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Some Biochemical Changes during Summer Islamic Fasting in Diseased Patients in Comparison with Normal

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Abstract Some biochemical parameters in serum of diabetic, hypertensive and hypothyroid patients are estimated pre and post summer Islamic fasting in comparison with healthy control. Sixteen diseased patients (3 male and 13 female) with twelve healthy control persons (3 male and 9 female) at a mean age of (43 ± 8.22 years) and (37.5 ± 10.81 years) respectively. Proper history and blood sample were collected from all subscribers in the first and last day of Ramadan. Patients group demonstrate significant decrease in fasting blood glucose (FBG) level, blood urea, serum creatinine, and uric acid (as an improvement of kidney function), total and direct serum bilirubine and aspartate transaminase (AST) (indicate improvement of liver detoxification and excretion capacity) in addition to significant elevation of high density lipoprotein (HDL) levels during Ramadan. Healthy subjects show decrease in the body weight; with significant decrease in FBG, alkaline phosphatase (ALP), AST and significant increase in the HDL. All previous results clinically insignificant as they are not deviated from the normal reference ranges, meanwhile they are considered as good factors for controlling lipids, diabetes, hypertension and other diseases related to kidneys or liver during Ramadan, moreover health benefit in non-diseased subjects.

Keywords: *islamic fasting, transaminases, FBG, kidney function and lipid profile tests*

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1. Introduction

Fasting during Ramadan starts one hour before sunrise till sunset, as about 15 hours/ day at which food and drink are prohibited during the daylight hours. Many people observe fasting as a religious obligation while it is generally safe and beneficial for all healthy able bodied adults by modulating life style like changing sleep hours, increase physical activities, decrease food consumption, meals frequencies, and dietary habits [1]. Accordingly it promotes detoxification, rests of digestive system however it does not stop production of acids in the stomach, resolves inflammatory response and healing of inflammatory bowel diseases, increases breakdown of blood glucose, utilization of stored glycogen and reduces production of insulin, reduces blood and body storage of fat, boosts immunity and overcome addictions on nicotine, alcohol, caffeine and other substance abuse [2] in addition it defends against aging-related disease, improves metabolic fitness and increases resistance to acute oxidative stress, carcinogenic and toxicological stressors which have remarkable effects on various hormones, neural, and psychological behavior that would be helpful for better understanding of the phenomenon of hunger, satiety, and the way the body tackles these issues [3].

Fasting may be protective from the risk of atherosclerosis as hunger has been associated with catecholamine inhibition and reduced venous return, this cause a decrease in the sympathetic tone and fall in blood pressure, heart rate, and cardiac output [1]. Therefore, Ramadan fasting can safely be undertaken in patients with mild to moderate hypertension treated with monotherapy [4], hypothyroidism patients taking thyroxine tablets on an empty stomach at bedtime instead of half an hour before dawn time (Sehur) [5].

While the adverse effect of Islamic fasting includes heat stress, dehydration especially in the summer due to restricted fluid intake, leading to disturbance in the fluid balance which is indicated by the increase serum biochemical parameters as uric acid [6].

This study aimed to estimate the pre and post Ramadan fasting of blood glucose, lipid profile, specific and sensitive liver function tests and kidney function tests in order to investigate and prove the benefit of Ramadan fasting especially during summer as a good prognosis of different diseases and improvement of health in general.

2. Subjects, Materials and Methods

2.1. Subjects and Methods

Sixteen patients and twelve healthy (due to financial limitations as reagents and other required appliances)

employees were sampled purposively from State Company for Marketing Drugs and Medical Appliance in Ministry of Health (to ensure their follow up as we have two samples before and after Ramadan fasting) after getting official approval as well as the verbal consent of participants. All were fasted for 26-30 days (in Ramadan, their body weight and height were recorded.

Two specimens each of 10 ml venous blood were collected from all subscribers, one in the first day of Ramadan (pre-fasting sample) and the other in the last day of Ramadan (post-fasting sample). The collected samples were centrifuged at 3000 rpm for 10 minutes, and serum was separated within 30 minute from the time of blood collection. Serum was aliquots in an eppendorf tube and frozen in deep freeze at -40°C.

2.2. Materials

The laboratory investigations were performed in the teaching laboratories of medicinal city directorate using autoanalyzer and manual techniques (tietz).

2.3. Statistical Analysis

The results were expressed using Software Statistical Package for Social Science (SPSS) version 20 and STATISTICA version 9 for the estimation of result's differences between the studied groups consider the significance at P value < 0.05, using t-test (Independent and paired samples) for the assay of results.

3. Results and Discussion

The ten hypertensive, one diabetic and five hypothyroid patients, their mean age was (43 year ± 8.22) year with age range (26- 53 years), while the mean age of twelve apparently healthy control subjects was (37.5 year ± 10.81) year, with a range (24 - 57 year).

Data of Figure 1 shows significant decrease in the body weight post-fasting of the healthy individual ($p < 0.05$) when compared with that of the patients, while the pre-fasting measurement shows no such significant differences. Decreased body weight during Ramadan in healthy subjects could be due to body fat loss rather than catabolism of body cell mass [7].

However reduced energy intake may lead to weight loss [1,8], and skipping meals on the other hand may induce weight gain, presumably, due to over-compensatory eating habits or it may be attributed to reduced daily activities in fear of hypoglycemia [9,10].

There is significant decrease ($P < 0.05$) in the fasting blood glucose levels of patients and healthy persons in comparison with their pre fasting levels as shown in Figure 2. Although, the baseline pre- and post-fasting fasting blood glucose levels of the patients group was higher than the corresponding levels of the healthy control group.

