Effects of Ramadan Fasting on Ambulatory Blood Pressure in Hypertensive Patients

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4 Baqiyatallah University of Medical Sciences, Tehran, Iran
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ABSTRACT

Article type: Original article

Introduction: Previous studies have indicated that Ramadan fasting has beneficial effects on cardiovascular risk factors, specially blood pressure and heart rate (1). In the present study, the effect of Ramadan fasting on 24-hour ambulatory blood pressure and heart rate has been investigated.

Method: This prospective observational study was conducted on two groups of individuals. Six patients under hypertension treatment were allocated to the case group and 12 healthy individuals were selected as the control group. Twenty-four-hour blood pressure monitoring was carried out during four periods: prior to Ramadan, during the first ten days and the last ten days of Ramadan, and one month after it. All patients continued their medication, which was administered twice per day. Twenty-four-hour mean blood pressure, weight, body mass index (BMI), and waist circumference were compared among the groups.

Results: In the case group, there was a significant reduction in subjects' weight during the third period of the experiment; also, a significant improvement was observed in the heart rate during the second and third periods in the case group (P<0.05, t-test).

Conclusion: This study indicated a significant improvement in the subjects' heart rate over second and third periods of measurements; also, no high-risk variations in blood pressure or heart rate were observed among the subjects.


Introduction

Ramadan is an Islamic month during which Muslims abstain from eating, drinking, and smoking from dawn to sunset. Cardiovascular diseases are considered the leading cause of mortality worldwide (2), and hypertension is one of the most common risk factors associated with increased risk of atherosclerotic cardiovascular disease or stroke (3).

During the month of Ramadan, repeated cycles of fasting and feeding, along with alterations in the daily patterns of sleep and activities and medication timing might contribute to changes in blood pressure among hypertensive patients.

Studies on the effects of fasting on the blood pressure of hypertensive patients are scarce, and have provided inconclusive results (4, 5). However, previous studies have indicated that Ramadan fasting has beneficial effects on cardiovascular risk factors, specially blood

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Table 1. Effect of Ramadan fasting on systolic blood pressure in hypertensive patients (n=6)

<table>
<thead>
<tr>
<th>Compression the Systolic blood pressure (SBP) in 4periods</th>
<th>x± SD</th>
<th>x’2, x’1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean SBP - before Ramadan mean SBP - first period in Ramadan</td>
<td>139.81±16.6 134.67±21.2</td>
<td>-5.14±14.9</td>
<td>0.437</td>
</tr>
<tr>
<td>1&amp;3 mean SBP - before Ramadan mean SBP - last period in Ramadan</td>
<td>139.81±16.6 135.44±16.1</td>
<td>-4.37±16.8</td>
<td>0.176</td>
</tr>
<tr>
<td>1&amp;4 mean SBP - before Ramadan mean SBP - after Ramadan</td>
<td>139.81±16.6 133.04±17.1</td>
<td>-6.77±12.0</td>
<td>0.228</td>
</tr>
<tr>
<td>2&amp;3 mean SBP - first period in Ramadan mean SBP - last period in Ramadan</td>
<td>134.67±21.2 135.44±16.1</td>
<td>0.77±12.2</td>
<td>0.884</td>
</tr>
<tr>
<td>2&amp;4 mean SBP - first period in Ramadan mean SBP - after Ramadan</td>
<td>134.67±21.2 133.04±17.1</td>
<td>1.63±12.2</td>
<td>0.758</td>
</tr>
<tr>
<td>3&amp;4 mean SBP - last period in Ramadan mean SBP - after Ramadan</td>
<td>135.44±16.1 133.04±17.1</td>
<td>2.40±5.2</td>
<td>0.317</td>
</tr>
</tbody>
</table>

1= mean systolic blood pressure - before Ramadan 2= mean systolic blood pressure - first period in Ramadan
3= mean systolic blood pressure - last period in Ramadan 4= mean systolic blood pressure - after Ramadan
5SD=standard deviation

In the current study, the effect of Ramadan fasting on the ambulatory blood pressure of hypertensive patients has been investigated.

Materials and Method

Subjects

This prospective observational study was conducted on two groups of individuals. Six patients under hypertension treatment were allocated to the case group and 12 healthy individuals (without any diagnosed diseases) were selected as the control group. Hypertensive volunteers were recruited from outpatient cardiology clinics in teaching hospitals in Mashhad, Iran.

