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Impact of Ramadan Fasting on Metabolic Syndrome Criteria: Among Treated Hypertensive and Diabetic Females of Halabja

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ABSTRACT

The influence of Ramadan fasting (RF) on patients with "Metabolic Syndrome" (MetS) remains debatable. Meanwhile, the majority of evidences demonstrated a beneficial effect on nearly most of the metabolic criteria that are reducing the risk of MetS. Hypoglycemia is a significant consequence of diabetes that has already been associated to an increased cardiovascular risk, and hypertension. However, there have also been reports of mixed results. Therefore, the objective of this observational study was to detect the impact of "Ramadan Fasting" on Metabolic criteria among treated hypertensive and diabetic patients. A total of 73 female MetS patients aged 20 to 45 years old took part in this prospective study, were evaluated a week before Ramadan fasting and, after Ramadan month having hypertension and diabetics of more than 2 years. All attended Halabja Hospital and were treated with one daily medication based on the doctor's prescription. To estimate the sample size, the sample random technique was employed, and the computed sample size was used. The eligibility criteria for female patients having diabetes and hypertension were based on the International Diabetic Federation (IDF) definition criteria. Fasting blood samples were taken, blood pressure was assessed, and BMI was computed, as well as fasting blood sugar and lipid profiles of all collected blood samples. There was a substantial weight loss, and WC decreased. This result has been reflected on BMI as well ($p < 0.0001$). During the month of fasting, both the systolic and diastolic blood pressures changed significantly. Overall, Ramadan fasting was found to decrease fasting glucose levels. Fasting Ramadan was found to have a significant drop in TC and TG levels in terms of lipid profile modifications. The levels of LDL-C in the blood did not differ significantly, after Ramadan compared to baseline. However, we did notice a decrease in serum HDL-C levels, which was not accompanied by any significant alterations. Ramadan has a synergistic effect. In people with a history of hypertension and hyperglycemia, fasting combined with conventional medical treatment results in significant improvements in weight, BMI, waist circumference, lipid profile, systolic and diastolic blood pressure, are all heart disease risk indicators.

1. INTRODUCTION

Diabetic and hypertension are the two most important criteria of the Metabolic Syndrome (MetS), and resolute hazards calculate for Cardio Vascular Disease (CVD). Study shows that complications from diabetic patients develop vastly greater if blood pressure (BP) was high [1]. However, in exception to the role of BP, a study indicates that hyperglycemia in patients with irregular fasting, glucose is considered a crucial marker in estimating the risk of mortality [2]. Other shows, in diabetic patients the risk of developing CVD are multiplied [3] and the predominance of hypertension in diabetic individual is high [4]. Around, 80% of people with diabetes will die from hypertension [5].

Globally, the incidence of adults with hypertension is high and was assessed to be 972 Million in 2000 and is anticipated to extend in 2025 to about 60% in total of 1.56 Billon [6]. Besides, the prevalence of diabetes be high around the world, it is approximately 8.8% accounting for 415 Million human being in 2015 and predicted to rise 10.4% by way of 2040 accounting for 642 Million [7]. Most of the patients with diabetes will develop hypertension. Therefore, it is difficult to control BP in diabetic patients compared to non-diabetics, meanwhile, the venture of CVD is high in hypertensive patients with hyperglycemia than in patients that only have high blood pressure [8]

There is a lack of scientific proof on the outbreak and risk factors of hyperglycemia and hypertension amongst Kurdish Muslim people with different behavior compared to non-Muslims. In both industrialized and poor countries, the combination of diabetes, hypertension, and other metabolic risk factors may have a substantial influence in determining the risk of death and morbidity. [9][10]. But there is no enough evidence why there is such a significant relationship between the two criteria. However, many factors might also contribute.

