Effects of Ramadan Fasting on Some Biochemical Parameters in healthy subjects.

Haleema AlNahari¹ and Hamed Kouja²

Abstract—During the fasting month of Ramadan, Muslims are obliged to fast during daytime hours and restrict food and drink intake to the period after sunset. Modifications in the circadian distribution of the eating and sleeping schedule result in various changes in different biochemical parameters. In this study the effect of fasting on glucose, insulin, Cortisol, triglyceride, cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), estradiol, testosterone, thyroid stimulating hormone (TSH), FT4 and FT3 during and post fasting was measured. Blood samples were taken from 26 adult male subjects during and post fasting. The results obtained showed a significant decrease in glucose and TSH levels, while the levels of insulin triglyceride, free thyroxine (FT4) and free triiodothyronine (FT3) showed a significant increase. This study showed that there are changes in dietary habits depending on cultural rituals, often practices during Ramadan, among Muslim societies. Consequently that may affect various components of metabolic importance.

Keywords: Ramadan Fasting, biochemical parameters, Glucose, Insulin, Cortisol, Cholesterol, Testosterone, lipoprotein and thyroid stimulating hormone.

1. Introduction

Ramadan is month during which Muslims refrain from food liquid hours and eat a meal Free eating is allowed from sunset to dawn. Ramadan teaches Muslims self-restraint and reminds them of the feelings of the impoverished. Ramadan is observed by over 400 million of Muslims who spread across the globe; and live under various geographical, climatic, social, cultural and economic conditions. This provides a unique opportunity to study the biochemical changes over Ramadan time (Al Hourani, 2009).

Ramadan fasting affects a huge population, numerous studies were performed in the last two decades to show the effect of Ramadan fasting on various parameters in healthy (Dewanti et al., 2006; Ziaee et al., 2006) and unhealthy populations (Sadiya et al., 2011; Khafaji et al., 2012; Kul et al., 2013).

The metabolic effects of fasting during Ramadan, may be affected by genetic and environmental factors, such as nutrition habits and the length of fasting day. Therefore, differences in the effects of Ramadan fasting may occur between seasons and countries (Azizi, 2010).

During the fasting month of Ramadan, Muslims are obliged to fast during daytime hours and restrict food and drink intake to the period after sunset. Long lasting modifications in the circadian distribution of the eating and sleeping schedule result in various changes in metabolism. This will provide a unique opportunity to study the effect meal frequency reduction on biological indices (Al Hourani, 2009).

In most of the studies, it was found that Ramadan fasting leads to changes in the metabolic status including blood glucose and lipid (Dewanti et al., 2006; Ziaee et al., 2006; Sadiya et al., 2011; Khafaji et al., 2012; Kul et al., 2013). However, results of these studies vary due to eating habits, gender, age, and ethnicity.

Metabolic modifications are accompanied by endocrine changes thought to be capable of altering sleep. Compared with non-fasting controls, cortisol secretion is significantly higher during Ramadan (Sliman et al., 1993).

All recent studies on healthy subjects with normal body weight to show the effect of Ramadan fasting on the most widely reported health outcomes including total cholesterol, HDL (high density lipoprotein), LDL (low density lipoprotein), triglycerides, and fasting blood glucose (Kul et al., 2013).

Fasting in Ramadan has been shown to have some effects on the circulating levels of several biochemical markers known to be associated with vascular and metabolic disorders including lipid profile (Zadegan et al., 2000; Saleh et al., 2005; Khaled and Belbraouet, 2006).
2009). It is known that the lipid is influenced by dietary habits, physical factors, the percentage of fat, type of fat saturation, and the percentage of simple sugars in the daily diet and weight loss (Hallak and Nomani, 1988; Nomani et al., 1992; Maislos et al., 1993; Adlouni et al., 1997; Nomani, 1997; Nagra et al., 1998; Tsai et al., 2003; Furuncuoglu et al., 2007). Ramadan fasting showed to have effect on lipid profile by increasing HDL and decreasing LDL levels (Mansì, 2007; Ibhrim, et al., 2008; Lamri-Senhadji, et al., 2009). It has been found a significant decrease in serum cholesterol and serum triglycerides(Marbut et al.2005). It has been reported that a significant increase in high density lipoprotein - cholesterol (HDL-C) and a decrease in low density lipoprotein – cholesterol (LDL-C) during Ramadan (Marbut et al.2005; Abdulrahman et al 2006 and Farshidfar et al., 2006). Moreover, there are regional disparities in dietary habits depending on cultural rituals, often practices during Ramadan, among Muslim societies. Consequently such disparities may affect various components of metabolic importance (Barkia et al., 2011). Other lifestyle changes, most notably, the more frequent and voluntary prayers performed during Ramadan which is comparable to moderate exercise, may lead to a healthier outcome (Shehab et al., 2012).

