing fast during the month of Ramadan in Tripoli Libya.

Patients and methods

This is an observation study (longitudinal) that included 46 participants (27 males and 19 females), with mean age 52.10 ±13.33 years. These participantswere recruited from the diabetic out patients' clinic ofthe NationalDiabetic & Endocrine Center in Tripoli Libya. The study began 3 weeks before Ramadan and ended 3 weeks after Ramadan (May to July, 2017). Verbal consent was obtained from the participants prior to their participation in the study, and ethical approval was obtained from a labartory of private clinic before commencing data collection. The investigators were recruited to administer the questionnaires, perform anthropometric measurements, and conduct face-to-face interview in order to fill the questionnaires. These questionnaires were composed of socio-demographic data such as age, sex, address, education level, and occupation.

a. Anthropometric data such as height was measured by using height scale (SECA, Germany) while the patient is standing bare foot and with a normal straight posture. Weight was measured in kilograms using weight scale (SECA, Germany). BMI was calculated as the ration of weight (kg) to the square of height (m).

b. Blood pressure was measured using a standard zero mercury sphygmomano-meter on thepatients left arm, while in the sitting position. Following 5-10 minutes of rest, two reading were taken, and the average of the two reading was obtained.   Hypertension was defined according to the WHO guidelines, which is systolic blood pressure of at least 140mm Hg, and diastolic blood pressure 85 mmgh , or using antihypertensive medication[7].

c. Laboratory investigations before and after Ramadan were conducted for blood glucose and glycated hemoglobin (HbAlc) levels in order to control the diabetes status of the patients. The control target of HbA1c was <7%[8]. Low density and high-density lipoprotein (HDL and LDL) cholesterol levels, triglyceride, urea,

and creatnine were measured using a (Roche integra 400 Pulse machine).

Statistical Analysis: This was done by using the software SPSS version 21. A paired T test was used to compare between the two sets of data before and after Ramadan . A p-value < 0.05 was considered

Results

Regarding the sociodemographic characteristics of the 46 participants; 27 (58.7%) were men. The Mean age of the participants was 50.16±1.33 years. The Mmean duration of diabetes was 9.15 ± 7.57 years. The Mean number of days fasted was 28.80±2.45 days, with about 84.8% of patients completing all 29 days of fasting. about the main reason for breaking the fast was hypoglycemia (8.7%), followed by hyperglycemia (6.5%). 26 of the participants were on an insulin treatment. Among comorbidity, 24 of the participants were found to have no chronic illnesses associated with diabetes. Table (1), and Table (2) shows the comparison of mean biochemical characteristics and blood pressures among the participants before and after Ramadan. On average, blood glucose, HbA1c, total cholesterol, triglycerides, HDL-c, LDL-c, urea, creatnine, and systolic and diastolic

to indicate a statistically significant difference.

Ethical approval: Ethical approval and clearance from theNational Diabetic and Endocerinecenterand laboratory of private clinic was obtained to conduct the study

blood pressure were all significantly lower after the month of Ramadan as compared with before Ramadan (P< 0.05). Table (3) shows, the comparison of chemical characteristics and blood pressure among male and female participants before and after the month of Ramadan. Among both male and female participants, the mean± SD blood glucose levels were different before and after fasting the month of Ramadan (188.8 ± 96.83mg vs. 168.48 ± 65.50 mg; p = 0.0280) and (163.21 ± 67.34mg vs. 158.9 ±68.64mg ; p =0.032). In terms of statistics, this is significantly variant. In addition, mean ±SD Hb A1c levels were significantly lower among both male and female participants after Ramadan as compared with before Ramadan (8.81±1.92 % vs 8.12 ± 1.72%; p = 0.001) and (7.61 ± 1.60% vs. 7.54 ±1.49%; p =0.001) respectively. Both total cholesterol and triglycerides were also significantly reduced among both men and women before and after fasting Ramadan.