All healthy adult Muslims are required to fast from dawn to dusk throughout Ramadan, with an exception for women in a period of the menstrual cycle and those who are suffering from any disease. During this month the majorities of Kurdish Muslims have devoured two well large, sized meals one directly before dawn and second after dusk. Fasting may cause metabolic level changes. Evidence for the consequence of Ramadan fasting and physiological responses during fasting is still not fully understood. Fasting, sleep disturbance, changes in dietary behavior, and lifestyle have a major important role in controlling metabolic criteria levels including diabetic and hypertension [11]. However, research on the impact of Ramadan fasting on blood sugar level and hypertension have been controversial; one study import a considerable Glucose levels in the fasting state are lower over time [12], while another found a modest rise [13], and a reduction in blood pressure in either “hypertensive and normotensive” people [14], additionally study on diabetic patients during Ramadan were showed a significant increase in systolic BP but no difference in Diastolic BP [12]. The aim of this study was to see how Ramadan fasting affected metabolic parameters in females on hypertensive and diabetic treatment at Halabja Hospital.

2. METHODS AND MATERIALS

A group of 73 female patients with Met S, aged (20-45) years were evaluated before and after the Ramadan month (one week before the fasting month and were followed up a week after the month), having a disease (diabetic and hypertension) of more than two years. All attending the Halabja Hospital were treated with once-daily medication and continued their medications during Ramadan (atenolol: 50mg, metformin 500 mg, and aspirin 100mg orally once a day) medication was taken before sunrise. In addition, they were regularly fasting during past years and have the intention to fast. The study was undertaken in Halabja Hospital from (17-4-2020) to (24-5-2020), include one week before Ramadan Month, patients were examined at the Center of Communicable and non-Communicable disease. This center provides all required patients including; Examination and drug supplements with a free for those people living in Halabja and around. The sample size was calculated using a basic random sampling procedure. Each individual is chosen totally by random in this situation, and every member of the population has an equal chance of being chosen.

2.1 Inclusion and exclusion criteria

The (IDF) defining criteria were used to determine eligibility for female participants with diabetes and hypertension between the ages of 20 and 45 who live in Halabja (Kurdistan Region of Iraq) [15]. This study excluded participants who were taking any medications other than antihypertensive and diabetic treatments (atenolol 50 mg, metformin 500 mg, and aspirin 100 mg orally once a day). After a medical evaluation, the candidates for the study were chosen. Patients having renal disease, liver disease, pregnant and lactation women, type one diabetes, smoker, alcoholic, insulin user, and newly diagnosed with hypertension and type II diabetes were excluded. Moreover, patients who were unable to fast for at least 21 days during the trial period were eliminated from the study.

2.2 Ethics

Ethical ratification for the study was commissioned through the Ethical Review Board of; Halabja Hospital, Center of communicable and non-communicable disease. Respondents gave patients a survey questionnaire before and after Ramadan after they signed a consent form.

2.3 Data collection methods

The questionnaire comprised a socio-demographic section, such as; gender, age, anthropometric measure, onset and duration of disease, and medical history were recorded (type and dose of anti-hypertensive and anti-diabetic agent used).

Clinical data section including systolic and diastolic blood pressure and laboratory investigation was performed to examine blood glucose level. Hypertension was defined according to the IDF guideline, which is SBP> 130 mm/Hg and, or DBP > 85 mm/Hg or using anti-hypertensive remedy [15]. After at least 10-20 minutes of rest, blood pressure was collected from the participant's left arm while seated with a standardized zero-mercury sphygmomanometer and stethoscope. The IDF criteria were used to make the diagnosis of type 2 diabetes (more than 120). The presence of diabetes was specified by reviewing previous medical history of the patient and confirming that they were using anti-hyperglycemic medication. The first sample was collected a week prior to Ramadan at 9 to 10 am, and the second sample was tested at least two days before Ramadan ended. After 8 to 10 hours of fasting, blood glucose was measured using a glucose kit (Randox-USA). BMI was calculated according to the $\mathrm{BMI} = (\text{weight (kg)})/\ (\text{height (m)}^2$, and waist circumference was measured by using steel tape at baseline and end of Ramadan fasting.

