

# Effect of Physical Activities and Obesity on Ramadan Fasting among Hypertensive Patients

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p> <hr/> <p><i>Article History:</i> Received: 24 Nov 2016 Accepted: 18 Dec 2016 Published: 20 Dec 2016</p> <hr/> <p><i>Keywords:</i> Hypertensive patients Karachi Pakistan Ramadan fasting Systolic and diastolic blood pressure</p>	<p><b>Introduction:</b> The aim of this study was to find out the effect of physical activities and obesity among Ramadan fasting hypertensive patients of Karachi.</p> <p><b>Methods:</b> 117 hypertensive patients were selected conveniently from the staff and faculty members of Dow University and other locations of Karachi. The inclusion criterion was the hypertensive patients with at least 20 days of fasting. The investigators visited the participants three times (last ten days of Shaban, Ramadan and Shawwal) for data collection. A questionnaire was completed before clinical examination. Blood pressure was measured 3 times in sitting position. 103 patients fasted at least 20 days.</p> <p><b>Results:</b> The mean age of the 103 patients was 53.7±11.0 years. 11% participants could be considered as active using MET value of 600 and above. Mean sleeping hours decreased from 6.9 hours in Shaban to 6.3 hours in Ramadan. Mean systolic and diastolic blood pressures decreased from Shaban to Ramadan and bounced back in Shawwal for both 'active' and 'inactive' patients. However, it was statistically significant for 'inactive' patients only. Only mean SBP decreased significantly from Shaban to Ramadan for normal and overweight patients. Combined effect of physical activity, obesity, sleeping pattern and number of fasting days with repeated measure ANOVA showed that only number of fasting days was statistically significant.</p> <p><b>Conclusion:</b> The study concludes that fasting does not incur any harm for the hypertensive patients. Nevertheless, it significantly reduces the systolic and diastolic blood pressures. Factors such as changes in physical activities, sleeping patterns, and weight reduction, except for the number of fasting days, do not affect the fasting hypertensive patients.</p>

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## Introduction

Ramadan is the most sacred month of Islam. It is the ninth month of Islamic calendar, in which fasting is mandatory for every adult male and female. However, due to certain health conditions these fasting days could be postponed or exempted. More than one billion adult Muslims (1), between 15 to 60 years old, abstain from food, drink, smoking and sexual activities from dawn to sunset. Since in Islam, lunar calendar is used for religious activities, which is about 11 days shorter than solar calendar, Ramadan's exact time shifts from one season to another. Consequently the fasting duration varies from 11 to 18 hours in tropical countries (2). An additional set of prayers, known as *Traweeh*, are

performed at early night. Even though it is not obligatory and is only recommended, most Muslims try to perform these prayers. Fasting people take their first meal of the day (Sahor) before the dawn. Due to the inadequate sleeping time during the night, most of the fasting people take a nap at day time. The alteration in eating timing and its frequency, special prayers and sleeping pattern may affect the physiology of the body of a fasting person. Many studies have been performed on the effect of Ramadan fasting for diseased and healthy subjects. Majority of them belonged to diabetic patients (3-5) and healthy subjects (6-11). However, few studies were conducted on the effect of Ramadan fasting

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among hypertensive patients (12-20). A systematic review has been published recently on this topic (21). However to the authors' knowledge, no study has been published concerning the effect of Ramadan fasting on Pakistani hypertensive patients. Since the eating habits and social behavior of Pakistani people are relatively different from other nationalities, therefore a study was required to determine the effect of Ramadan fasting among Pakistani hypertensive patients. The objective of the study was to find out the effect of physical activities and obesity among Ramadan fasting Karachi hypertensive patients.

### Material and methods

The study was conducted on diagnosed hypertensive patients in 1434 H (corresponding 2013G). The participants were selected conveniently from staff members of Dow University of Health Sciences (DUHS) and different locations of Karachi. The study was registered in the Research Department and approved by the Institutional Review Board of DUHS before starting the study. One hundred seventeen patients were enrolled in the study, who were intended to fast during the Ramadan of that year. The purpose of the study was explained to the participants and informed verbal consent was obtained from them. The inclusion criterion was the declared hypertensive patients with the intension of at least 20 days of fasting during upcoming Ramadan. The detailed methodology has been explained in the earlier article published by Khan et al in *Ann Jinnah Sindh Med Uni*, 2016; 2(1) (22).