These results are in agreement with other studies demonstrating that Ramadan fasting not disturb glucose regulation [11]; and a significant decline in serum glucose may be due to increase in the body's responsiveness to insulin [12] or result from influence of enzymes of carbohydrate metabolism in brush border membrane of small intestine and liver. These changes occur due to increase of maximal velocity of the enzyme reactions due to increased activities of intestinal lactate-, isocitrate-, succinate- and malate- dehydrogenases, liver lactate dehydrogenase, glucose-6-phosphatase and fructose 1, 6-bisphosphatase. However, the activities of glucose-6-phosphate dehydrogenase and malic enzyme reduced significantly in the intestine and increased in the liver [13].

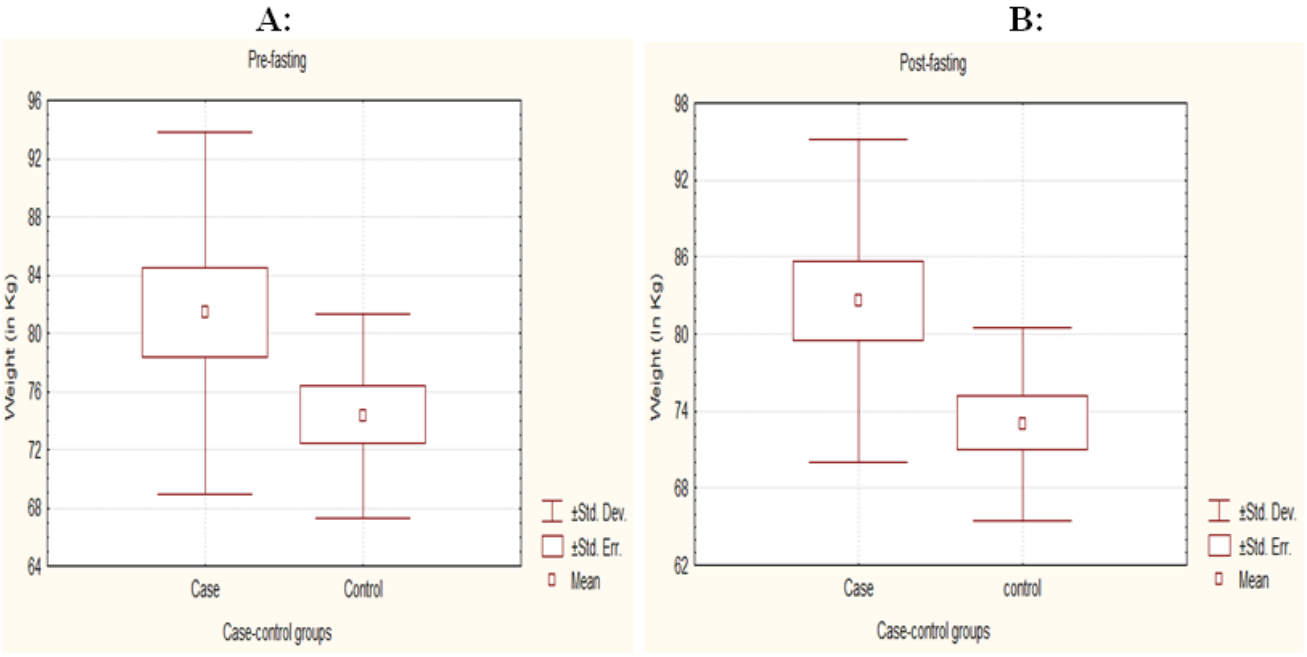

Figure 1. Pre-fasting[A] and post-fasting[B] body weight (Kg) in the studied groups

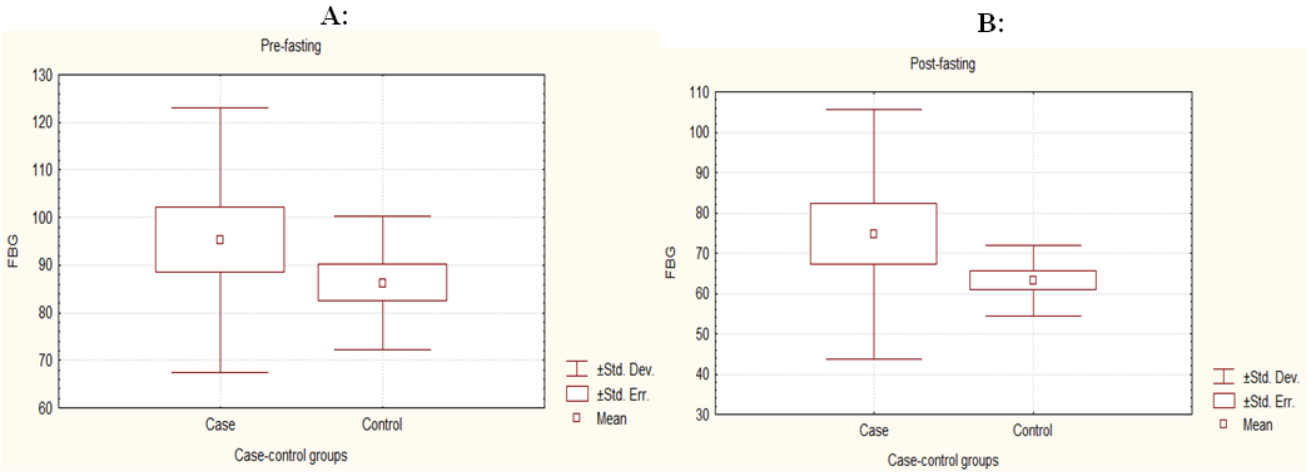

Figure 2. Pre-fasting[A] and post-fasting[B] measurement of Fasting Blood glucose (FBG mg/dl) in the studied groups