Several studies have demonstrated the effect of total food abstinence on the peripheral metabolism of thyroid hormone and hypothalamic-pituitary-thyroid axis (Boear et al., 1983; Spencer et al., 1983). Fedail et al. (1982) has studied serum levels of thyroid hormones on the first and the last days of Ramadan and found significant increase in serum T4 but no change in serum T3 levels. Khan et al. (1986) in their study on 33 normal volunteers compared serum T3 and T4 levels during 15th hour of fasting with levels reached three hours after breaking the fast. They did not observe any significant difference. Al-Chalabi,(2013) Resulted that was a decrease in testosterone level after fasting but not reach significance when compared with its level before fasting. Serum levels of FSH, LH, prolactin and testosterone were unchanged after fasting of Ramadan.

Aim of research:
The aim of this study was to assess the effects of Ramadan fasting on several biochemical parameters in physically active men by comparing the values of these parameters during and post fasting.

2. MATERIALS AND METHODS:

Blood samples were taken from 26 adult male subjects during and post fasting. Insulin and cortisol were measured by electrochemiluminescence immunoassay using the Elecsys 2010. Glucose, triglyceride, cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), estradiol, testosterone, thyroid stimulating hormone (TSH), FT4 and FT3 were measured using Hitachi/Roche 917 chemistry autoanalyzer.

STATISTICAL ANALYSIS:
The data were presented as the mean ± S.E. Statistical differences between the values during and post fasting were determined by Student’s t-test.

3. RESULTS AND DISCUSSION:

From table (1) and figure (1,11) the glucose (mmol/l) and TSH (mlu/l) during fasting shows a values of (5.57 ± 0.07) (3.49 ± 0.31), and post fasting glucose and TSH shows a lower values (5.23 ± 0.15) (2.37 ± 0.20). Glucose and TSH are significantly decreased. Insulin (µU/l), triglyceride (mmol/l) FT4 and FT3 (pmol/l) during fasting have a values of (9.53 ± 0.73), (1.12 ± 0.08), (16.55 ± 0.37), (4.52 ± 0.14), respectively, and post fasting insulin, cortisol, triglyceride FT4 and FT3 have a higher value (28.79 ± 5.78), (1.37 ± 0.08), (17.71 ± 0.50) (4.90 ± 0.16), respectively, as shown in table (1) and figure (2,4, 12,13). Insulin, cortisol, triglyceride FT4 and FT3 are significantly increased post fasting. The result record that the cortisol (nmol/l), Cholesterol and HDL (mmol/l) during fasting shows a value of (2.87 ± 0.14), (4.49 ± 0.17) (1.10 ± 0.04), respectively, and post fasting cortisol shows a slightly higher value(296.62 ± 13.58), (4.55 ± 0.17) (1.12 ± 0.03), respectively, figure (3,5,6). Table (1) and figure (7) shows the levels of LDL (mmol/l), during fasting it has a value of (2.87 ± 0.14), and post fasting LDL it has no difference in value (2.87 ± 0.15). Estradiol (pmol/l) and testosterone levels during fasting have a value of (203.24 ± 18.23) (9.88 ± 0.80), respectively, and post fasting estradiol and testosterone have a slightly lower value (198.43 ± 18.53) (9.38 ± 0.80), respectively, as can be seen from table (1) and figure (9,10).