Men: (169.42 ± 48.32mg/dl vs. 164.24 ± 37.44mg/dl; p = 0.001) and (153.2 ± 57.21mg/dl vs. 148.68 ±54.70mg/dl; p =0.005). **Women**: (165.14±34.52 mg/dlvs. 5.159.11 ± 24.65mg/dl; p = 0.005) and (143.14 ± 65.14mg/dl vs. 137.62 ± 62.55mg/dl; p =0.001). In addition, LDL levels were significantly reduced among both men and women before and after fasting Ramadan (99.63 ± 33.30mg/dl vs. 94.15 ± 25.96mg/dl; p = 0.001), and (97.61 ± 24.78mg/dl vs. 91.48 ± 20.55mg/dl; p =0.003). However, HDL cholesterol concentration levels were significantly increased among both genders before and after fasting the month of Ramadan (37.52 ± 8.38 mg/dl vs. 36.89 ± 7.13mg/dl; p = 0.001) and (39.40 ± 8.45mg/dl vs. 42.2 ±

10.85mg/dl; p =0.001). The anthropometric characteristics of body weight and body mass index were significantly reduced among both men and women before and after fasting the month of Ramadan (84.68 ± 20.1mg/dl vs. 82.52 ± 20.42kg; p = 0.001) and (81.77 ± 16.31kg vs. 79.35 ±14.01kg; p=0.001, 31.08 ± 5.60 %vs. 29.99 ± 5.63%; p =0.001, 33.49 ± 6.48% vs. 32.48 ±5.88%; p =0.001) respectively. Figure (1.2) shows the comparison of Average HbA1c level before and after the month of Ramadan fasting across to the treatment of participantsfigures(1.2). There was a significant decrease in HbA1c levels after fasting Ramadan in the participant using OHD rather than using insulin.

Table (1) Distribution of demographic and clinic characteristic of the participants (Tripoli 2017)(N=46).

Character	Number	percentage
Age (mean ± SD) (years) 52.10±13.33		
≤ 30 years	2	(4.3%)
31-45 years	15	(32.6%)
46-60 years	16	(34.8%)
≥ 61 years	13	(28.3%)
Gender		
Males	19	(41.3%)
Females	27	(58.7%)
Occupation		
House wife	17	(37%)
Employee	25	(54.3%)
Free employee	3	(6.5%)
Student	1	(2.2%)
Education level		
Illiterate	9	(19.6%)
Primary	4	(8.7%)
Secondary	6	(13.0%)
Inter mediate	15	(32.6%)
University	12	(26.1%)
Address		
Inside Tripoli	38	(82.6%)
Outside Tripoli	8	(17.4%)
Duration of Diabetes mellitus		
< 1 years	2	(4.3%)
1-5 years	17	(37%)
6-10 years	11	(23.9%)
> 11 years	16	(34.8%)
Treatment of Diabetes mellitus		
Insulin	26	(56.5%)
Oral ant,diabetic	20	(43.5%)
Past medical history		
No any other disease	24	(52.2%)
Hypertension	15	(32.6%)
Ischemic heart disease &hypertension	4	(8.7%)
Bronchial Asthma	3	(6.5%)
Causes of fasting		
Fasting mean ± SD days 28.80±2.45 days		
Complete fasting	39	(84.8%)
Hypoglycemia	4	(8.7%)

Hyperglycemia	3	(6.5%)

Table (2) Comparison of mean anthropometric, Biochemical characteristics and blood pressure among paretic paints before and after Ramadan(Tripoli 2017).

