

Effects of Ramadan fasting on Waist Circumference, Blood Pressure, Lipid Profile, and Blood Sugar on a Sample of Healthy Kuwaiti Men and Women

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ABSTRACT

The effects of Ramadan fasting on waist circumference, lipid profile, blood pressure and blood glucose was investigated in 60 healthy Kuwaiti volunteers consisting of 41 males and 19 females. Their ages ranged between 24 and 56 years in the male group, and from 23 to 33 years in the female group. Each volunteer had observed fasting for 12 hours a day for 21 days including menstruating women. There were no dietary restrictions in the study. Blood pressure, waist circumference and blood samples for total cholesterol, LDL cholesterol, HDL cholesterol, VLDL cholesterol, serum triglycerides and blood glucose were determined on the 1st and 4th week of Ramadan. In male subjects, the waist circumference, total cholesterol and LDL cholesterol were significantly reduced at the end of the 21-day fast period ($p < 0.0001$, $p < 0.05$, $p < 0.01$ respectively). Serum triglycerides, VLDL cholesterol and HDL cholesterol were not significantly increased. There were no significant changes in mean blood pressure and blood glucose among the men. In the female group, waist circumference was significantly reduced ($P < 0.001$), whereas total cholesterol, triglycerides, LDL cholesterol, VLDL cholesterol, mean blood pressure and blood glucose were not significantly decreased. The HDL cholesterol of the women was increased compared to pre-fasting, but the difference was not statistically significant. In the study population in general, the Atherogenic Index [(total cholesterol-HDL cholesterol)/HDL cholesterol] was significantly decreased ($p < 0.01$). The reduction in waist circumference and Atherogenic Index were probably due to the beneficial effect of Ramadan fasting. We believe that fasting during Ramadan beneficially influences the waist circumference and lipid profiles of the subjects in this sample of Kuwaiti population. The benefits were more pronounced in the male compared to the female subjects.

INTRODUCTION

Ramadan fasting is one of the main pillars of Islam. The majority of Muslims fast from dawn to dusk during the whole month of Ramadan to fulfill religious criteria. Ramadan is the ninth month in the

lunar calendar. The daily fast lasts about 12-19 hours every day, depending on the season in which Ramadan falls and on the geographic location of the country. Muslims who observe fasting usually have 2 meals per day, *Iftar* at sunset and *Sohor* before dawn. During Ramadan, Muslims

can take regular food allowed to them during the other months of the year. There is no restriction on any special diet or food items during the Ramadan fast. According to Islamic law, children aged below 12, sick patients, travelers and menstruating or nursing women are exempted from fasting. Ramadan fasting differs from total fasting, as re-feeding is permitted twice in 24 hours.

Ramadan Islamic fasting is an excellent model of how dietary modifications may affect the lipid profile. There have been only few studies on the effect of Ramadan fasting on health, especially in Kuwait. Akanji, Mojiminiyi & Abdella (2000) demonstrated beneficial changes in serum apo A-1 and its ratio to apo B and HDL in stable hyperlipidaemic subjects after Ramadan fasting in Kuwait. Mohammad *et al* (2003) observed no significant differences in acute myocardial infarction admissions during Ramadan months compared to one month prior to it in 5 consecutive years

Hyperlipidaemia is one of the established major risk factors of coronary heart disease & cerebrovascular disease. As early as in 1996, statins were hailed as "miracle drugs" and their underuse duly noted (Roberts, 1996). According to criteria based on the current guidelines of the NCEP- ATP III, of the 36 million people who should be taking statins in the United States only 11 million are on them (Ford *et al.*, 2003). Across the world, of 200 million people who meet criteria for treatment, only 25 million take treatment with statins due to excessive cost. The statin drugs account for the largest prescription drug expenditure in the United States at \$12.5 billion per year (Wilde & Landers, 2003). However there is an equally important, yet grossly underutilised means of treatment of hyperlipidaemia.