### Sample Size Calculation

The mean $\pm$ SD of systolic blood pressure of an Indian study (15) a day prior to Ramadan and the last day of Ramadan were 148 $\pm$ 5.06 mmHg and 133 $\pm$ 4.63 mmHg respectively; and mean $\pm$ SD of diastolic blood pressure were 90 $\pm$ 2 mmHg and 81 $\pm$ 1.63 mmHg respectively. The effect size (mean difference/SD) of systolic and diastolic blood pressures were 2.6 and 4.5 respectively. Using 99.9% confidence interval and 95% of power of the test with effect size and SD the systolic blood pressure gave the largest sample size of 90. Twenty percent of this sample size was added for the incomplete information and for the cases who did not observe the

minimum level of 20 days fasting. Hence, the minimum sample size we needed for the study was 108. We have used sample size calculator developed by the University of California, San Francisco.

The field investigators visited the study participants on three occasions (last ten days of Shaban, Ramadan and Shawwal; corresponding to 30/6/2013 to 9/7/2013; 29/7/2013 to 6/8/2013 and 28/8/2013 to 6/9/2013) to collect the data. A structured questionnaire was completed before clinical examination. Besides other information, the questionnaire included questions concerning the demographic variables (gender, age, height and weight), family history of hypertension, medicine being used, co-morbidity, smoking and sleeping pattern, physical exercise and dietary habits. On the Shawwal's visit, information concerning the number of fasting days and number of night special prayers (Traweeh) were also recorded. Blood pressure was measured in sitting position. (Participants' weight (kg, without shoes) and height (cm) were measured. Three patients did not attend the Shawwal's visit and 11 patients fasted less than 20 days. Therefore, only the data gathered from 103 participants were analyzed. Metabolic Equivalent (MET) value was calculated using the formula mentioned in Nozha et al (23) and Khan et al (4). The patient was assumed active if the MET value was more than 600 minutes per week. The Body Mass Index (BMI) was divided into three categories normal ( $18.5 < \text{BMI} < 25$ ), overweight ( $25 \leq \text{BMI} < 30$ ) and obese ( $30 \leq \text{BMI} < 40$ ). None of the patients was measured outside of these ranges. The average temperature of Karachi in July is approximately comfortable, ranging from 27°C to 34°C with breezing speed of 2m/s to 8 m/s. The fasting duration was about 15 hours in Karachi in 1434 H. The data were entered into computer using SPSS version 21. Repeated measure design ANOVA was employed to determine significant difference among the three readings of systolic and diastolic blood pressures with obesity and active/inactive among subjects; along with sleeping hours before Ramadan and number of fasting days as co-factors.

### Results

The mean age of the 103 hypertensive patients was 53.7 $\pm$ 11.0 (R: 28-84) years. Forty

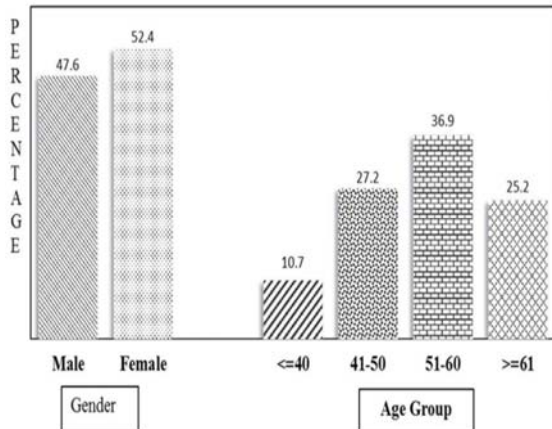


Figure 1. Distribution of samples by gender and age group

nine (47.6%) participants were males and more than one-third 36.9% belonged to age group of 51-60 years (Figure 1). Forty percent of the participants were overweight and 23.3% were obese. Only 10.7% participants could be considered as 'active' using MET value criterion of 600 or more (Figure 2). Figure 3 describes the smoking habits and the mean sleeping hours indicated by the participants during their visits. Mean sleeping hours decreased significantly from 6.93 hours in Shaban to 6.3 in Ramadan ( $P<0.0001$ ), however, it was restored to the same level (6.88 hours) in Shawwal. Mean sleeping hours of females were higher than males in all three months.