The diagnosis of primary hypertension was based on the cardiologist’s clinical judgment. Medications were prescribed twice per day for all the patients under treatment (including β blockers, diuretics and ACE inhibitors); the subjects followed the prescription before sunrise and after sunset during Ramadan.

The patients who met the following criteria were excluded from the study: <45 or >75 years of age, previous history of smoking, secondary hypertension, diabetic mellitus, acute coronary syndrome and other systemic diseases, and fasting period less than 10 days. Patients' medical history, and history of smoking and drug abuse were obtained prior to the study.

This study was conducted according to the guidelines laid down by the Declaration of Helsinki. All procedures involving human subjects were approved by the Research Ethics Committee of Mashhad University of Medical Sciences (approval number: 88201), and the written informed consents were obtained from all subjects. This study was conducted in the month of Ramadan in August 2011 in Mashhad, Iran.

Data collection

Twenty-four-hour blood pressure monitoring was carried out over four periods: prior to Ramadan, during the first ten days and the last ten days of Ramadan, and one month after this month, using ABPM (mobile-o-graph NG, I.E.M company, Germany).

For monitoring the blood pressure, the cuff was placed on the non-dominant arm and removed after 24 hours. Calibration was checked by comparing the auscultatory results with a mercury sphygmomanometer, which were verified to be in close agreement (5 mm Hg). Blood pressure was measured once an hour during the 24-hr monitoring. Subjects were instructed to immobilize their arms during cuff inflation. The patients kept a diary of their daily activities, specifying every sleep period during the day and every awake period and mealtime at night.

Anthropometric parameters such as height, body weight and waist circumference were measured during all four phases, using standardized procedures.

Data analysis

Statistical analysis was performed using SPSS version 11.5 (SPSS Inc. Chicago, IL). Twenty-four-hour average blood pressure, average awake and asleep blood pressures, as
Table 2. Effect of Ramadan fasting on systolic blood pressure in the control group (n=12)

<table>
<thead>
<tr>
<th>Compression the Systolic blood pressure (SBP) in 4 periods</th>
<th>x̅± SD</th>
<th>x̅², x̅¹</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean SBP - before Ramadan</td>
<td>119.57±6.9</td>
<td>-4.20±7.9</td>
<td>0.096</td>
</tr>
<tr>
<td>mean SBP - first period in Ramadan</td>
<td>115.37±5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;3 mean SBP - before Ramadan</td>
<td>119.57±6.9</td>
<td>-1.89±6.8</td>
<td>0.360</td>
</tr>
<tr>
<td>mean SBP - last period in Ramadan</td>
<td>117.68±9.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4 mean SBP - before Ramadan</td>
<td>119.57±6.9</td>
<td>-0.03±4.2</td>
<td>0.976</td>
</tr>
<tr>
<td>mean SBP - after Ramadan</td>
<td>119.54±7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;3 mean SBP - first period in Ramadan</td>
<td>115.37±5.0</td>
<td>2.30±9.6</td>
<td>0.427</td>
</tr>
<tr>
<td>mean SBP - last period in Ramadan</td>
<td>117.68±9.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;4 mean SBP - first period in Ramadan</td>
<td>115.37±5.0</td>
<td>4.17±7.9</td>
<td>0.096</td>
</tr>
<tr>
<td>mean SBP - after Ramadan</td>
<td>119.54±7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&amp;4 mean SBP - last period in Ramadan</td>
<td>117.68±9.6</td>
<td>1.86±7.0</td>
<td>0.381</td>
</tr>
<tr>
<td>mean SBP - after Ramadan</td>
<td>119.54±7.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1= mean systolic blood pressure - before Ramadan  2= mean systolic blood pressure - first period in Ramadan
3= mean systolic blood pressure - last period in Ramadan  4= mean systolic blood pressure - after Ramadan
5SD=standard deviation

Table 3. Effect of Ramadan fasting on diastolic blood pressure in hypertensive patients (n=6)