2.4 Statistical analysis

The data was collected and analyzed by using SPSS version 22. (SPSS. Chicago, IL, USA). For the complete sample, descriptive statistics such as; standard deviation, mean, and percentages were determined. The differences in mean were investigated using the independent samples t-test and the paired sample t-test. In this study, a P value of less than 0.05 was considered statistically significant.

3. RESULTS

The mean size of fasting days was 26.5 days, with the range being 24 to 29, and the total number of fasting hours was 15 hours and 25 minutes. All of the women in this study missed four and a half days of fasting because they couldn't fast during their menstrual period. The study enrolled 82 volunteers, nine of whom were withdrawn from the final analysis, and four of whom failed to provide blood samples at the conclusion of the trial and five volunteers withdraw from the study due to acute medical conditions and did not complete fasting. The remaining 73 volunteer patients with a mean age of 37.6 ± 6.7 took part in this study.

Most of our patients were taking aspirin 100mg/day n=48 (67 %). The majority of type 2 diabetic patients who underwent Ramadan fasting consumed oral antidiabetic drugs; 65 subjects were on oral antidiabetic metformin and 8 were on metformin for glucose-lowering therapy. In addition, all of the patients were taking an antihypertensive medication (calcium Chanel blockers). The regularity of medicine taken was necessary in the inquiry to learn that n=49 (68%) of the patients took their meds every day, but n=24 (33%) of the individuals frequently missed their medications throughout the fasting month. (Table 1).

There was a substantial weight loss during the month of Ramadan; it has changed from 86.4 ± 14.7 kg to 83.2 ± 14.7 kg with a percentage change of 3.1 ± 3.3 kg and $p < 0.0001$. Also, WC

decreased significantly compared to before Ramadan; it has changed from 109.4 ± 8.7 cm to 106.6 ± 8.4 cm with a percentage change of 2.8 ± 2.7 cm and $p < 0.0001$. This result has been reflected on BMI as well that showed a reduction from 34.5 ± 5 to 33.2 ± 4.9 with a percentage change of 1.3 ± 1.9 and $p < 0.0001$. (Table 2).

The systolic blood pressure (143.04 ± 22.6 vs 124.6 ± 14.3), and diastolic blood pressure (88.9 ± 11.2 vs 77.8 ± 7.8) showed a significant change during fasting period. Overall, fasting throughout Ramadan was found to significantly reduce fasting blood sugar levels. It has improved from 127.1 ± 62.1 mg/dl to 103.2 ± 20.2 mg/dl, and p-value 0.0001, which has a significant change compared to before Ramadan fast. (Table 3).

With regards to changes in lipid profile, fasting Ramadan was found to a significant decrease in TC level by (183.9 ± 39.9 to 173.7 ± 36.5) mg/dl, and TG level by (170.9 ± 58.3 to 144.6 ± 41.1) mg/dl. There was no significant change in serum LDL-C after Ramadan when comparing to the initial, however, we noticed a decline in serum HDL-cholesterol levels but this change was not paralleled by any significant changes. (Table 3).

