ORIGINAL ARTICLE

The Effect of Ramadan Fasting on Fasting Serum Glucose in Healthy Adults

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Summary

The effect of Ramadan fasting on fasting serum glucose (FPG) is still a matter of controversy. One hundred and fifteen healthy volunteers fasted for ≥25 days during Ramadan. Blood samples were taken 1 week before Ramadan and on the 14th and 28th day of Ramadan. Serum glucose was determined by the glucose oxidase method. FPG decreased from 88.4±9.0mg/dl to 62.9±7.7mg/dl ($p<0.001$). Men and women both experienced a significant drop in FPG. Calorie intake decreased in all groups ($p<0.001$) and was positively correlated with decreasing FPG. FPG decreases with Ramadan fasting and has no serious adverse effect on fasting adults.

Key Words: Ramadan, fasting, Serum glucose, Calorie intake

Introduction

Fasting during Ramadan is prescribed by the Holy Koran for every fit, adult Muslim [1]. Every year during Ramadan, millions of Muslims abstain from food, drink and smoking. It should be noted that Islamic fasting is different from other experimental fasting. Muslims have two main meals during Ramadan: one after sunset and the other just before first light. Ramadan is the ninth month of the lunar calendar, and accordingly cycles through the solar year. The daily fasting period therefore varies from season to season, and between 11 and 18 hours. Several studies have elucidated the distinct effects of Ramadan fasting on human blood biochemistry. In this study, we investigate the effect of Islamic fasting on serum glucose levels in normal healthy adults.

Materials and Methods

One hundred and fifteen adults between the ages of 15 and 45 years of age from a religious seminary in Rey, Iran, were enrolled in Ramadan 1423 (Nov/Dec 2000) in this study. All of them had similar pre-dawn and post-dusk meals. Average duration of daily fasting was about 12 (11.5±0.5) hours. All participants fasted for at least 25 days during Ramadan. Dietary intake was recorded by using a semi-quantitative food frequency questionnaire on the first and 15th days of fasting, data from day 1 questionnaires being used to estimate baseline caloric intake. Blood samples were collected one week before Ramadan (after a 12-hour overnight fast, as baseline), and repeated on the 14th and 28th days of Ramadan, just before the evening meal.

All participants underwent a general medical examination, which was normal in every case. No participant either gave a history of chronic illness or was on any medication during the study. All blood samples were sent to the reference laboratory of the Endocrinology & Metabolism Research Centre for

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analysis. Serum glucose levels were measured by the glucose oxidase method. Statistical analysis was carried out using SPSSv10 software. Data was expressed as mean ± SD, and data comparison was performed by the paired t-test. Relationship between variables (fasting serum glucose and calorie intake) was examined using Pearson's rank correlation analysis. Statistical significance was set at $p<0.05$.

Results

One hundred and fifteen subjects (67 male and 48 female) took part in the study. Mean age was 21.2±4.3 years. All 115 had normal fasting blood glucose levels throughout the study. Mean baseline fasting serum glucose level was 88.4±9.0mg/dl (range: 69-116), which decreased to 75.4±15.3mg/dl (range: 52-122) and 62.9±7.7mg/dl (range: 44-87) on days 14 and 28 of Ramadan, respectively. A significant decrease ($P<0.0001$) in fasting serum glucose was observed towards the end of the study. Results are given in Table I.

Mean total daily calorie intake was 1470±794kcal and 1191±521kcal on baseline and the 14th day, respectively. The difference between values in male and female subjects was significant ($P< 0.0001$). Correlation between fasting serum glucose and total calorie intake was significant in female subjects alone ($P=0.02$) and all subjects ($P=0.01$), but not in male subjects alone ($P=0.3$). None of the subjects reported any symptoms of hypoglycaemia during the fasting period.).

Discussion

During Ramadan, the quality and quantity of daily energy intake is not the same as during the rest of the year. Data from the questionnaire showed that total calorie intake was decreased during Ramadan in all participants. Daily physical activity and sleep pattern are also altered in these subjects. In addition to age and body mass index, these alterations influence biochemical parameters, especially blood glucose level.

Several studies have shown the effect of Ramadan fasting on serum glucose[2]. Our study shows a significant decrease in fasting serum glucose during Ramadan. Other studies have also reported a decrease in fasting blood sugar during Ramadan [3-6].

Our study does not agree with several reports, which have not found a significant change in blood glucose during Ramadan [7-13]. Prentice et al[14] measured glucose tolerance and fasting glucose, but did not observe any changes in blood glucose before and after fasting.

Nagra and Gilani[15] reported a 10% rise in blood glucose in adult males at the end of Ramadan. An increase in blood glucose was also reported by Scott [16]. Other workers also report an increase in blood glucose after 15 days of fasting, with levels returning to baseline values by the end of Ramadan [17]. Azizi et al showed a slight decrease in serum glucose during the first few days of Ramadan, normalization by day [20], and a slight rise by the end of Ramadan[12,18]. Khogheer et al also reported blood glucose variation - within the normal range - during Ramadan[19].

In our study, blood glucose decrease in parallel with total calorie intake. Nomani et al [2] showed that energy intake did not correlate with day-14 blood glucose level, but did have a negative correlation on day 28. Nomani showed that day-14 blood glucose level did not correlate with intake of any particular nutrient, but day-28 blood glucose was negatively associated with fat and positively associated with carbohydrate intake. Variations in blood glucose were explained more by the fat than by carbohydrate content of subjects' diet [2]. Based on the majority of studies, hypoglycaemia will not occur in fasting healthy adults on a normal diet [2, 20].

Note that duration of daily fasting may be an important factor in blood glucose variability between studies. Individual variations in glycogen storage, physical activity and dietary habits may influence serum blood glucose levels during Ramadan. It is therefore difficult to determine any trend in blood glucose levels during Ramadan, and offers a likely explanation for the divergent results reported by investigators in the field.

Table I: Fasting Serum Glucose in 67 Male and 48 Female Subjects

Time Gender	Baseline (Mean ± SD)	14th day (Mean ± SD)	28th day (Mean ± SD)
Females	89.7 ± 9.3	67.5 ± 9.0	65.7 ± 8.4
Males	87.5 ± 8.8	81.1 ± 16.5	60.8 ± 6.4

Conclusion

It seems that any change in blood glucose during Ramadan is slight and unlikely to adversely affect normal healthy subjects. As the Holy Prophet Muhammad (S) said: "Keep the fast, keep your health".

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