<table>
<thead>
<tr>
<th>Compression the Diastolic blood pressure (DBP) in 4 periods</th>
<th>x̅± SD</th>
<th>x̅², x̅¹</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean DBP - before Ramadan</td>
<td>85.06±11.3</td>
<td>-0.95±6.8</td>
<td>0.747</td>
</tr>
<tr>
<td>mean DBP - first period in Ramadan</td>
<td>84.11±6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;3 mean DBP - before Ramadan</td>
<td>85.06±11.3</td>
<td>-1.15±2.7</td>
<td>0.342</td>
</tr>
<tr>
<td>mean DBP - last period in Ramadan</td>
<td>83.90±12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4 mean DBP - before Ramadan</td>
<td>85.06±11.3</td>
<td>-1.95±3.8</td>
<td>0.268</td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>83.11±11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;3 mean DBP - first period in Ramadan</td>
<td>84.11±6.2</td>
<td>-0.20±8.4</td>
<td>0.954</td>
</tr>
<tr>
<td>mean DBP - last period in Ramadan</td>
<td>83.90±12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;4 mean DBP - first period in Ramadan</td>
<td>84.11±6.2</td>
<td>-1.00±8.6</td>
<td>0.790</td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>83.11±11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&amp;4 mean DBP - last period in Ramadan</td>
<td>83.90±12.7</td>
<td>-0.79±4.2</td>
<td>0.668</td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>83.11±11.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1= mean diastolic blood pressure - before Ramadan  2= mean diastolic blood pressure - first period in Ramadan
3= mean diastolic blood pressure - last period in Ramadan  4= mean diastolic blood pressure - after Ramadan
5SD=standard deviation

well as weight, body mass index (BMI) and waist circumference of the individuals in four periods of monitoring were compared. The Kolmogorov-Smirnov test was performed to assess the normal distribution, and the quantitative data were expressed as the mean±SD. For comparing data within the groups, (pre- and post-Ramadan measurements) paired Student’s t-test was used. P-value<0.05 was considered statistically significant for all tests.

Results

Duration of daily fasting in Ramadan 2011 ranged between 15 hrs and 59 min of the first day and 14 hrs and 50 min of the last day. The mean number of fasting days of the subjects was 29.11±1.74 days (range: 25-30 days).

Eighteen volunteers (8 males and 10 females) within the age range of 45-75 yrs, and the mean age of 56.44±6.8 yrs were divided to two groups of individuals. Six hypertensive patients were allocated to the case group and 12 healthy (without any diagnosed diseases) individuals were selected as the control group.

Blood pressure and heart rate

There were no significant changes in systolic and diastolic blood pressures in the case and control groups over the 4 aforementioned periods (Tables 1-4) (P>0.05, paired t-test).

In the case group, there was a significant improvement in the heart rate during the second and third periods in comparison with the pre-Ramadan period (P=0.018, P=0.039, respectively); in addition, heart rate improved in the post-Ramadan period compared with the first period of Ramadan (Table 5) (P=0.019, paired t-test).

There was a significant reduction in the heart rate after Ramadan fasting in comparison
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Table 4. Effect of Ramadan fasting on diastolic blood pressure in the control group (n = 12)

<table>
<thead>
<tr>
<th>Compression the Diastolic blood pressure (DBP) in 4 periods</th>
<th>x¯± SD</th>
<th>x¯2 - x¯1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean DBP - before Ramadan</td>
<td>78.5±8.9</td>
<td>-1.91±4.9</td>
<td>0.204</td>
</tr>
<tr>
<td>mean DBP - first period in Ramadan</td>
<td>76.59±7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - last period in Ramadan</td>
<td>77.70±10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>78.42±8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;3 mean DBP - before Ramadan</td>
<td>78.5±8.9</td>
<td>-0.79±4.6</td>
<td>0.567</td>
</tr>
<tr>
<td>mean DBP - first period in Ramadan</td>
<td>77.70±10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - last period in Ramadan</td>
<td>77.70±10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>78.42±8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4 mean DBP - before Ramadan</td>
<td>78.5±8.9</td>
<td>-0.08±3.2</td>
<td>0.931</td>
</tr>
<tr>
<td>mean DBP - first period in Ramadan</td>
<td>78.42±8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - last period in Ramadan</td>
<td>78.42±8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean DBP - after Ramadan</td>
<td>78.42±8.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1= mean diastolic blood pressure - before Ramadan
2= mean diastolic blood pressure - first period in Ramadan
3= mean diastolic blood pressure - last period in Ramadan
4= mean diastolic blood pressure - after Ramadan
5SD=standard deviation

Table 5. Effect of Ramadan fasting on heart rate in hypertensive patients (n=6)