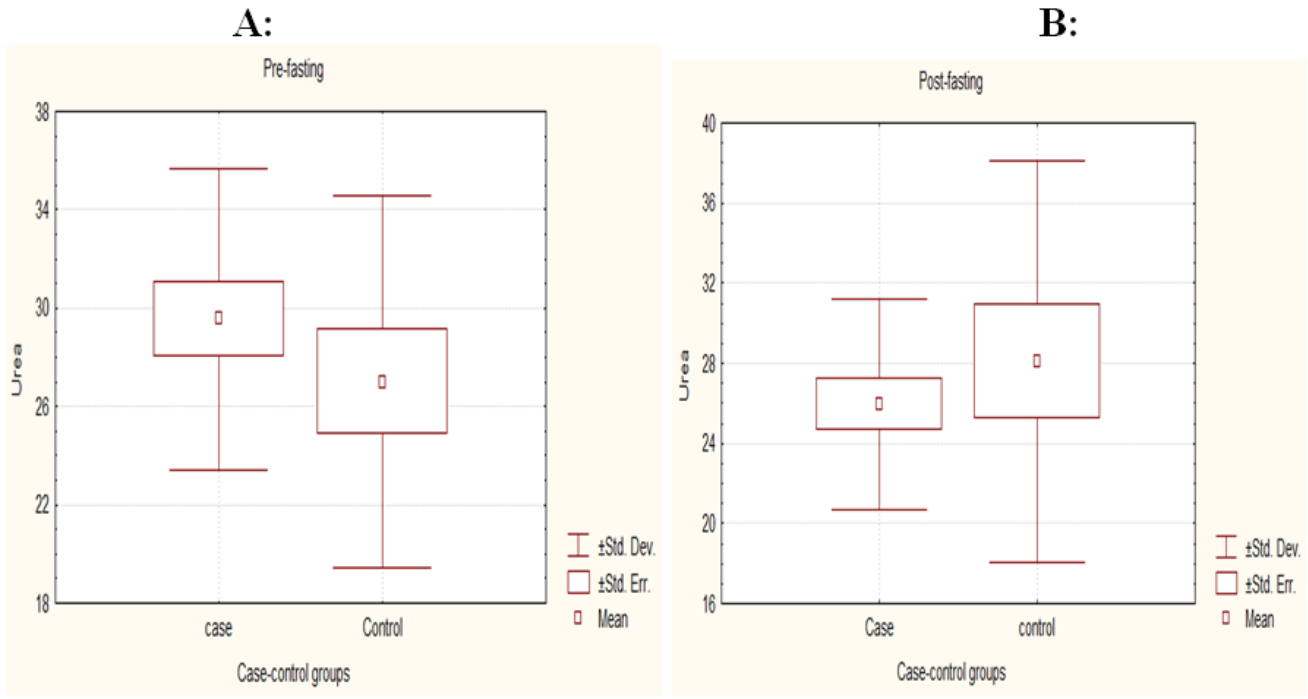

Figure 3. Pre-fasting[A] and post-fasting[B] Blood Urea between studied groups

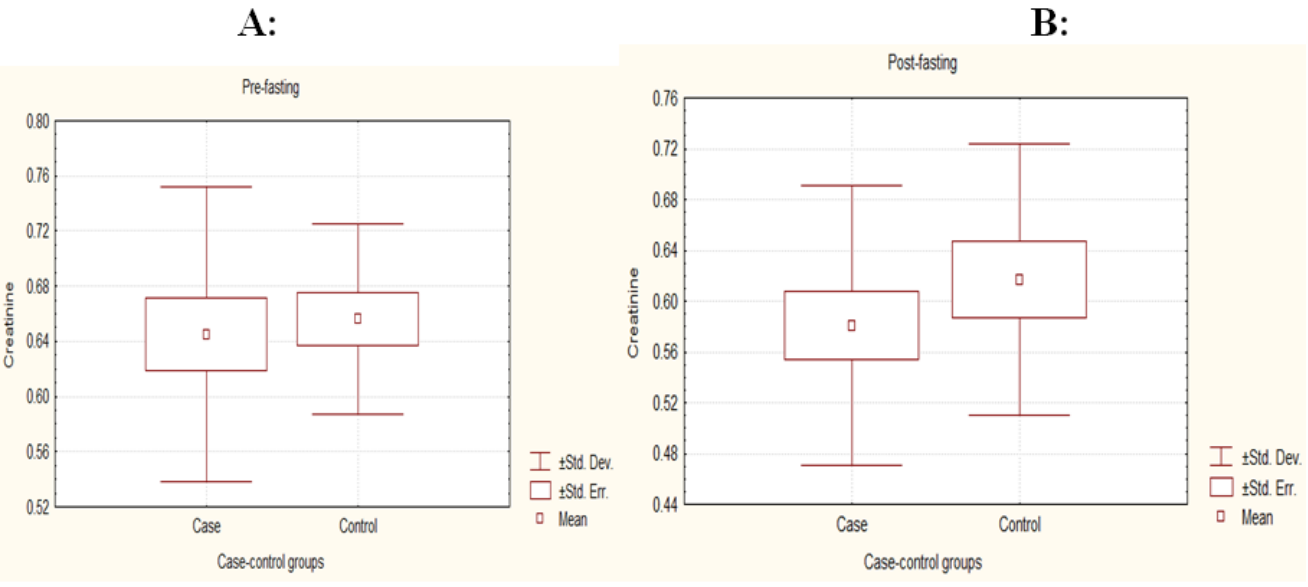

Figure 4. Pre-fasting[A] and post-fasting[B] Serum creatinine in the studied groups

Concerning kidney function tests the blood samples were collected in the early morning at which participants relatively well hydrated. In the patients group there is significant decreases in serum urea and creatinine levels post fasting when compared to pre-fasting, while healthy group shows non-significant changes in the serum urea and creatinine levels respectively in comparison between pre and post-fasting measurements (Figure 3 and Figure 4), the mechanism by which fasting significantly lowers oxidative stress in the body and may be due to reduced dietary intake of proteins during Ramadan [10,14].