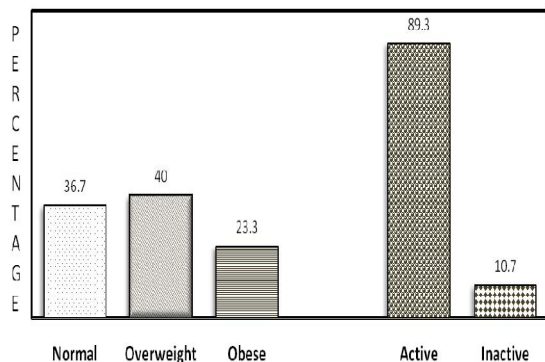


Figure 2. Distribution of samples by physique and active body

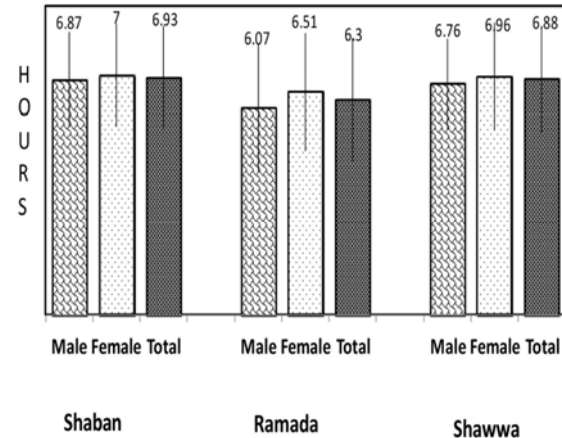


Figure 3. Mean sleeping pattern in the patients per day

Mean Systolic Blood Pressure (SBP) of the three visits categorized by physical activeness and obesity are shown in Table 1. Mean SBP of inactive patients decreased significantly from 142.1±16.4 mmHg in Shaban to 134.0±17.1 mmHg in Ramadan ( $P<0.0001$ ), but rose with statistically significant difference to 139.8 ± 15.7 mmHg in Shawwal ( $P=0.001$ ), however, it did not reach the same level as that of Shaban. Mean SBP also decreased among active patients from Shaban to Ramadan, which was not statistically significant ( $P=0.067$ ) and rose insignificantly to almost the same level in Shawwal ( $P=0.053$ ). Mean SBP decreased about 10 points among 'Normal BMI' patients from Shaban to Ramadan ( $P=0.001$ ); it re-bounced in Shawwal significantly by 8 points ( $P=0.006$ ). The overweight participants also showed significant reduction in their SBP reading by 7 points from Shaban to Ramadan ( $P=0.011$ ). However, they regained only 4 points in Shawwal which was insignificant ( $P=0.177$ ). Mean SBP of obese patients decreased about 6 points in Ramadan and remained the same in Shawwal. However, due to high standard deviation in Ramadan as compared to Shawwal, it was only significant from Shaban to Shawwal ( $P=0.045$ ).

Table 2 demonstrates the changes in Diastolic Blood Pressure (DBP), categorized by physical

Table 1. Mean systolic blood pressure in three visits categorized by physical activities and obesity

		N	Shaban	Ramadan	Shawwal
Physical Active	Inactive	91	142.1 <sup>a</sup> ±16.4	134.0 <sup>b</sup> ±17.1	139.8 <sup>a</sup> ±15.7
	Active	11	133.1 <sup>a</sup> ±11.5	126.4 <sup>a</sup> ±15.0	133.1 <sup>a</sup> ±16.0
Obesity	Normal	32	141.6 <sup>a</sup> ±17.6	131.9 <sup>b</sup> ±14.2	140.1 <sup>a</sup> ±18.7
	Overweight	36	142.3 <sup>a</sup> ±15.6	135.4 <sup>b</sup> ±18.6	139.4 <sup>ab</sup> ±12.2
	Obese	21	138.9 <sup>a</sup> ±12.2	133.1 <sup>ab</sup> ±15.5	133.5 <sup>b</sup> ±11.7