Diet modification is the cornerstone of therapy for mild to moderate hyperlipidaemia and is also recommended along with pharmacological treatment in people

at higher risk of coronary heart disease as a part of other interventions like exercise, smoking cessation, cessation of excessive alcohol, and weight control. Diet therapy has shown modest reductions in lipid levels in the population, (Henkin, Shai & Zuk, 2000; Alfred, 2003). A survey found that as many as 50% of patients with elevated cholesterol levels would prefer over-the-counter products like garlic, yeast or soya products (Caron & White, 2001; Anderson, Johnstone & Cook-Newell, 1995; Silagy & Neil, 1994).

The aim of this study is to evaluate and to compare the effects of Ramadan fasting on blood pressure, waist circumference, lipid profiles and blood sugar on healthy randomly-selected males and females.

METHODS

Sixty healthy adult volunteers were recruited, comprising 41 males between 24 and 56 years (mean age 37 ± 8.6 years) and 19 females between 23 and 33 years (mean age 27.7 ± 3.4 years). The subjects consisted of a group of healthy people from the community who responded to our advertisements of the study at mosques and hospitals. The study was carried out in the month of October-November, 2003. The average duration of the fast was about 12 hours a day. Volunteers were allowed to eat what ever they liked from *Iftar* to (sunset to dawn)

Blood samples were collected by finger-prick from the left index finger. Approximately 35-60 microliters of whole blood was drawn from each volunteer, after about 12 hours of fasting, in the 1st and 4th week of Ramadan, into a Cholestech capillary tube. The total cholesterol, LDL cholesterol, HDL cholesterol, VLDL cholesterol, serum triglycerides and blood glucose were analysed by enzymatic method using L.D.X. analyser (Cholestech Corporation, USA). The total

error estimate for lipid levels by L.D.X analyser meets the CDC guidelines and has documented agreement with the CDC reference method (Bachorik & Ross, 1995). The right arm was used to measure blood pressure twice, 5 minutes apart by the same observer and the average value calculated. The mean arterial blood pressure was determined using the formula: mean arterial blood pressure = diastolic blood pressure + 1/3 (systolic blood pressure - diastolic blood pressure). The waist circumference was measured at the narrowest point between the highest point of Iliac crest and the lower costal margin by the same observer (Ford, Giles & Dietz, 2002). The Atherogenic Index was calculated by the formula $AI = (Total\ cholesterol - HDL\ cholesterol) / HDL\ cholesterol$ (Tatsukawa *et al.*, 2000).

The statistical analysis was performed using SPSS (11) software standard version. Quantitative data were reported as mean \pm standard deviation and compared using the paired two-tailed student's T test. A probability level of <0.05 was considered statistically significant.

RESULTS

The subjects comprised 60 healthy volunteers, 41 males (68.3%) and 19 females (31.7%). The mean age was 37 ± 8.6 years (males) and 27.7 ± 3.4 years (females). In the male group (Table 1), the waist circumference, total cholesterol and LDL cholesterol were significantly reduced at the end of fasting ($p < 0.0001$, $P < 0.05$, $p < 0.01$ respectively). There was a non-significant rise in the HDL cholesterol, serum triglycerides and VLDL cholesterol values at the end of the fast ($p < 0.52$, $p < 0.89$, $p < 0.7$) respectively. Mean blood pressure and blood glucose levels were not affected significantly.

In the female group (Table 2), the waist circumference was reduced signifi-

cantly ($p < 0.001$). A reduction in the average values of total cholesterol, serum triglycerides, LDL cholesterol, VLDL cholesterol, mean blood pressure and blood glucose was observed at the end of the fast but the differences were not statistically significant. There was a non-significant increase in HDL cholesterol at the end of the fast ($p < 0.52$). In the study population in general, there was a significant reduction in the Atherogenic Index - (AI) ($p < 0.01$) Table 3.