A slight non-significant increase in blood urea of healthy subjects may be due to an increased protein catabolism through doing physical activity, or reduction of blood circulation and kidneys filtration as inadequate liquid consumption [15].

Figure 5 show non- significant decrease in serum uric acid post fasting in patients and healthy groups in comparison with pre-fasting results; however, these results incompatible with others in healthy individuals at which temporary slightly increase in uric acid concentration due to decrease in glomerular filtration rate and uric acid clearance [16].

Increased dietary fat favors reduced breakdown of body protein including low-density lipoprotein (LDL) cholesterol-receptors, which are protein in nature, and uric acid which is a product of purine metabolism. Therefore dietary-fat especially poly unsaturated fat may be helpful in preventing catabolism of these nitrogen containing compounds and protein during the fasting period. This hypothesis is compatible with this study (as increased serum cholesterol and triglycerides is associated with decreased serum uric acid post fasting in the studied groups) [17].

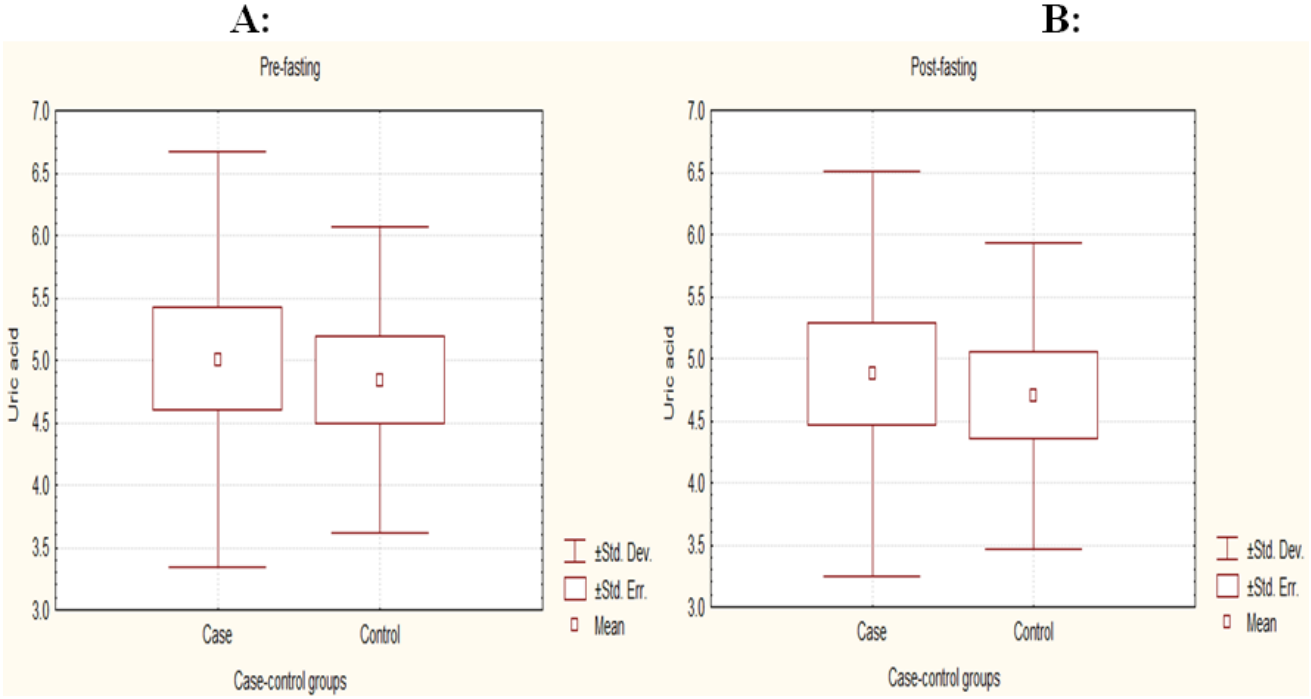

Figure 5. Pre-fasting[A] and post-fasting[B] Uric acid in the studied groups

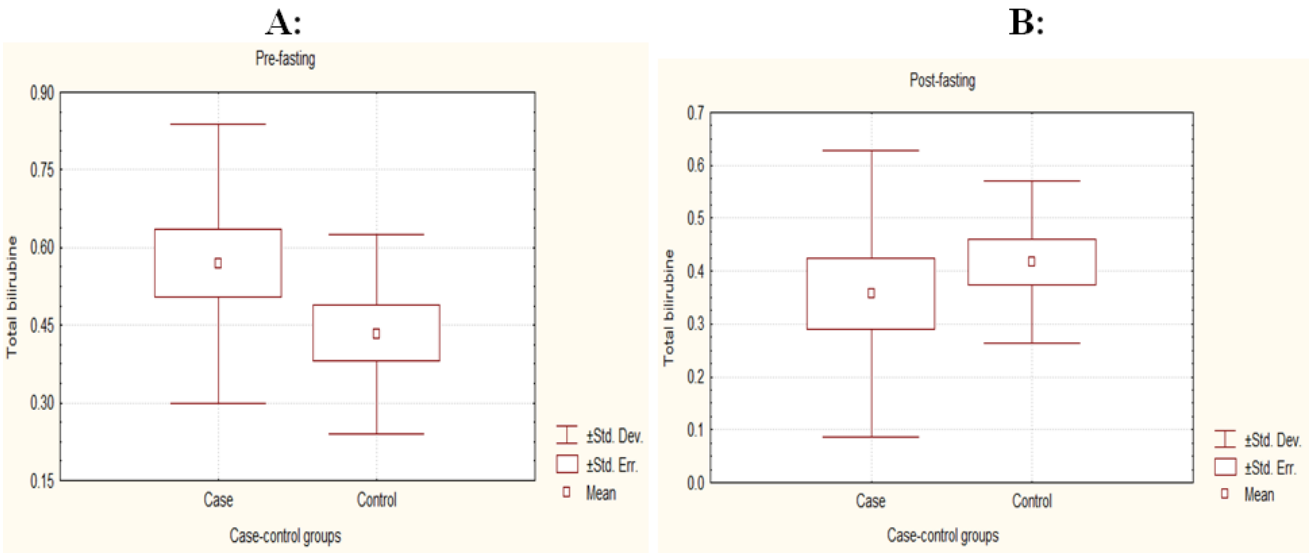

Figure 6. Pre-fasting and post-fasting Total Bilirubine in the studied groups

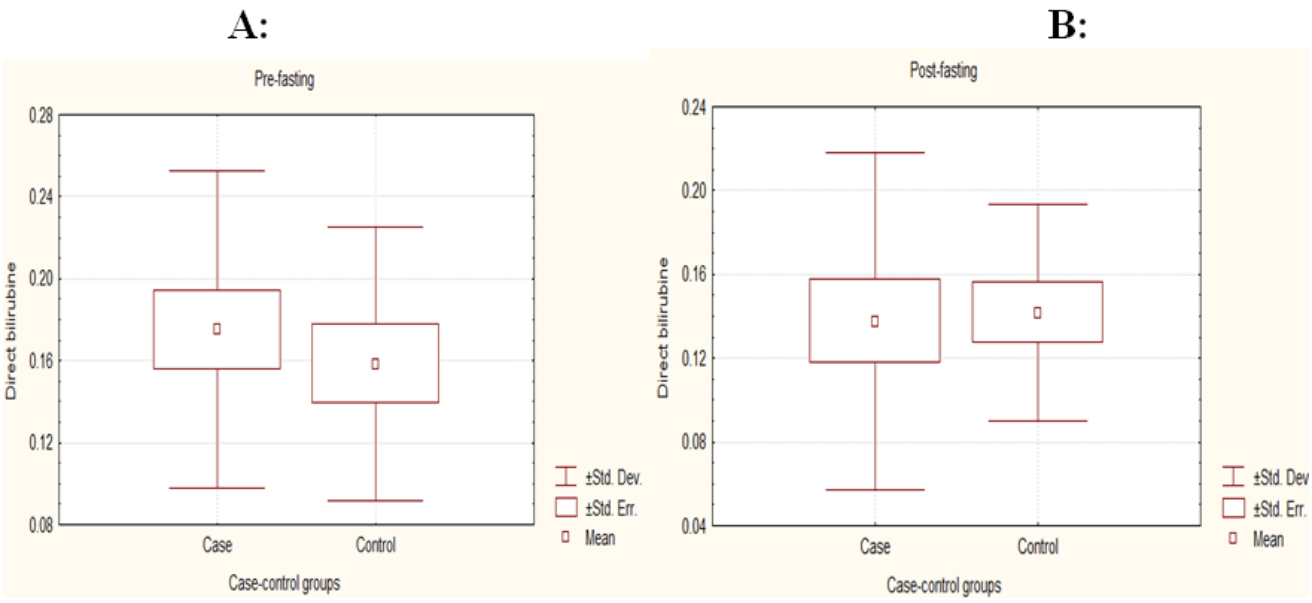

Figure 7. Pre-fasting[A] and post-fasting[B] Direct bilirubine in the studied groups