4. DISCUSSION

Incompatibles studies have been reported for BMI, WC, and weight loss in response to Ramadan fasting. The most significant interpretation from this study is the impact that "Ramadan fasting has over many parameters including body weight, WC, BMI, and many analyzes in the blood such as TC, TG, and HDL-C, nevertheless, the fact that after Ramadan all encounters of the study matched in an improvement of their systolic and diastolic blood pressure. We found both BMI and WC significantly decreased after Ramadan, this was following works [16], [9], In addition, there was a significant drop in the Basal Metabolic Index (BMI), which is aligned with another study[18], [11]. Decrease in body weight and BMI [20]. However, it is not clear the exact reason for the result, whether it was related to a decrease in hydration or fat mass or to other lifestyle conditions. The significant weight reduction during Ramadan fasting is since participants went through almost a month of depriving themselves during the days starting from dawn and continuing to dusk. And different periods of fasting in different seasons (16 to 17 hours) are other important factors, which can affect the obtained findings[21]. The qualifications of eating configuration, low-calorie intake, loss of midday meals when the body is metabolically active, exercise religious activity (prayer), behavioral changes, and improvement of psycho-physiological during Ramadan fast status[22], might help improve and arrangement of lifestyle-related disorders like MetS overweight and obesity [23]. Again, BMI and WC, are significant changes, not just result of the decrease in food intake (less energy intake and more energy expenditure) but also the result may strongly have related to dehydration produced by exhaustion of body fluids and loss of water and fluid intake, not related to decreasing in body fat [24]. Such changes could be showcased as a positive indication resulting from fasting the month.

The result of the finding for BP is compatible with similar studies performed by other researchers, including a research paper from our team that found similar observations among hypertensive patients during Ramadan fasting in Halabja [25]. Besides, the targeted group of patients in this study was females having troubles with their blood pressure and were taking drugs for controlling their symptoms. The outcome in this regard also demonstrated the usefulness of Ramadan fasting along with the continuous taking of the drugs in improving the systolic and diastolic blood pressures for these encounters. Also, the fasting indicated no negative contribution in worsening the health status of the patients when blood pressure matters. A Mixed change in B.P among diabetic patients was reported by many researchers during Ramadan fasting. This change may result of different reasons; first, individual are licensed to drink and eat after the dusk and before dawn, second, traditional high sugar intake and consumption of high-fat foods [26], third, longer fasting hours-high temperature-associated with dehydration then increased blood viscosity [27], forth, changing in dietary pattern and behaviors-weak up for a meal at night and return to a sleep-some afternoon nap and less physical activity [28], finally, sleep imbalance, energy restriction, physiological

effects and decrease number of meals [29]. All reasons may be able to have posed an additional risk for BP control. Our finding is in agreement with other studies in diabetic patients [30, 31, 32] , other shows, no significant changes [8, 34], No change in BP may be due to the fact that people are on diet and doing exercise, this retained homeostasis and BP didn't change.

Others believe that this discrepancy could also be thanks to a long hunger period during which glucose storage is exhausted and fat becomes a source of energy, thus, helping in weight loss, better glycemic control, help in decreasing BP and other lifestyle-related diseases[34]. Besides, the mixed result for change in BP among diabetic patients that use metformin during Ramadan has been reported. The beneficial effect of metformin has been appraised its anti-hyperglycemic efficacy and it can affect weight and BP. Study shows that metformin significantly decreases BP in non-diabetic hypertensive obese [35], and Improving insulin sensitivity by metformin during Ramadan fasting decreases BP in untreated hypertensive non-obese [36]. In contrast to our result, use of metformin for diabetic control did not affect BP [37, 38]. Interestingly, other finding shows, participants with long time use metformin had higher systolic blood pressure compared to a participant with shorter duration use of metformin, meanwhile other trial reached the same result[39]. Improvement in glycemic control has also been reported in type 2 diabetics [40], and healthy adults [41]. Overweight and obesity is a heterogeneous disease associated with the higher risk for the outreach of type II DM [16, 17]. A "meta-analysis study shows that being overweight is involved with a development risk of diabetic retinopathy [44]. Therefore, the greatest parts of researchers and physicians, find intermittent fasting is satisfactory for patients with well-controlled diabetes.