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Ramadan is the holiest month in the Islamic . This
cohort study was performed during and after Ram-
adan. In this study we found the level of glucose
has decreased post fasting in comparison with the
value during fasting. This finding was in line with
the previous studies of Azizi, (1996); Sariri. et al.,
(2010); Kul et al., (2013) that found that a slight de-
crease in serum glucose occurs in normal adults a f-
after fasting has begun. In the case of blood glucose,
reduction during Ramadan could be due to gluco-
neogenesis (Sariri. et al., 2010).

Table 1. Mean values of Glucose, Insulin, Cortisol, Triglyc-
eride, Cholesterol, HDL, LDL, HDL/LDL ratio, Estradiol,
Testosterone, TSH, FT4 and FT3 during and post fasting.

<table>
<thead>
<tr>
<th></th>
<th>Fast</th>
<th>Mean ± S.E</th>
<th>Post</th>
<th>Mean ± S.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose (mmol/l)</td>
<td>5.57 ± 0.07</td>
<td>5.23 ± 0.15*</td>
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<tr>
<td>Insulin (µU/l)</td>
<td>9.53 ± 0.73</td>
<td>28.79 ± 5.78*</td>
<td></td>
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</tr>
<tr>
<td>Cortisol (nmol/l)</td>
<td>267.06 ± 14.82</td>
<td>296.62 ± 13.58</td>
<td></td>
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</tr>
<tr>
<td>Triglyceride(mmol/l)</td>
<td>1.12 ± 0.08</td>
<td>1.37 ± 0.08*</td>
<td></td>
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</tr>
<tr>
<td>Cholesterol (mmol/l)</td>
<td>4.49 ± 0.17</td>
<td>4.55 ± 0.17</td>
<td></td>
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<tr>
<td>HDL (mmol/l)</td>
<td>1.10 ± 0.04</td>
<td>1.12 ± 0.03</td>
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<tr>
<td>LDL (mmol/l)</td>
<td>2.87 ± 0.14</td>
<td>2.87 ± 0.15</td>
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<tr>
<td>HDL/LDL ratio</td>
<td>0.41 ± 0.03</td>
<td>0.42 ± 0.03</td>
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<tr>
<td>Estradiol (pmol/l)</td>
<td>203.24 ± 18.23</td>
<td>198.43 ± 18.53</td>
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<tr>
<td>Testosterone (nmol/l)</td>
<td>9.88 ± 0.80</td>
<td>9.38 ± 0.80</td>
<td></td>
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</tr>
<tr>
<td>TSH (mIU/l)</td>
<td>3.49 ± 0.31</td>
<td>2.37 ± 0.20*</td>
<td></td>
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</tr>
<tr>
<td>FT4 (pmol/l)</td>
<td>16.55 ± 0.37</td>
<td>17.71 ± 0.50*</td>
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<tr>
<td>FT3 (pmol/l)</td>
<td>4.48 ± 0.13</td>
<td>4.94 ± 0.15*</td>
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</tbody>
</table>

The mean ± S.E. P < 0.05 *.
However, the results recorded an increase in insulin and cortisol levels in fasting comparison with the value post fasting, the increase in insulin may be due to maintain glucose levels in the normal range which agrees with the study of Hasselbalch et al. (1995). They found that the elevations of insulin were to be able to maintain glucose levels in the normal range (Bahijri et al. 2013). The increase in cortisol levels during Ramadan, may be due to the greatly disturbed sleeping pattern the results are in agreement with earlier studies of al-Hadramy et al. (1988); Ben Salem et al. (2002); Haouari et al. (2008) that reported higher cortisol during the month of Ramadan. The elevation of cortisol post fasting was caused by a greatly disturbed sleeping pattern and may be associated with the hypercortisolism of chronic stress (Bahijri et al. 2013).

Also the current study found a significant decrease in triglyceride level in fasting comparison with the value post fasting. That may be due to that Ramadan may have beneficial influence on metabolic.