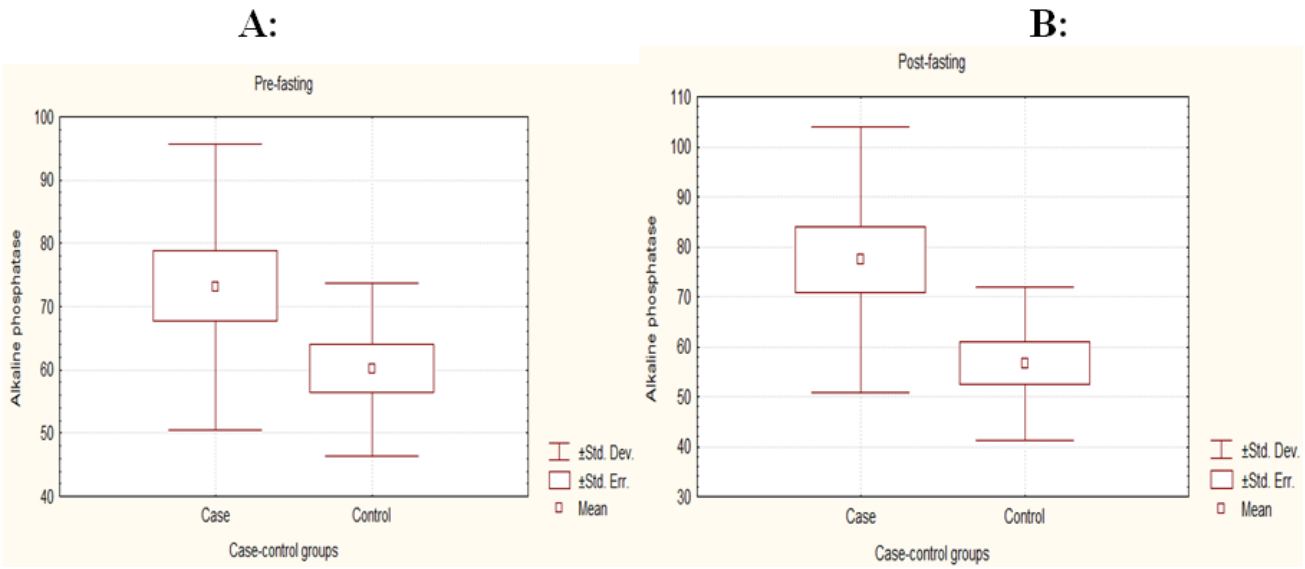

Figure 8. Pre-fasting[A] and post-fasting[B] Alkaline phosphatase studied groups

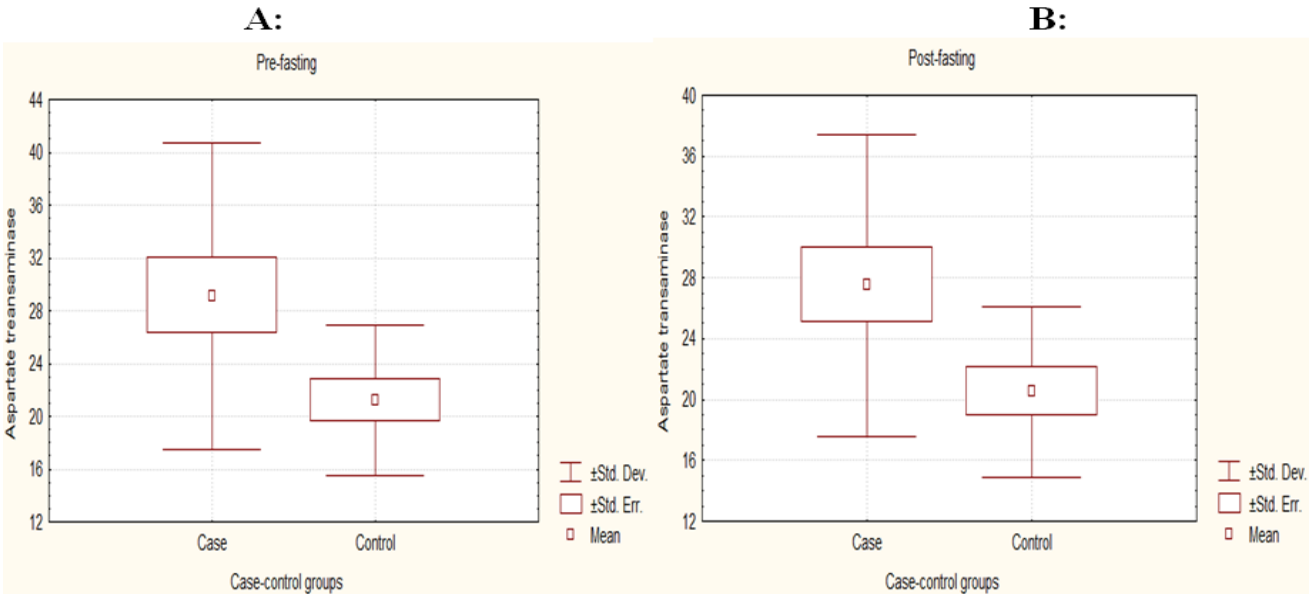

Figure 9. Pre-fasting[A] and post-fasting[B] Aspartate transaminase in the studied groups

Liver function tests during Ramadan show significant decrease in serum total and direct bilirubine with AST in patients group post fasting in comparison to pre fasting. Serum ALP and AST of healthy group decreased significantly post fasting compared to pre fasting, however, serum ALP level in patients were increased. Serum alanine transaminase (ALT) increased non- significantly during Ramadan in the studied groups, meanwhile these results clinically considered insignificant as they are not deviated from normal reference ranges. (Figure 6 - Figure 9).

These findings are in agreement with others, except ALT, which may be related to changes in cytokines and alteration in circadian rhythms of hormones during Ramadan [18]. Moreover, liver and intestine have tremendous metabolic adaptation capacity leading to alterations in enzyme's levels without adverse effect on adult's healthy [13,19].

Serum cholesterol and triglyceride show non-significant increases in the studied groups post fasting compared to pre fasting, however the elevation of serum cholesterol is more than the normal reference value. There is significant difference in triglyceride levels between patients and healthy group. HDL-cholesterol shows significant elevation in serum level of studied groups post fasting compared to pre fasting group (Figure 10 - Figure 12).

Increased concentration of serum cholesterol may have been related to loss of weight during Ramadan fasting and this is compliance in healthy group [20,21]. Lifestyle related factors like high consumption of saturated fats and refined carbohydrates (quality and quantity of food consumed at Iftaar “dusk” and Sahur), combined with lack of physical activity in addition to the genetic background of the participants may be a causative factor of increased cholesterol level in the blood [7,22]. While low blood glucose levels during fasting logically decrease insulin levels and enhance fat oxidation [1], these consequences may be the causes of elevated HDL-cholesterol in the serum of studied groups post fasting. Others find non-significant changes in serum total cholesterol and triglycerides with a significant discrepancy in the levels of LDL and HDL this may be closely related to the biochemical response to starvation or due to metabolic changes in Ramadan [1,23,24,25].