DISCUSSION

In males and females, waist circumference, as a reflection of abdominal adiposity, was decreased significantly. These results are in line with the reports of Azizi (1978), Takruri (1989) and Poh *et al.* (1996), who observed a significant decrease in body weight during Ramadan fasting. The decrease in body weight was attributed to efficient utilisation of body fat during fasting (ElAti, Beji & Danguir, 1995). It has also been reported that overweight persons lose more weight than normal or under-weight subjects during Ramadan fasting, (Takruri, 1989). Obesity has been recognised as a serious risk factor for mortality and morbidity of cardiovascular diseases in general population (Huebert *et al.*, 1983). Kissebah & Krakower (1994) and Wajchenberg (2000) have demonstrated that cardiovascular disease-related morbidity and mortality might be affected not only by the total amount of fat but also by the regional distribution of body fat. Subsequent epidemiological reports have established that abdominal fat accumulation increases the incidence of cardiovascular disease and death (Daniel *et al.*, 2003). Hence the reduction in waist circumference observed in this study after 3 weeks of fasting may translate into a significant health benefit for those who fast.

Table 1. Comparison of the effects of Ramadan fasting on various parameters in male group (n=41)

<i>Variables</i>	<i>1st week of Ramadan</i>	<i>4th week of Ramadan</i>	<i>Normal value^a</i>	<i>P value</i>
Waist circumference, cm	94.68±11.01	92.00±10.70	<102	<0.0001
Total cholesterol, mM/L	4.91±0.96	4.75±0.76	3.4-7.2 ^b	<0.05
Triglycerides, mM/l	1.33±0.60	1.54±1.1	0.5-3.3 ^b	0.89
LDLc, mM/L	3.40±0.82	3.16±0.78	1.55-5.31 ^b	<0.01
HDLc, mm/L	1.02±0.33	1.04±0.37	0.78-1.81 ^b	0.52
VLDLc, mM/L	0.65±0.29	0.67±0.30	0.128-0.645	0.7
Mean blood pressure ^c	93.1±9.0	90.83±9.83	93.33	0.13
Blood glucose	5.55±0.58	5.55±0.55	3.9-6.1	<0.98

Values given in columns 2 and 3 are mean±standard deviation

^a Handbook of Laboratory Investigation (Mughal, 1996)

^b Reference ranges adjusted to age & sex

^c Mean arterial blood pressure = diastolic blood pressure + 1/3(systolic blood pressure - diastolic blood pressure)

Table 2. Comparison of the effects of Ramadan fasting on various parameters in female group (n=19)

<i>Variables</i>	<i>1st week of Ramadan</i>	<i>4th week of Ramadan</i>	<i>Normal value^a</i>	<i>P value</i>
Waist circumference, cm	89.76±17.52	87.18±17.53	<88	<0.001
Total cholesterol, mM/L	4.17±0.72	4.07±1.02	3.4-5.7 ^b	0.62
Triglycerides, mM/l	1.38±0.96	1.19±.80	0.5-1.8 ^b	0.45
LDLc, mM/L	2.40±0.72	2.32±0.77	1.55-4.40 ^b	0.46
HDLc, mm/L	1.27±0.34	1.32±0.36	0.78-3.07 ^b	0.52
VLDLc, mM/L	0.55±0.20	0.49±0.19	0.128-0.645	0.36
Mean blood pressure ^c	86.39±9.84	85.23±9.24	93.33	0.51
Blood glucose	5.40±0.89	5.20±0.54	3.9-6.1	0.34

Values given in columns 2 and 3 are mean±standard deviation

^a Hand book of Laboratory Investigation (Mughal, 1996)

^b Reference ranges adjusted to age & sex

^c Mean arterial blood pressure = diastolic blood pressure + 1/3(systolic blood pressure - diastolic blood pressure)

Table 3. Comparison of the effects of Ramadan fasting on Atherogenic Index (n=60)

Variables	1st week of Ramadan	4th week of Ramadan	Normal value	P value
Atherogenic Index	3.78±1.9	3.4±1.55	<4.0	<0.01

