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IMPACT OF RAMADAN FASTING ON SOME BIOCHEMICAL ASPECTS IN HEALTHY SUBJECTS

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ABSTRACT

Muslims are obligated to fasting during the day and restricting food and drinking amount for the period after the sunset during Ramadan. 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), FT_4 and FT_3 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 (FT_4) and free triiodothyronine (FT_3) 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, Triglyceride, Cholesterol, Testosterone, Thyroid stimulating hormone (TSH).

Contribution/ Originality

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1. INTRODUCTION

Ramadan is the month during which Muslims refrain from food, liquids and tobacco smoking during daylight hours and eat a main meal after sundown. Free eating is allowed from sunset to dawn. Ramadan teach Muslims self–restraint and remind 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 [1].

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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 [2, 3] and unhealthy populations [4-6].

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 [7].

In most of the studies, it was found that Ramadan fasting leads to changes in the metabolic status including blood glucose and lipid [2-6]. However, results of these studies vary due to eating habits, gender, age, and ethnicity. Metabolic changes are accompanied by endocrine changes thought to be capable of altering sleep. Compared with non-fasting controls, cortisol secretion is significantly higher during Ramadan [8].

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 [6].

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 [9-11]. 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 [12-19]. Ramadan fasting showed to have effect on lipid profile by increasing HDL and decreasing LDL levels [20-22]. It has been found a significant decrease in serum cholesterol and serum triglycerides[23]. 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 [23-25]. Consequently such disparities may affect various components of metabolic importance [26]. 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 [27].

Several studies have demonstrated the effect of total food abstinence on the peripheral metabolism of thyroid hormone and hypothalamic-pituitary-thyroid axis [28, 29]. Fedail, et al. [30] has studied serum levels of thyroid hormones on the first and the last days of Ramadan and found significant increase in serum T_4 but no change in serum T_3 levels. Khan, et al. [31] in their study on 33 normal volunteers compared serum T_3 and T_4 levels during 15th hour of fasting with levels reached three hours after breaking the fast. They did not observe any significant difference. Al-Chalabi [32] Resulted that was a decrease in testosterone level after fasting but not reach significance when compared with its level before fasting.

1.1. Aim of Research

The aim of this study was to assess the effects of Ramadan fastingon several biochemical parameters in physically activemen 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 measured by electrochemiluminscence immunoassay (the Elecsys, 2010). Glucose, triglyceride, cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), estradiol, testosterone, thyroid stimulating hormone (TSH), FT_4 and FT_3 were measured using Hitachi/Roche 917 chemistry autoanalyzer.

2.1. 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

Table: Mean values of Glucose, Insulin, Cortisol, Triglyceride, Cholesterol, HDL, LDL, HDL/LDL ratio, Estradiol, Testosterone, TSH, FT_4 and FT_3 during and post fasting.

	Fast Mean ± S.E	Post Mean ± S.E
Glucose (mmol/l)	5.57 ± 0.07	5.23 ± 0.15*
Insulin (µU/l)	9.53 ± 0.73	28.79 ± 5.78*
Cortisol (nmol/l)	267.06 ± 14.82	296.62 ± 13.58
Triglyceride(mmol/l)	1.12 ± 0.08	1.37 ± 0.08*
Cholesterol (mmol/l)	4.49 ± 0.17	4.55 ± 0.17
HDL (mmol/l)	1.10 ± 0.04	1.12 ± 0.03
LDL (mmol/l)	2.87 ± 0.14	2.87 ± 0.15
HDL/LDL ratio	0.41 ± 0.03	0.42 ± 0.03
Estradiol (pmol/l)	203.24 ± 18.23	198.43 ± 18.53
Testosterone (nmol/l)	9.88 ± 0.80	9.38 ± 0.80
TSH (mlu/l)	3.49 ± 0.31	2.37 ± 0.20*
FT_4 (pmol/l)	16.55 ± 0.37	17.71 ± 0.50*
FT_3 (pmol/l)	4.48 ± 0.13	4.94 ± 0.15*

The mean ± S.E. $P < 0.05$ *.

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 (Mol/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 (nmol/l) during fasting shows a value of (267.06 ± 14.82), (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).