The different alphabets in superscript identify the statistical significance

**Table 2.** Mean diastolic blood pressure in three visits categorized by physical activities and obesity

		n	Shaban	Ramadan	Shawwal
Physical Activity	Inactive	91	87.9 <sup>a</sup> ±10.6	85.1 <sup>b</sup> ±11.2	87.4 <sup>ab</sup> ±12.3
	Active	11	86.8 <sup>a</sup> ±10.1	81.8 <sup>a</sup> ±10.8	87.3 <sup>a</sup> ±8.8
Obesity	Normal	32	86.7 <sup>ab</sup> ±9.6	83.9 <sup>a</sup> ±11.7	89.2 <sup>b</sup> ±14.8
	Over weight	36	89.2 <sup>a</sup> ±9.7	86.7 <sup>a</sup> ±11.2	88.1 <sup>a</sup> ±11.2
	Obese	21	88.8 <sup>a</sup> ±12.2	85.2 <sup>a</sup> ±10.3	85.5 <sup>a</sup> ±7.4

The different alphabets in superscript identify the statistical significance

**Table 3.** Mean systolic and diastolic blood pressures in three visits with co-factors of physical activities, obesity, sleeping pattern and number of days of fasting

	N	Shaban	Ramadan	Shawwal	Physical Activity	Obesity	Physical Activity and Obesity	Sleeping Pattern	Number of Days of Fasting
Systolic blood pressure	96	142.6 <sup>a</sup> ±17.8	134.2 <sup>b</sup> ±17.2	139.7 <sup>c</sup> ±17.0	0.280	0.975	0.740	0.513	0.011
Diastolic blood pressure	96	88.1 <sup>a</sup> ±10.9	85.3 <sup>b</sup> ±11.2	89.1 <sup>c</sup> ±6.6	0.455	0.526	0.651	0.541	0.859

The different alphabets in superscript identify the statistical significance

activeness and obesity. Mean DBP of inactive patients dropped by 2.7 mmHg points which was statistically significant (P=0.032). In Shawwal, the mean DBP rose by 2.3 mmHg, however this increase was not strong enough to be considered as statistically significant (P=0.053). The mean DBP of ‘active’ patients decreased more than the ‘inactive’ patients’ in Ramadan. However, due to smaller sample size, it was not statistically significant (P=0.153). Furthermore, the increase in Shawwal was almost 5.5 mmHg, however, given the small sample size, this increase was statistically insignificant (P=0.198). Among normal BMI patients, the DBP decreased by 2.8 mmHg, but it was not statistically significant (P=0.174). However, the increase in mean DBP in Shawwal was 5.3 mmHg and it was statistically significant (P=0.015). Overweight and obese patients had the same trend of reduction of DBP in Ramadan and increase in Shawwal, but all those changes were statistically insignificant.

An overall change of SBP and DBP in the three visits based on physical activity/inactivity and the level of obesity is shown in Table 3. The effect of number of days of fasting and sleeping hours is also summarized in the same Table. Mean SBP of all the samples reduced significantly from 142.6 mmHg to 134.2 mmHg in Shaban to Ramadan (P<0.0001), but reversed back significantly to 139.7 mmHg in Shawwal (P<0.0001). There was no significant effect of active/inactive, obesity level and its interaction in the changes of SBP. Number of days of fasting showed significant effect (P=0.011), but changes in sleeping hours showed no statistical effect in the change of SBP (P=0.513). DBP also reduced significantly from 88.1 mmHg to

85.3 mmHg in Shaban to Ramadan (P=0.013) and reached back to 89.1 mmHg in Shawwal. This increase was also statistically significant (P=0.021). There was no significant effect of active/inactive, obesity and its interaction in the changes of DBP in three readings. Number of days of fasting and changes in sleeping hours also did not show any statistically significant effects.

### Discussion

As mentioned in the introduction fasting is mandatory for all Muslim adult except in few special situations. One of these special situations applies to the sick people whose health condition might deteriorate as a result of fasting. Yet, many chronically sick people with diabetes, hypertension, and chronic heart diseases etc. keep fasting due to their spiritual beliefs. While there are few studies on the effect of Ramadan fasting on hypertensive patients; a number of studies have been published in last few years.