<table>
<thead>
<tr>
<th>Compression the Heart rate (HR) in 4 periods</th>
<th>x¯± SD</th>
<th>x¯2 - x¯1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean HR - before Ramadan</td>
<td>69.87±13.0</td>
<td>14.24±10.0</td>
<td>0.018</td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>84.1±6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>69.87±13.0</td>
<td>-1.37±6.1</td>
<td>0.695</td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>69.87±13.0</td>
<td>-0.62±5.5</td>
<td>0.792</td>
</tr>
<tr>
<td>1&amp;3 mean HR - before Ramadan</td>
<td>69.87±13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>84.1±6.2</td>
<td>-15.61±13.8</td>
<td>0.039</td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>68.50±15.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>68.50±15.0</td>
<td>-14.86±10.6</td>
<td>0.019</td>
</tr>
<tr>
<td>1&amp;4 mean HR - before Ramadan</td>
<td>69.87±13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>84.1±6.2</td>
<td>-14.86±10.6</td>
<td>0.019</td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>69.25±13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>69.25±13.2</td>
<td>0.75±6.4</td>
<td>0.788</td>
</tr>
</tbody>
</table>

1= mean heart rate - before Ramadan
2= mean heart rate - first period in Ramadan
3= mean heart rate - last period in Ramadan
4= mean heart rate - after Ramadan
5SD=standard deviation

Table 6. Effect of Ramadan fasting on heart rate in the control group (n=12)

<table>
<thead>
<tr>
<th>Compression the Heart rate (HR) in 4 periods</th>
<th>x¯± SD</th>
<th>x¯2 - x¯1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2 mean HR - before Ramadan</td>
<td>76.20±6.4</td>
<td>0.39±6.9</td>
<td>0.848</td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>76.59±7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>73.72±7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>76.20±6.4</td>
<td>-2.47±5.2</td>
<td>0.132</td>
</tr>
<tr>
<td>1&amp;3 mean HR - before Ramadan</td>
<td>76.20±6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>72.98±7.8</td>
<td>-3.21±3.4</td>
<td>0.008</td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>73.72±7.5</td>
<td>-2.86±5.8</td>
<td>0.120</td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>76.59±7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4 mean HR - before Ramadan</td>
<td>76.20±6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - first period in Ramadan</td>
<td>73.72±7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>76.59±7.1</td>
<td>-3.61±7.9</td>
<td>0.142</td>
</tr>
<tr>
<td>mean HR - after Ramadan</td>
<td>72.98±7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;3 mean HR - first period in Ramadan</td>
<td>76.59±7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean HR - last period in Ramadan</td>
<td>73.72±7.5</td>
<td>-0.74±4.7</td>
<td>0.594</td>
</tr>
</tbody>
</table>

1= mean heart rate - before Ramadan
2= mean heart rate - first period in Ramadan
3= mean heart rate - last period in Ramadan
4= mean heart rate - after Ramadan
5SD=standard deviation

with the pre-Ramadan measurement in the control group (Table 6) (P=0.008, paired t-test).

Anthropometric parameters

There was a significant reduction in...
Table 7. Effect of Ramadan fasting on the weight of hypertensive patients (n=6)

<table>
<thead>
<tr>
<th>Compression the Body weight (w) in 4 periods</th>
<th>x̄± SD</th>
<th>x̄’, x̄’1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2  mean w - before Ramadan</td>
<td>73.33±11.4</td>
<td>-1.08±1.2</td>
<td>0.093</td>
</tr>
<tr>
<td>mean w - first period in Ramadan</td>
<td>72.25±12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;3  mean w - before Ramadan</td>
<td>73.33±11.4</td>
<td>-0.25±1.3</td>
<td>0.673</td>
</tr>
<tr>
<td>mean w - last period in Ramadan</td>
<td>73.08±11.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4  mean w - before Ramadan</td>
<td>73.33±11.4</td>
<td>0.08±1.5</td>
<td>0.618</td>
</tr>
<tr>
<td>mean w - after Ramadan</td>
<td>73.42±12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;3  mean w - first period in Ramadan</td>
<td>72.25±12.0</td>
<td>0.83±1.5</td>
<td>0.011</td>
</tr>
<tr>
<td>mean w - last period in Ramadan</td>
<td>73.08±11.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;4  mean w - first period in Ramadan</td>
<td>72.25±12.0</td>
<td>1.17±1.5</td>
<td>0.128</td>
</tr>
<tr>
<td>mean w - after Ramadan</td>
<td>73.42±12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&amp;4  mean w - last period in Ramadan</td>
<td>73.08±11.8</td>
<td>0.33±1.5</td>
<td>0.618</td>
</tr>
<tr>
<td>mean w - after Ramadan</td>
<td>73.42±12.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1= mean Body weight (w) - before Ramadan  
2= mean Body weight (w) - first period in Ramadan  
3= mean Body weight (w) - last period in Ramadan  
4= mean Body weight (w) - after Ramadan  
5SD=standard deviation