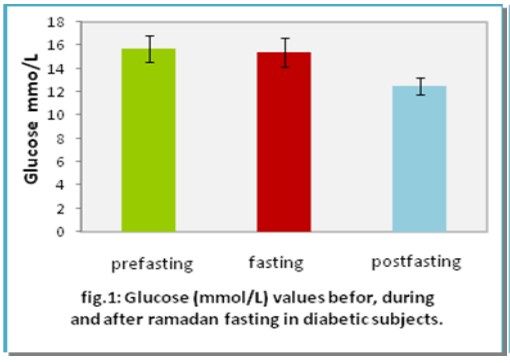

fig.1: Glucose (mmol/L) values befor, during and after ramadan fasting in diabetic subjects.

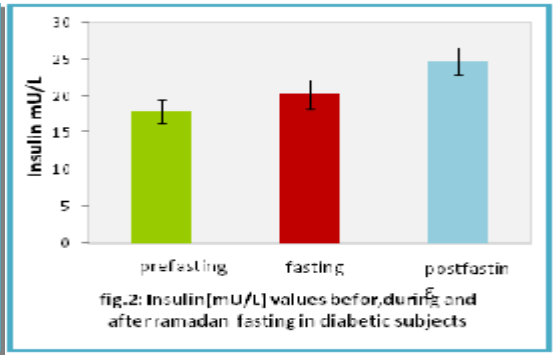

fig.2: Insulin [mU/L] values befor,during and after ramadan fasting in diabetic subjects

Ramadan is the holiest month in the Islamic . This cohort study was performed during and after Ramadan. 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 [33]; Sariri, et al. [34]; Kul, et al. [6] that found that a slight decrease in serum glucose occurs in normal adults after fasting has begun.

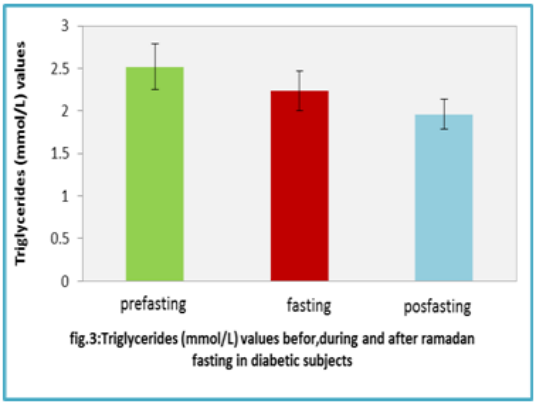

fig.3:Triglycerides (mmol/L) values befor,during and after ramadan fasting in diabetic subjects

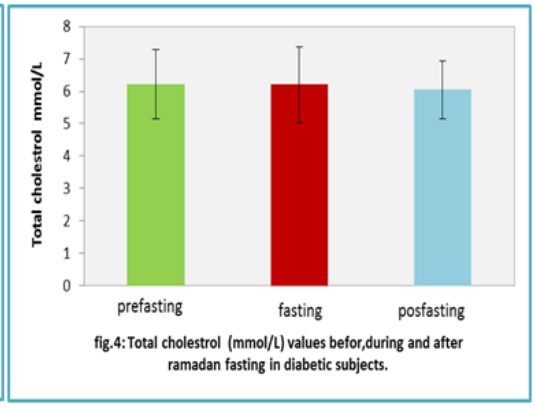

fig.4: Total cholestrol (mmol/L) values befor,during and after ramadan fasting in diabetic subjects.

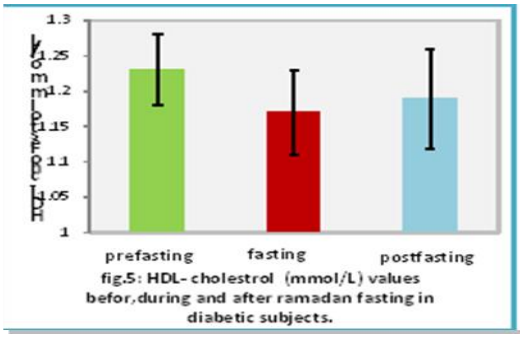

fig.5: HDL- cholestrol (mmol/L) values befor,during and after ramadan fasting in diabetic subjects.