Blood Invgestigation	Before Ramadan (mean ± SD)	After Ramadan (mean ± SD)	Chang (paired± value) (95% cl)	P value
Blood glucose	176.9±67.33	160.71±67.38	11.32(-6.61 to 39.1)	0.017
HbAlc	8.58±1.79	7.56±1.50	0.200 (0.61 to- 1.42)	0.001
Weight	82.97±17.77	80.66±16.83	0.54(1.21 to 3.41)	0.001
BMI	32.49±6.19	31.45±5.85	0.22 (0.59 to 1.49)	0.001
Cholesterol	166.78±40.33	161.30±30.31	4.34 (-3.27 to 14.23)	0.001
LDL-C	98.45±28.27	92.58±22.70	3.78 (-1.75 to 13.49)	0.001
HDL-C	38.63±8.38	40.04±9.77	1.03 (-3.48 to 0.66)	0.001
Triglycerides	147.30±61.53	142.19±59.05	7.41 (-9.82 to 20.03)	0.001
Urea	25.8±7.95	24.4±8.61	1.16 (-0.99 to 3.69)	0.001
Creatinine	0.47±.15	0.46±.16	.02(-.052 to .067)	0.78
Systolic BP	131.63±15.42	126.39±17.14	2.017 (1.17 to 9.30)	0.001
Diastolic Bp	81.73±9.08	79.47±6.27	1.40 (-0.56 to 0.088)	0.06

Table (3) : Comparison of anthropometric, Biochemical, blood pressure, among participants before and after Ramadan in both gender (Tripoli 2017).

Blood Invgestigation	Before Ramadan (mean ± SD)	After Ramadan (mean ± SD)	Chang (paired± value) (95% cl)	P value
Blood glucose				
Males	188.8±69.83	163.2±67.34	19.12(-14.5 to 65.88)	0.028
Females	168.45±65.50	158.9 ±69.64	13.98(-19.22 to 38.26)	0.032
HbAlc				
Males	8.81±1.92	7.61±1.60	0.38(-.40 to 2.008)1	0.001
Females	8.12± 1.72	7.54 ±1.49	0.21(0.44 to1.32)	0.001
WT				
Males	84.68±20	82.52±2.045	0.65(0.77 to 3.54)	0.001
Females	81.77±16.31	79.35 ±14.01	0.81(0.74 to 4.10)	0.001
BMI				
Males	31.08±5.60	29.99±5.63	0.30 (0.44 to 1.73)	0.001
Females	33.49±6.48	32.48 ±5.88	0.32 (0.35 to 1.66)	0.004
Cholesterol				
Males	169.42±48.32	16.24±37.44	6.71(-9.43 to 18.74)	0001
Females	165.14±34.52	159.11 ±24.65	5.80(-5.89 to 17.96)	0.005
LDL-c				
Males	99.63±33.30	94.15±25.96	4.71(-4.40 to 15.35)	0.001
Females	97.62±24.78	91.45±20.55	5.61 (-5.38 to 17.68)	0.028
HDl-c				
Males	37.52±8.38	36.89±7.13	1.62(-2.78 to 04.05)	0.001