Table 8. Effect of Ramadan fasting on the weight of the control group (n=12)

<table>
<thead>
<tr>
<th>Compression the Body weight (w) in 4 periods</th>
<th>x̄± SD</th>
<th>x̄’, x̄’1</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&amp;2  mean w - before Ramadan</td>
<td>67.46±12.3</td>
<td>-1.01±1.6</td>
<td>0.053</td>
</tr>
<tr>
<td>mean w - first period in Ramadan</td>
<td>66.44±11.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;3  mean w - before Ramadan</td>
<td>67.46±12.3</td>
<td>-0.04±0.7</td>
<td>0.857</td>
</tr>
<tr>
<td>mean w - last period in Ramadan</td>
<td>67.50±12.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&amp;4  mean w - before Ramadan</td>
<td>67.46±12.3</td>
<td>-0.25±1.0</td>
<td>0.447</td>
</tr>
<tr>
<td>mean w - after Ramadan</td>
<td>67.21±11.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&amp;3  mean w - first period in Ramadan</td>
<td>66.44±11.2</td>
<td>1.05±1.9</td>
<td>0.085</td>
</tr>
<tr>
<td>mean w - last period in Ramadan</td>
<td>67.50±12.3</td>
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<tr>
<td>2&amp;4  mean w - first period in Ramadan</td>
<td>66.44±11.2</td>
<td>0.76±1.4</td>
<td>0.090</td>
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<tr>
<td>mean w - after Ramadan</td>
<td>67.21±11.4</td>
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<tr>
<td>3&amp;4  mean w - last period in Ramadan</td>
<td>67.50±12.3</td>
<td>-0.29±1.1</td>
<td>0.409</td>
</tr>
<tr>
<td>mean w - after Ramadan</td>
<td>67.21±11.4</td>
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<td></td>
</tr>
</tbody>
</table>

1= mean Body weight (w) - before Ramadan  
2= mean Body weight (w) - first period in Ramadan  
3= mean Body weight (w) - last period in Ramadan  
4= mean Body weight (w) - after Ramadan  
5SD=standard deviation

Discussion

In the current study, there were no significant changes in systolic and diastolic blood pressures during the 4 periods of ambulatory blood pressure monitoring in the case and control groups. In the study by Harvest, a significant decrease of 1 mm Hg or less was observed in the average 24-h blood pressure between the two measurements performed with a 3-month interval (6); however, most of the reports have shown no significant difference between the average 24-h blood pressure before and during Ramadan fasting (4, 6, 7).

In the present study, in the case group, there was a significant improvement in the heart rate during the second and third periods in comparison with the pre-Ramadan period; in addition, heart rate improved in the post-Ramadan period compared with the first period of Ramadan. Also, there was a significant reduction in heart rate during the post-Ramadan fasting period in comparison with pre-Ramadan measurement in the control group. To the best of our knowledge, there have been no reports of 24-hr heart rate monitoring during Ramadan fasting.

In the present study, weight was reduced by 0.830 kg during the third period in comparison with the pre-Ramadan period in the case group; this finding is similar to the weight decrease reported in previous studies (1.4 kg) (1). Although the findings of most studies are similar to the present results (4, 8-11), according to a previous study, no change was observed in anthropometric parameters (5).
Conclusion

This study showed a significant improvement in the heart rate over second and third periods of 24 hr monitoring in hypertensive patients. According to the results, no high-risk variations in blood pressure or heart rate were observed among the subjects. This finding suggested that fasting during the month of Ramadan, along with (previous) medication continuation might be useful and non-threatening for patients with essential hypertension, and free of complications.

Acknowledgement

This study was funded by a research grant from Mashhad University of Medical Sciences. We are most grateful to all subjects for their participation. AN, MHD, MAN were responsible for suggesting the study concept and design. MAN, AKKH, AKH and JF contributed to the design and conduct of the study, acquired, analyzed and interpreted the data, performed statistical analysis and assisted with the writing of the manuscript. All the authors read and approved the manuscript before submission, and none had personal or financial conflicts of interest.

References