The reports of Haghdoost and Poorranjbar (2009); Mahboob et al. (1999); Asgary et al. (2000); Marbut et al.(2005); Unalacak et al.( 2011) and Al-Shafei (2013) agree with our findings as they found a significant decrease in serum triglyceride during Ramadan. The reduction in serum triglyceride can be explained either by changes in fat intake or inherent metabolic changes during Ramadan (Mahboob et al. 1999 and Asgary et al. 2000). Fasting improves lipids profile (Unalacak et al. 2011 and Al-Shafei 2013)

Haghdoost and Poorranjbar (2009) They found that physical activity alone cannot explain the variations in the lipid profile. Other factors, such as changes in the diet and sleeping hours, may have more important roles

While, an increase in cholesterol levels was found in this study. These results are in agreement with
And, there was an increase in HDL after fasting in the present study, which agrees with the previous studies of Adlouni et al. (1997); Maislos et al. (1998); Rahman et al. (2004); Farshidfar et al. (2006); Salehi and Neghab, (2007); Chao uachi et al. (2008); Kul et al. (2013) that found a marked increase in plasma HDL occurring after Ramadan fasting has been observed. The changes in lipid profile, however, may vary depending on the quality and quantity of food intake, and physical activity (Alkandari et al. 2012). But, this study found no change in the level of LDL after fasting, and that agrees with the study of Bahijri et al. (2013) that found that LDL had a remarkable stability that can be explained by the feeding pattern of the subjects.

While, there has been a decrease in the ratio of LDL/HDL, and that agrees with the previous studies of Streja et al. (1980); Maislos et al. (1993); Murphy et al. (1996), and that may be due to eating one large meal each day and that leads to a significant increase in serum HDL levels, while decreasing the LDL/HDL ratio in healthy subjects during Ramadan (Streja et al. 1980; Maislos et al. 1993 and Murphy et al. 1996).

It has been found in this study that estradiol level decreased slightly and insignificantly, that comes in line with Shahabi, (2010) that found that Islamic fasting causes neither significant variation in the secretion of hormones around ovulation nor does it influence the occurrence of ovulation. Also, the current study found a decrease in the level of testosterone. Mean testosterone levels decreased in the study of Mesbahzadeh et al. (2005), which agrees with our findings. Other studies found no significant change in the levels of testosterone before, during and after Ramadan (Azizi, 1991, El-Migdadi et al. 2004). Previous studies have demonstrated that abstinence from eating and drinking during the Ramadan fast, which is accompanied by variations in the sleeping and waking pattern, and the psychological effects of fasting may bring about rhythmic changes in the secretion of most of the body’s hormones (Fedail et al. 1982; Irak et al. 1997).

In our study we found a significant increase in TSH level during Ramadan fasting, this result agrees with the study of Sajid et al. (1991) and Bogdan et al. (2001) that said that normal adults basal levels of TSH decreased by 50% after 36 hours of fasting. The increase in TSH level might be due to daytime fasting, modifications in sleep schedule and psychological and social habits during Ramadan that induce changes in the rhythmic pattern of a number of hormonal variables (Bogdan et al. 2001).

Consequently, this study reported a significant decrease in FT3 and FT4, during Ramadan fasting might be due to feeding behavior that does not agree with previous study of Azizi, (1991) that reported that Ramadan has no effect FT3 level. This study agree with Chao uachi et al. (2008) they found change in FT3 might be due to metabolic adjustments made with alterations in fluid and food intake and bdulla,(2011)They resulted that there were reduction in diameter of thyroid follicles, amount of colloid and height of follicular epithelium in the experimental group. There was a significant increase in the number of C- cells in experimental group. The reduction in thyroid follicles, thyroid colloid and height of follicular epithelium occur as a result of changing in feeding behavior which causes decrease in iodine food incorporation, and decrease in level of 5- monodeiodinase a mediator of T3 and T4. The increase in the number of C cells happened as a protective mechanism to save the skeleton from excessive bone resorption. Belchetz et al. (1978)The decrease in TSH level and increase in FT4 and FT3 is a natural result of the negative feedback regulation of thyrotrophin secretion.

References


[5]. Al-Hadramy, MS., Zawawi, T.H.and Abdul-