Conflicting results for FBS, lead to different decisions, especially in the management of type 2 diabetics. "Expert Muslim medical practitioners" believe that fasting during Ramadan may make disease harmful, but, it is different in patients with type II DM if fitting direction about meal and hypoglycemic medication is designated [22, 23]. In the result of our study, we found that the range of FBS is significantly changed during and after Ramadan fasting. It is acceptable that living with type 2 diabetes did not inhibit patients from fasting with regular metformin medication and it can improve insulin sensitivity due to the long duration of fasting [36]. Studies are reported a noticeable decline in glucose levels during Ramadan fasting. However, many factors like environmental factors, regular drug intake, differences in dietary habits, seasons, prolonged hunger, disorder, physical activity, and sugar intakes, make our result to an agreement with some of the previous studies [47, 26, 27]. Conflict report study shows a significant reduction in blood glucose towards the end of Ramadan in adults, it may be related to increased "gluconeogenesis" [51].

When it comes to the changes in the levels of "lipid profile" variable during Ramadan, we could observe a significant decrease in certain parameters and non-significant decreases in others. For TC and TG the change was minus directed and was significant. However, for the good HDL-C there was also a decrease in its levels which could not be attributed to a benefit of Ramadan fasting. Yet, the change in HDL-C, was not significant. Besides the promising results observed from the current study, yet, the benefit of fasting for patients with metabolic syndrome is controversial [52]. Although, in a systematic review that surveyed 28 studies performed upon various Muslim societies from the Middle East, Asia, and Africa, Tahapary et. al. found the common characteristic among all studies were observing a decrease in fasting plasma glucose (FPG), HbA1c, TG, TC, HDL, and LDL levels without any fatal hypoglycemic cases [53]

Table 1: Anthropometric data before Ramadan.

Variables	Total (n=73) Female	P Value
Age (years)	30-45	0
Weight (kg)	86.4±14.7	0
BMI (kg/m2)	34.5±4.9	0
WC (cm)	109.4±8.7	0

Table 2: Effect of Ramadan fasting on anthropometric measure

Variables	No.	Before Ramadan (mean ± SD)	After Ramadan (mean ± SD)	Changes	95%CI difference	P value
weight (kg)	73	86.4±14.7	83.2±14.7	3.1±3.8 (-)	2.2- 4	0.001
BMI (kg/m2)	73	34.5±4.9	33.2±4.9	1.3±1.6 (-)	1-1.6	0.001
WC (cm)	73	109.4±8.7	106.6±8.4	2.8±2.7 (-)	2.1-3.4	0.001

The descriptive statistics of mean, and standard deviation were calculated for the entire sample. The differences between means were tested by paired sample *t- test*. P value less than 0.05 was considered as statistically significant

Table 3: Effect of Ramadan fasting on Blood sugar, Blood pressure and Lipid profile

Variables	No.	Before Ramadan (mean ± SD)	After Ramadan (mean ± SD)	Changes	95%CI difference	P value
FBS	73	127.1±62.1	103.2±20.2	23.9±55.6 (-)	10.9-36.8	0.001
SBP(mmHg)	73	143±22.6	124.6±14.3	18.4±20.9 (-)	13.5-23.3	0.001
DBP(mmH)	73	88.9±11.2	77.8±7.8	11±9.6 (-)	8.7-13.2	0.001
TC (mg/dL)	73	184±39.9	173.7±36.5	10.3±33.6 (-)	2.4-18.1	0.011
TG (mg/dL)	73	170.9±58.3	144.6±41.1	26.3±65.6 (-)	11-41.7	0.001
HDL-C (mg/dL)	73	39.4±14.7	36.5±13.8	2.8±13.4 (-)	0.2-6	0.07
LDL-C (mg/dL)	73	129.4±43.7	123.7±36.1	5.6±38.4 (-)	3.3-14.6	0.2

The descriptive statistics of mean, and standard deviation were calculated for the entire sample. The differences between means were tested by paired sample *t- test*. P value less than 0.05 was considered as statistically significant

5. CONCLUSION

Per the results, of the current discussion and a review of the literature, fasting throughout the Holy month of Ramadan is rather advantageous for groups taking hypertension and blood sugar control medicines; their health state has improved relatively after fasting this month. On the other hand, fasting appears to necessitate more research in order to assess its effect.

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