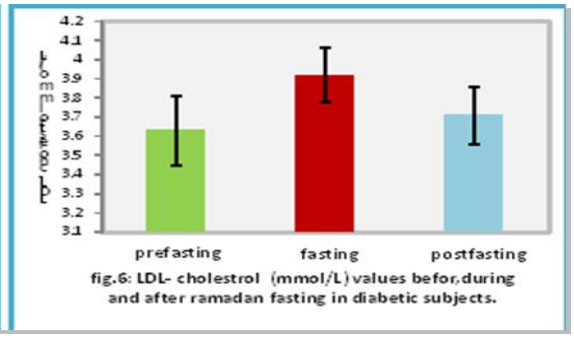

fig.6: LDL- cholestrol (mmol/L) values befor,during and after ramadan fasting in diabetic subjects.

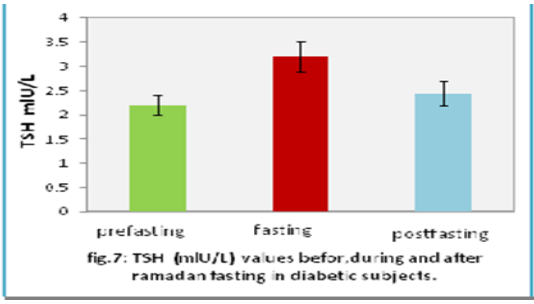

fig.7: TSH (mIU/L) values befor,during and after ramadan fasting in diabetic subjects.

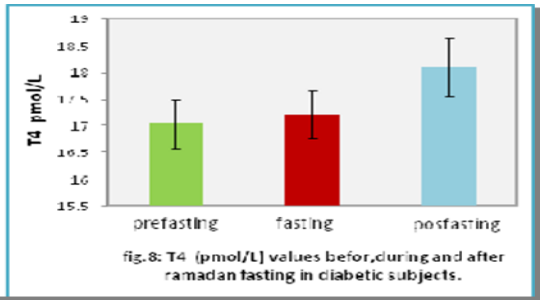

fig.8: T4 (pmol/L) values befor,during and after ramadan fasting in diabetic subjects.

In the case of blood glucose, reduction during Ramadan could be due to gluconeogenesis [34].

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. [35]. They found that the elevations of insulin were to be able to maintain glucose levels in the

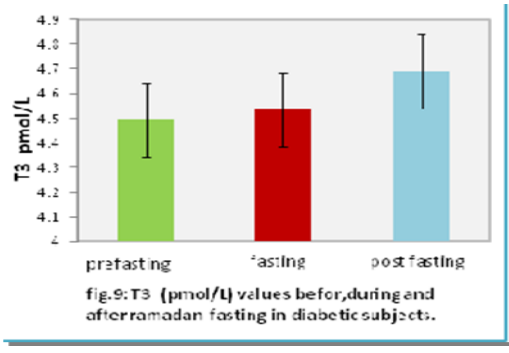

fig.9:T3 (pmol/L) values befor,during and afterramadan fasting in diabetic subjects.

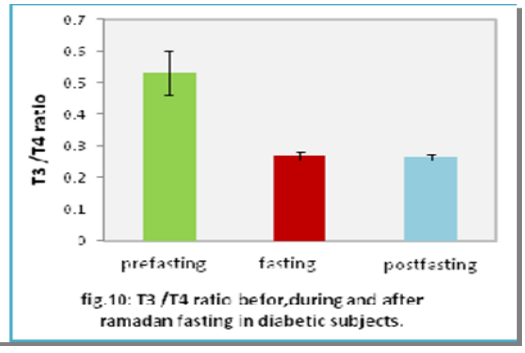

fig.10: T3 /T4 ratio befor,during and after ramadan fasting in diabetic subjects.

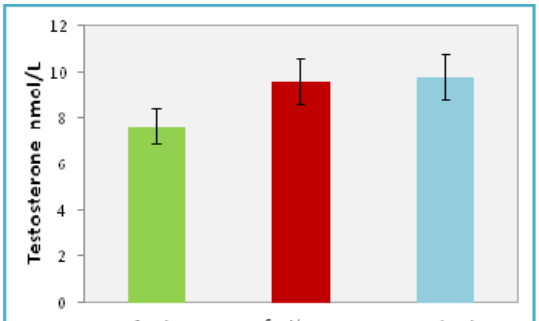

fig.11: Testosterone (nmol/L) values befor,during and after ramadan fasting in diabetic subjects.