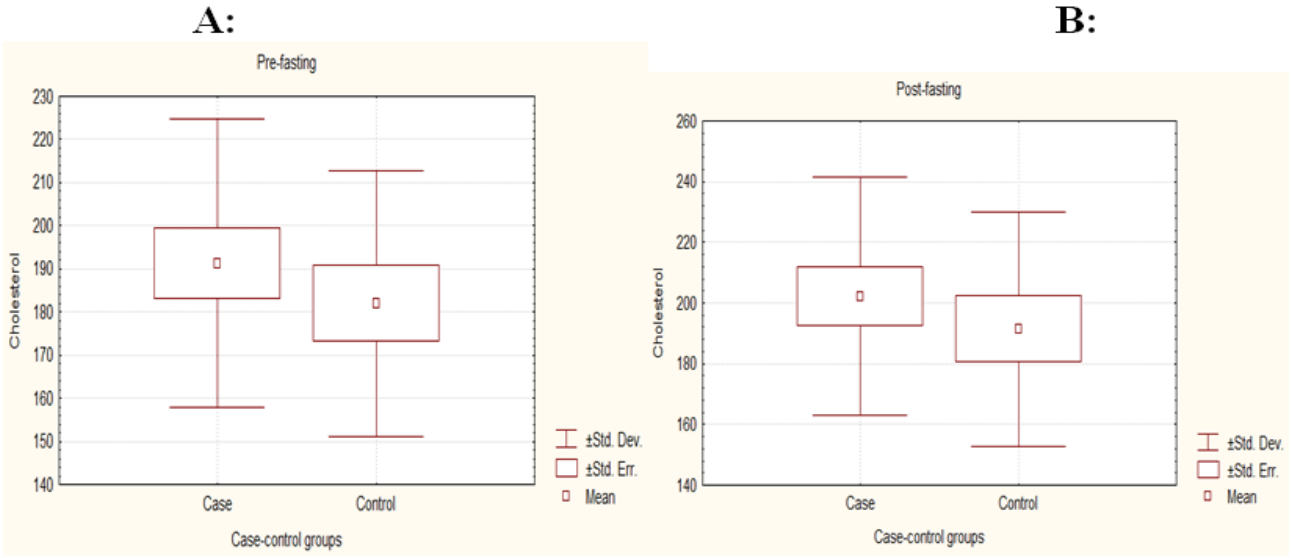

Figure 10. Pre-fasting[A] and post-fasting[B] Cholesterol in the studied groups

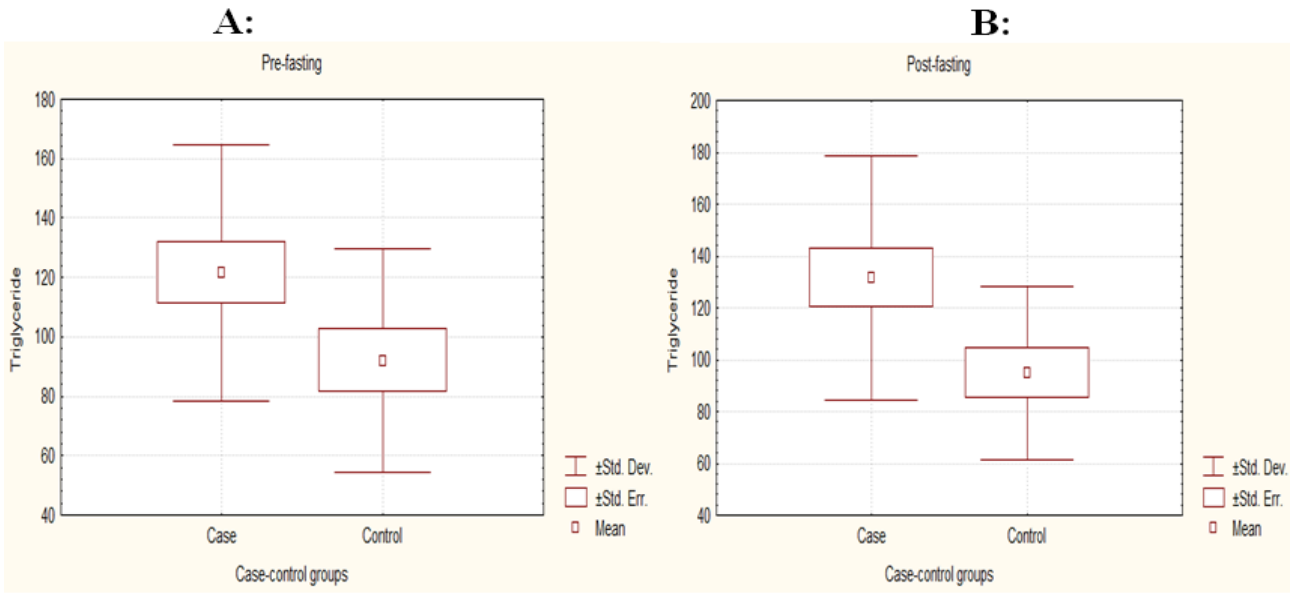

Figure 11. Pre-fasting[A] and post-fasting[B] Triglyceride in the studied groups

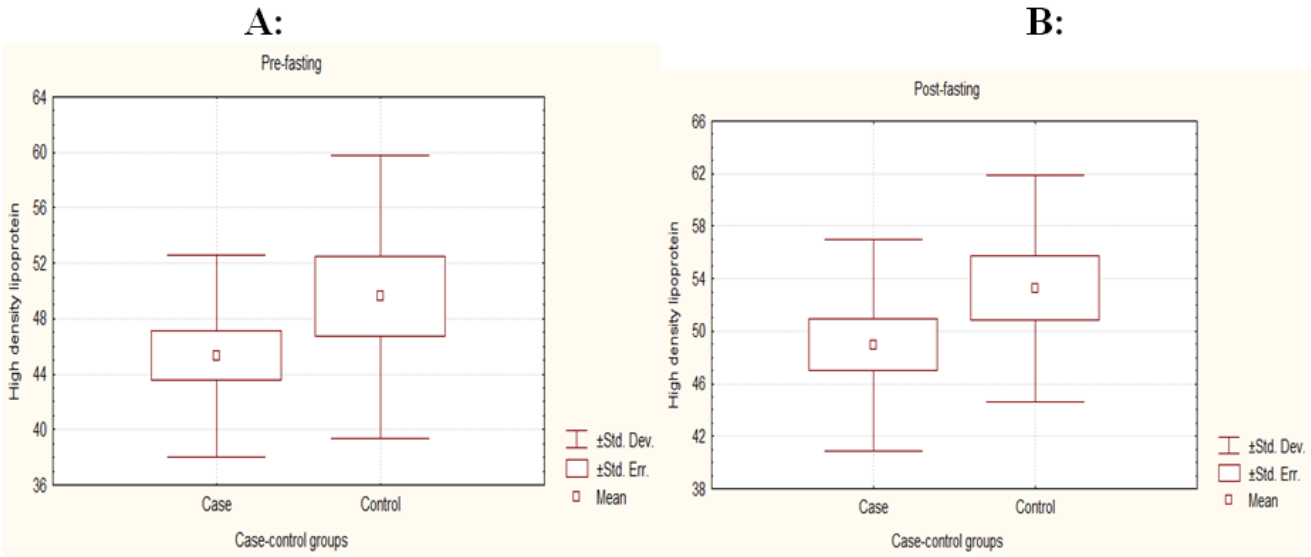

Figure 12. Pre-fasting[A] and post-fasting[B] High Density Lipoprotein (HDL) in the studied groups

Table 1. Study parameters finding and significance

Parameters	Pre-fasting Mean ± std. Error		Post-fasting Mean ± std. Error		P value within same group pre and post-fasting	
	Patients/16	**Control/ 12**	**Patients/16**	**Control/ 12**	**Patients**	**Control**
Body weight (Kg)	81.37 ± 3.1	74.33 ± 2.024	82.56 ± 3.14	73.00 ± 2.16	P > 0.05	P > 0.05
P value	P > 0.05		**P < 0.05**			
FBG mg/dl	95.31 ± 6.96	86.25 ± 4.06	74.69 ± 7.73	63.17 ± 2.51	**P > 0.001**	**P < 0.05**
P value	P > 0.05		P > 0.05			
Blood Urea (mg/dl)	29.56 ± 1.54	27.00 ± 2.18	25.94 ± 1.31	28.08 ± 2.89	**P < 0.05**	P > 0.05
P value	P > 0.05		P > 0.05			
Serum Creatinine (mg/dl)	0.645 ± 0.03	0.656± 0.02	0.581 ± 0.03	0.617 ± 0.03	**P < 0.05**	P > 0.05
P value	P > 0.05		P > 0.05			
Uric acid (mg/dl)	5.01 ± 0.42	4.84 ± 0.36	4.87 ± 0.42	4.70 ± 0.36	P > 0.05	P > 0.05
P value	P > 0.05		P > 0.05			
Total Bilirubine (mg/dl)	0.566 ± 0.07	0.433 ± 0.56	0.356 ± 0.07	0.417 ± 0.44	**P < 0.05**	P > 0.05
P value	P > 0.05		P > 0.05			
Direct bilirubine (mg/dl)	0.175 ± 0.02	0.158 ± 0.19	0.138 ± 0.02	0.142 ± 0.015	**P < 0.05**	P > 0.05
P value	P > 0.05		P > 0.05			