This study showed that systolic and diastolic blood pressures of the participants decreased significantly from Shaban to Ramadan and bounced back significantly from Ramadan to Shawwal. This trend is confirmed by most of other studies (12,15,18,19,22). However, some were not statistically significant. Samad et al (24) indicated four possible causes (atrial natriuretic peptide, catecholamines, opiates and weight decrease) for reduction in blood pressure during Ramadan. But these factors are mainly obtained from animal studies.

Partitioned of the data by physical active (active/inactive) showed the significant reduction only among ‘inactive patients’. Since, the active



patients keep their body system in better shape than the inactive patients, Therefore, Ramadan fasting has less effect on active patients. This trend is also shown by Haghdoost and PoorRanjbar (25) when comparing the change in lipid profile among physical active and inactive Ramadan fasting subjects. Changes in blood pressure by level of obesity indicated that the patients with normal BMI reduced the maximum in Ramadan, but regained the same amount in Shawwal. However, with increasing BMI the reversal in blood pressures from Ramadan to Shawwal was relatively slow and with obese patients the changes were mostly insignificant. The correlation of these variations with the increase of BMI needs further investigation.

The changes in blood pressure with combined effect of obesity, physical activity, sleeping pattern and number of days of fasting indicated that none of them, except number of days of fasting, had any significant effect except the fasting itself. Salahuddin and Javed (15) showed a significant decrease in hypertensive patients and insignificant drop in normotensive patients.

Ramadan appeared in July in the research-study period. Even though, it is the summer time with longer fasting duration in Pakistan but in Karachi the weather in July is usually fair as compared to other part of the country with pleasing breeze. Therefore, the changes in blood pressure should not be attributed to inclement weather. Investigators also indicated the change of blood pressure due to reduction of body weight and alteration in sleeping timing. Most of the studies showed that fasting during Ramadan reduces the weight and hence decreases the blood pressure (26). Univariate analysis did show that patients with different BMI behaved differently. However, in multivariate analysis this factor was not statistically significant. Bursztyn et al (27) also showed that the sleeping pattern affects the blood pressure. The people who take two rounds of sleep during 24 hours in afternoon and at night usually have lower blood pressure as compared to who sleep only at night time. It is a usual practice during Ramadan days that the fasting people take an afternoon nap, even though they do not sleep in day time in other months. During Ramadan fasting people sleep late due to longer night prayers and wake up early before dawn for Sahor (pre-dawn meal). Therefore, they need to

cover their missing sleeping time during day time. However, this study did not show any significant effect due to change of sleeping pattern as co-factor. Salahuddin and Javed (15) also indicated that fasting reduces systolic and diastolic BP and weight of hypertensive patients which corresponds to the findings of this study.

During Ramadan, patients change the timing and doses of their medicine. They take the medicine at Iftar (breakfast) time and/or at Sahor (pre-dawn meal) time. A drop in BP level indicates that the change in time and dose of drugs do not incur any negative effects in the control of hypertension. Alterations in pharmacokinetic and pharmacodynamics should be studied among hypertensive patients. Studies also indicated that weight reduction has some correlation with blood pressure reduction. Because, people lose some weight due to alteration in frequency and timing of meals in Ramadan.

This study revealed same trend of significant reduction in Ramadan and then re-bounced in Shawwal of systolic and diastolic blood pressures for inactive hypertensive patients. Furthermore, the patients with normal BMI lost more weight in Ramadan and regained fast in Shawwal as compared to overweight and obese patients. However, multivariate analysis does not show any significant effect of these factors. The strength of this study lies in the fact that it is the first study on Pakistani hypertensive patients and has relatively bigger sample size as compared to the other studies conducted on this topic. However, the results should be read with caution, because it was a convenient sample and most of participants were medical university employees and hence had better health related knowledge and medical support. This study did not use any ambulatory blood pressure monitoring device to record 24-hours blood pressure. Randomized control trial and large scale clinical studies could be conducted to observe the physiological changes due to Ramadan fasting among hypertensive patients. Furthermore, the data were collected by a team of fourth year students of Bachelor of Medicine and Bachelor of Surgery. Therefore, measurement error could be possible.

## Conclusion

The study concludes that fasting does not incur any harm for the hypertensive patients. Nevertheless, it significantly reduces the systolic

and diastolic blood pressures. Factors such as change in physical activities, sleeping patterns, and weight reduction, except for the number of fasting days, do not affect the fasting hypertensive patients.

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