|				
Females	**39.40±8.45**	**42.2±10.85**	**1.28(-5.48 to – 0.21)**	**0.001**
Triglyceride				
Males	**153.2±57.21**	**148.68±54.70**	**11.30(-19.22 to 28.77)**	**0.005**
Females	**143.14±65.14**	**137.62 ±62.55**	**9.98(-15.01 to 26.04)**	**0.001**
Urea				
Males	**24.68±7.85**	**26.16±7.80**	**1.30(-4.26 to 1.42)**	**0.001**
Females	**26.62±8.08**	**23.33±9.11**	**1.66(-0.11 to 6.70)**	**0.005**
Creatinine				
Males	**0.52±0.17**	**0.50±0.08**	**0.75(-.21 to 0.26)**	**0.52**
Females	**0.46±0.15**	**0.46±0.11**	**0.03(-0.06 to0.07)**	**0.01**
Systolic BP				
Males	**130.26±13.17**	**120.94±8.12**	**2.85(-3.32 to 15.30)**	**0.092**
Females	**132.59±17.05**	**130.22±20.63**	**2.69(-3.17 to 7.91)**	**0.038**
Diastolic Bp				
Males	**81.54±6.88**	**78.15±5.05**	**1.43 (0.40 to 6.43)**	**0.28**
Females	**81.40±10.46**	**80.85±6.95**	**2.17(-3.03 to 5.92)**	**0.51**
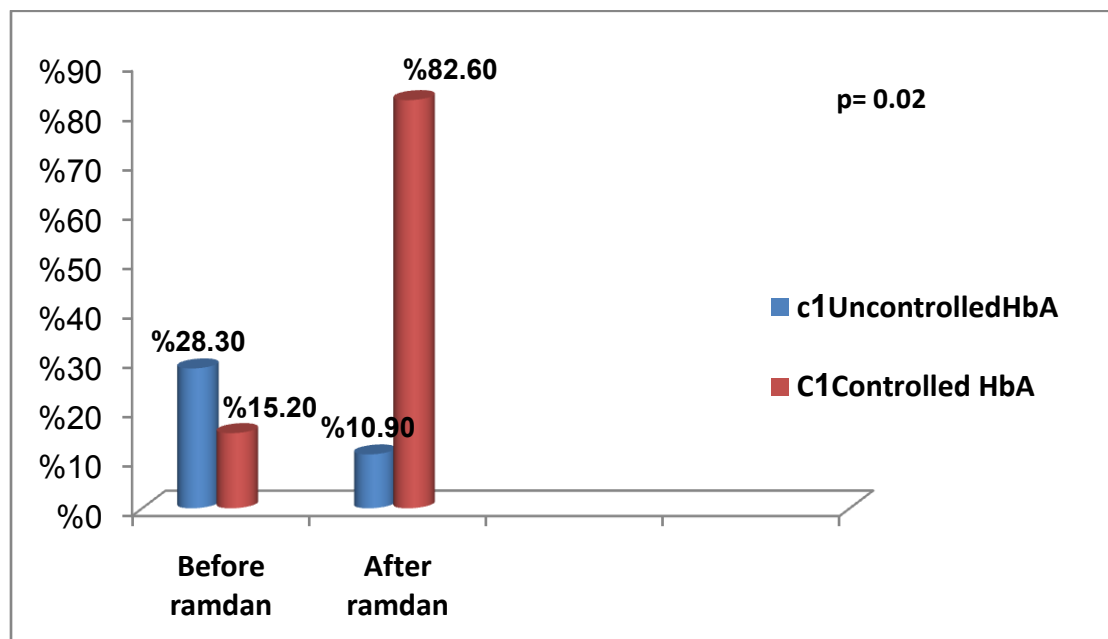
Figure (1). Comparison of glycemic status control across oral antidiabetic treatment participants before and after month Ramadan fasting(Tripoli 2017)
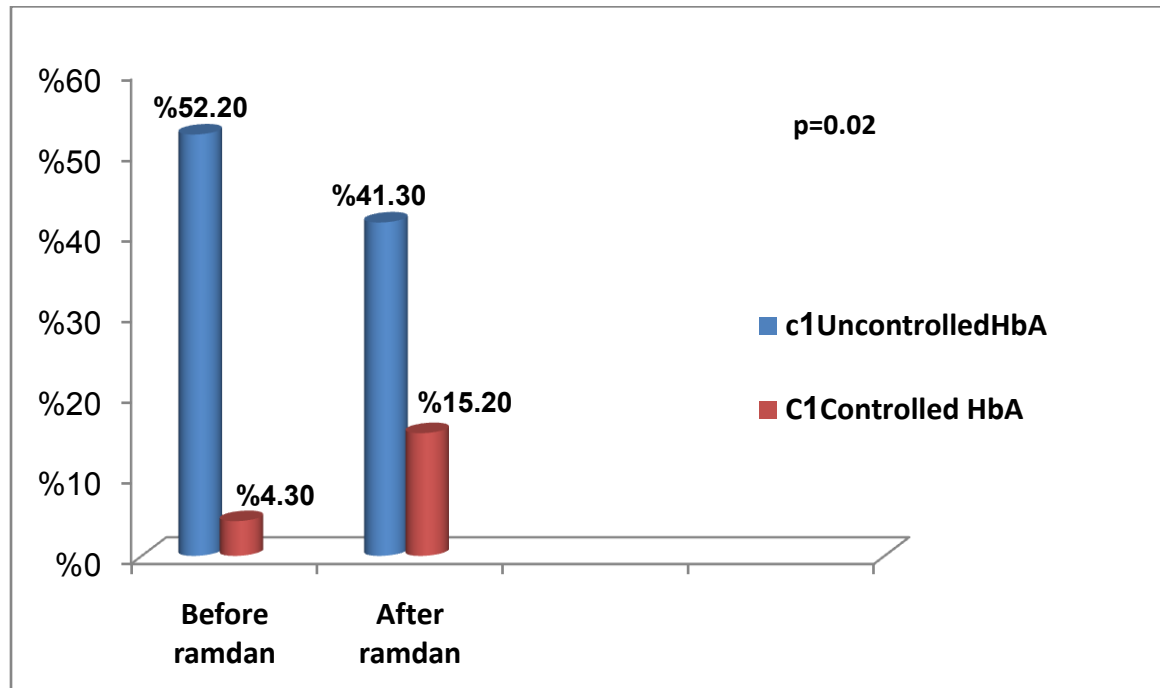
Figure (2). Comparison of glycemic status control across to insulin treatment participants before and after month Ramadan fasting(Tripoli 2017).