ALP (IU/L)	73.13 ± 5.65	60.08 ± 3.94	77.31 ± 6.64	56.50 ± 4.42	P > 0.05	**P < 0.05**
P value	P > 0.05		**P < 0.05**			
ALT (IU/L)	12.44 ± 2.05	8.75 ± 0.86	14.63 ± 2.36	11.08 ± 1.76	P > 0.05	P > 0.05
P value	P > 0.05		P > 0.05			
AST (IU/L)	29.13 ± 2.90	21.17 ± 1.64	27.50 ± 2.48	20.50 ± 1.62	**P < 0.05**	**P < 0.05**
P value	**P < 0.05**		**P < 0.05**			
Cholesterol (mg/dl)	191.25 ± 8.34	181.92 ± 8.87	202.19 ± 9.81	191.33 ± 11.16	P > 0.05	P > 0.05
P value	P > 0.05		P > 0.05			
Triglyceride (mg/dl)	121.50 ± 10.76	92.00 ± 10.83	131.50 ± 11.74	94.83 ± 9.67	P > 0.05	P > 0.05
P value	P > 0.05		**P < 0.05**			
HDL (mg/dl)	45.31 ± 1.83	49.58 ± 2.96	48.94 ± 2.02	53.25 ± 2.496	**P < 0.05**	**P < 0.05**
P value	P > 0.05		P > 0.05			

Table 1 placed ultimately reveals all statistical findings and significance of the study parameters.

4. Conclusion

The benefit health effects of Ramadan fasting of healthy and diseased patients provide that among the two groups no adverse effects observed. Otherwise lowering of serum enzymes (that are protein in nature), glucose, non-significant increase in cholesterol and triglyceride forcing Muslims to increase dietary intake of protein during fasting.

Some recommendations that may be of important value in the future work should attempt to minimize the effect of confounding variables and strengthen the results involving non-fasting group, and evaluate serum protein levels for more clarification of kidney and liver functions.

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