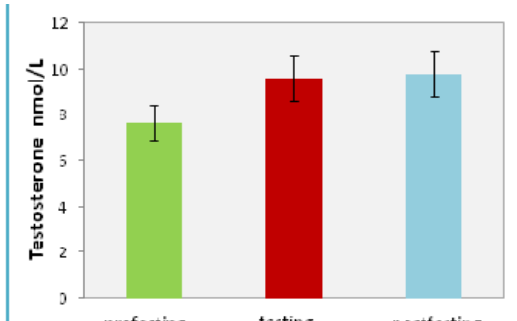

fig.11: Testosterone (nmol/L) values befor,during and after ramadan fasting in diabetic subjects.

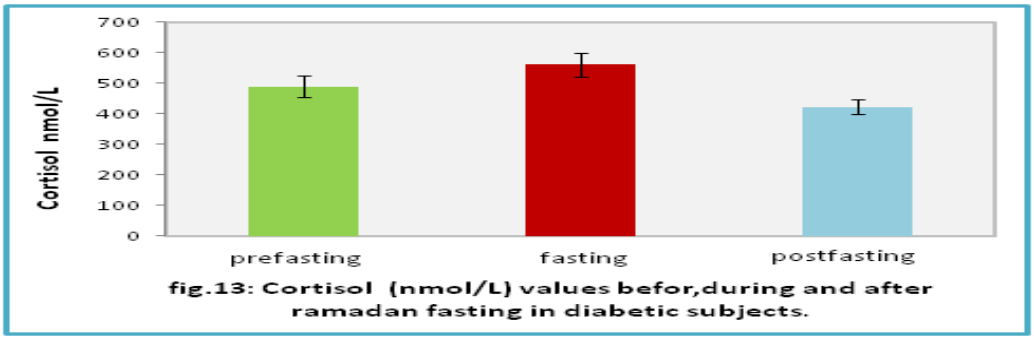

fig.13: Cortisol (nmol/L) values befor,during and after ramadan fasting in diabetic subjects.

normal range [36]. 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. [37];Ben Salem, et al. [38]; Haouari, et al. [39] 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 [36].

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 [40]; Mahboob, et al. [41]; Asgary, et al. [42]; Marbut, et al. [23]; Unalacak, et al. [43] and Al-Shafei [44] 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 [41, 42]. Fasting improves lipids profile [43, 44]

Haghdoost and Poorranjbar [40] found that physical activity alone cannot explain the variations in the lipid profile. While, an increase in cholesterol levels was found in this study. These results are in agreement with the reports of Gumaa, et al. [45];El-Hazmi, et al. [46] and Ziaee, et al. [3]. They said that serum cholesterol may rise during Ramadan. That elevation may be may be related to weight loss during Ramadan fasting [3, 12, 30, 47].

And, there was an increase in HDL after fasting in the present study, which agrees with the previous studies of Adlouni, et al. [15]; Maislos, et al. [48]; Rahman, et al. [49]; Farshidfar, et al. [25]; Salehi and Neghab [50]; Chaouachi, et al. [51]; Kul, et al. [6] 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 [52]. But, this study we found no change in the level of LDL after fasting, and that agrees with the study of Bahijri, et al. [36] 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. [53]; Maislos, et al. [14]; Murphy, et al. [54], 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 ratioin healthy subjects during Ramadan [14, 53, 54].

It has been found in this study that estradiol level decreased slightly and insignificantly, that comes in line with Shahabi, et al. [55] 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 present study found that a decrease in the level of testosterone. Other studies found no significant change in the levels of testosterone before, during and after Ramadan [56, 57,58].

In our study we found a significant increase in TSH level during Ramadan fasting, this result agree with the study of Sajid, et al. [59] and Bogdan, et al. [60] 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 [60].

Consequently, this study reported a significant decrease in FT_3 and FT_4, during Ramadan fasting might be due to feeding behavior. This result does not agree with previous study of Azizi [56] that reported that Ramadan has no effect FT_3 level. This study agree with Chaouachi, et al. [51] they found change in FT_3 might be duo to metabolic adjustments made with alterations in fluid and food intake and Abdulla [61] 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 cell number in the 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-monodeiodoinase 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. [62] found that the decrease in TSH level and increase in FT4 and FT3 is a natural result of the negative feedback regulation of thyrotrophinsecretion .

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