Values given in columns 2 and 3 are mean±standard deviation

The effect of Ramadan fasting on lipid profile in this study was more pronounced in the male subjects compared to the female. This difference in benefit could probably be explained by a significantly higher pre-fasting or basal level of total cholesterol in the male group 4.91 ± 0.96 compared to the total cholesterol 4.17 ± 0.72 in the female group ($p < 0.005$). A significantly higher pre-fasting LDL cholesterol value 3.40 ± 0.82 was also observed in the male group compared to the LDL cholesterol 2.40 ± 0.72 in the female group ($p < 0.001$). This is in line with a study conducted on 96 hyperlipidaemic subjects who received physician or dietitian counseling for lifestyle modification which concluded that the magnitude of the effect of diet control on the levels of cholesterol & LDLc are proportionate to the baseline cholesterol & LDLc levels (Henkin & Shai, 2003). Hence the significantly lower baseline lipid values in the younger female population might have limited the magnitude of the beneficial effect of fasting in that group.

Studies reported in literature on the effect of Ramadan fasting on various blood components have been conflicting and inconsistent. Adlouni & Ghalim (1997) reported a significant decrease in total cholesterol, serum triglycerides, LDL cholesterol and HDL cholesterol with fasting that persisted even up to one month after Ramadan. Maislos *et al.* (1993) observed a rise in HDL-cholesterol, a reduction in the total cholesterol/HDL cholesterol ratio and in the LDL chol/HDL chol ratio, and no significant difference in serum triglyc-

erides and total cholesterol, LDL cholesterol and VLDL cholesterol with fasting. Hallak & Nomani (1988) found a decrease in LDL cholesterol, an increase in HDL cholesterol, but no change in the total cholesterol with fasting. Nagra & Rahman (1998) reported a significant decrease in total cholesterol and LDL cholesterol, but there were non-significant increases in HDL cholesterol, serum triglycerides and VLDL cholesterol in a study conducted on 26 healthy females. The variations in the results from different studies could be explained by the fact that Ramadan fasting follows the lunar cycle rather than the solar cycle. Hence the duration of fasting, which is limited during daylight hours, varies from country to country and from year to year depending on whether Ramadan falls during long hot summer days or short cold winter days. Also the diverse social and economic differences between different ethnic groups may have influenced dietary patterns. These factors might have significant effects on the measured variables in different studies that were carried out in previous years.

Standardisation of research methodology regarding the time of the year and season when the data were collected and correction for the ethnicity of the subject populations may make study results more amenable to comparison.

In this study population in general, there was a significant reduction in the Atherogenic Index. Reductions in Atherogenic Index (decreased total cholesterol and increased HDL cholesterol) were associated with decreased morbidity and

mortality from coronary heart disease in both primary (West of Scotland Coronary Prevention study Group, 1996) and secondary prevention trials (Goldberg, Mellies & Sacks, 1998).

The mean blood pressure of the subjects was reduced at the end of the fast both in the male and in the female, but the reduction was not found to be statistically significant. This is in agreement with a study conducted by Habbal *et al.* (1998) who reported minimal variation of blood pressure during the month of Ramadan. This variation during Ramadan may be influenced by variations in sleep pattern, activity, eating pattern and hydration status during the month of Ramadan. However, spiritual fasting beneficially affects the mental and emotional health of individuals. Persons undergoing spiritual fasting describe a feeling of inner peace and tranquility. Hostility during the month of Ramadan is minimal as suggested by an investigation in Jordan where a significant reduction in parasuicidal cases was noticed during the month of Ramadan (Daradkheh, 1992). The blood glucose levels after fasting in our study showed non-significant changes.

We conclude that Ramadan fasting has a significant beneficial effect on the waist circumference and lipid profiles in the sample of subjects in Kuwait. The limitation of the study was the inability to find a control group, as it was not possible to find healthy Muslims in Kuwait who did not fast during Ramadan. Another limitation of the study is that dietary inventory was not kept and the volunteers were free to eat what they liked during the night. Our subject population totaling 60 is probably inadequate for subset analyses of the differential effects of Ramadan on gender, ethnicity and other population differences.

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