Discussion

Over one billion Muslims world widefastduring the month of Ramadan.where they neither eat nor drink from suhoruntil iftar. Fasting during Ramadan is a major change in lifestyle for the period of alunarmonth , and it could affect the glycemic control, and biochemical parameters among diabetic patients. The present study shows that the Ramadan fasting had a positive effect on FBG and HbA1c levels, this being more consistent in participants using oral antidiabetic than

those using insulin .The changes in the dose , time, and frequency of takingoral antdiabetic and insulin treatment may also contribute to affect in glycemic control (control or uncontrol) with diet education , For example, previous study[15] presented deterioration in glycemic control in patients using oral antdiabetic,which might be related to chaning the time and frequency of treatment along with uncontrolled food intake during Ramdan.The results revealed significant reduction in blood sugar, that was confirmed by HbAlc, and showed significant improvement, also reported in

previous studies [9-14]. Although other studies [15] revealed poor glycemic control, and some showed no changes[16], in our study, one of the contributing factors that had positive effects on glucose level may be receiving good advice regarding diet, exercise and medication by doctors during fasting. Another contributing factor is fasting days in Ramadan which could reach up to 16 hours. In fact, fasting in healthy subjects may contribute to an increase in insulin action, which leads to increased glucose uptake by tissues [17] and may reduce the incidence of diabetes [18]. In previous studies, the number of fasting hours per day varies, as it is affected by the season and the geographic distribution of the country. The Type of medication, and diet consumed could result in differences between the results of different studies regarding blood glucose and other biochemical parameters.[19] Moreover, in the present study, Ramadan fasting resulted in significant reduction in LDL cholesterol and

TG level, and an increase in HDL level. While , previous studies produced mixed results [9, 10, 15]. This may be related to the factors as previously discussed. The favorable changes in cholesterol profile observed may be related to the reduction of body weight and BMI in the present study. A previous study reported no reduction [9, 15] no changes [20], or even an increase in body weight. The weight loss induced by Ramadan fasting in diabetic patients was associated with reduced energy intake and meal frequency [21]Moreover most of diabetic patients reduce their physical activity due to the fear of hypoglycemia duringRamdan . Reduced physical activity not only inhibitsWeight loss as an effect ofRamdan fasting , but also leads to weight gain[22]. This study shows that the participants were normotensive but became significantly reduced during fasting, which consistent with one study[10],while other studies showed no changes. [9, 15].

Conclusion

The study showed that Ramadan fasting had a positive effect on diabetic control (glycemic control, and weight, BMI, blood Lipid profile, blood pressure) among men, and women with type II diabetes. All

diabetic patients who decide to fast , should be evaluated by their physicans 2-3 month before Ramadan to determine if they can fast safely during the month of Ramadan , andwhether it coulde even be beneficial for their health.

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