

BIOCHEMICAL CHANGES IN PREGNANT MOTHERS DURING RAMADHAN FAST IN BAGHDAD, IRAQ⁺

Ziad M. Bander^{*}

Abstract

During the holy month of Ramadhan, Muslims abstain from all food and drink between dawn and dusk. The present study examines the effect of fasting on certain biochemical variables. pregnant mothers aged 18-35 years have been selected. Blood sample and determination of the fasting plasma glucose, was done in the 2nd, 14th and 28th days of Ramadhan. Pregnant mothers undergoing a normal physiological fast were served as a control. The values of plasma glucose insulin and lactate were significantly decreased at the 28th day of Ramadan in comparison to basal level of the control group. Also significant increases of serum hydroxybutyrate at 28th days were observed. Considering this result, mothers should take up the dispensation from fasting during pregnancy, which is allowed according to our Holy Quran, Sura Al-Bakarah .

المستخلص

تضمن البحث اختيار مجموعة من النساء والحوامل وباعمار من (١٨ - ٣٥) سنة خلال صيام شهر رمضان في بغداد .

وتم اخذ عينات من الدم في اليوم الثاني والرابع عشر والثامن والعشرين من شهر رمضان ودلت النتائج :

ان قيم الكلوكوز glucose والانسولين insulin واللاكتيت Lactate قد انخفضت عن الطبيعي في اليوم الثامن والعشرون من رمضان وكما دلت النتائج على زيادة في الهيدروكسي بيوتيريت hydroxybutyrate وعليه :

فان هذه النتائج تؤكد وجوب اعفاء النساء الحوامل من صيام شهر رمضان المبارك وكما سمح بذلك القرآن الكريم (سورة البقرة).

Introduction

Ramadhan is a special period of year that Millions of Muslims had to go during fasting for one moth [1, 2]. Ramadhan is the ninth month of the Islamic lunar calendar, which lasts 28-29 day. During Ramadhan, all health adults abstain from all food and drink between dawn and dusk [3].

The effects of fasting in Ramadhan on various physiological and metabolic

⁺ Received on: 17/9/2003 - Accepted on : 30/3/2005

^{*} College of Health and Medical Technology

variables have been widely explored throughout the world [4-5]. However in Iraq, to date, only limited studies on the physiological effects of altered feeding schedule during Ramadan have been conducted [6, 7].

Since pregnancy is a time in the life cycle when nutrition has an influence on the course and outcome of conception. There is a need for characterizing the maternal response to caloric deprivation and address the metabolic response to periods of fasting extending beyond 14-18 hours. Studies address these effects on Iraqi: pregnant women's have not yet been investigated.

The present study examine the effects of fasting during Ramadan on healthy pregnant women with regards to some biochemical values, including plasma glucose, insulin, lactate and hydroxybutyrate,

Subjects and methods

Subjects

Pregnant mothers attending private clinics and maternal and child health centers, Baghdad for a routine prenatal examinations, were invited to take part in this study. All mothers gave their informed consent to participate in the study.

The prenatal center nurses screened mothers for study eligibility. Trained interviewers who then discussed all aspects of the study with them approached eligible mothers. Pregnant women's who consented to participate in the study were greeted by specially earned examiners at each subsequent prenatal clinic visit.

Two hundred twenty - five mothers fulfilled the criteria of inclusion in the study. Mothers were eligible for inclusion in the study if they were 1) either fasting for the whole Ramadan or consented to biochemical investigation following and overnight fast.

2) aged 18-35 years, 3) healthy on general medical examination 4) in 22-28 weeks of gestation 5) non- smokers 6) non-receiving any medication effecting the studies parameter.

Mothers were allocated to one of the two groups. The first group (Ramadan fasting group, RFG) included mothers who observed Ramadan. The second group (NRFG) included mothers who were not fasting Ramadan and consented to biochemical investigation following an overnight fast.

Sample collection and processing

Venous blood samples were collected form the subjected on the second, 14th and 22 th days of Ramadan, between 12.00-13.00 hours, following a fast of 10-14 hours. The samples were coded blindly to protect the confidentiality of the subjects, separated, processed immediately or land refrigerated and frozen at -20° for duplicate analysis of the selected biochemical variables. All specimens were centrifuged and plasma or the supernatant fraction separated. Plasma glucose was determined by the glucose oxidase method (Boehringer Mannheim).

Serum insulin concentrations were determined by using microparticle enzyme

immunoassay kits (IMX; Abbott Laboratories). Blood lactate and 3-hydroxybutyrate were measured [8]. Intra- and interassay CVs were, respectively, glucose (4.5%) and (4.7%); insulin (3.9%) and (4.4%); lactate (4.5%) and (4.8%); 3-hydroxybutyrate (3.9%) and (4.3%).

Anthropometric measurements

Mothers wore light clothing with footwear removed. Body weight was measured to the nearest 0.1 kg in light clothes and height to nearest 0.1 cm. Body mass index (BMI) was calculated as weight (kg) divided by height square (m²).

Data Collection

Socio – demographic data (age, marital status, annual income, occupation and educational level attained) were collected by trained interviewers.

All of the interviewers had BSc degrees in nutrition and participated in an intensive training program which included general interviewing techniques.

Data analysis

Data were statistically analyzed using computer package SPSS (version 10.0) for windows.

All results are expressed as mean $\pm$ SD percentage. The chi-square and t test were used to compare the data of selected subjects.

A P-value of < 0.05 was considered to be significant.

Results

The disposition of the participants in the study is shown in Figure –1. Of the 225 pregnant mothers, enrolled in the study, 114 mothers were fasted the whole Ramadan month and the remaining 111 were overnight fasted.

Nineteen Ramadan fasting mothers withdrew from the study, 4 moved out of the area, 9 abandoned the fast and 6 withdrew before completion of the study protocol.

Eleven non Ramadan fasting mothers dropped out from the study, [9] was prior to completion of the study protocol, [3] had hospital admission and [2] moved out of the area.

Table (1) summarizes the background and socio- demographic characteristics of the subjects. At enrollment Ramadan fasting pregnant mothers (control group) were well matched as to base line pre- intervention characteristic. RFG and control group were comparable in term of age ($P = 0.64$), marital status ($P = 0.61$) educational level attained ($P = 0.91$) annual household income ($P = 0.60$).

Table (2) gives the values regarding fasting plasma glucose, insulin, and lactate and

3- hydroxy butyrate.

In both groups of mothers (NRFG and RFG), fasting resulted in a fall in the concentration levels of plasma glucose, insulin and lactate and in the elevation in the concentration levels of blood 3- hydroxybutyrate, The changes tended to be higher in the RFG than in the NEFG. The difference was statistically significant by the 14 th and 28 th of Ramadan.

Mean (SD) plasma glucose levels were higher in the NRFG (4.5 SD 0.5) than in the RFG (4.2 SD 0.68); $P < 0.001$. Plasma glucose was highest in the 2 nd day of Ramadan fasting and declined throughout the 14 th day and 28 th days of fasting ($p < 0.001$). Similarly plasma insulin and lactate levels were significantly decreased throughout the fasting Ramadan, the decline being greatest during the last 14 days (101.05 SD19.0 pmo1/L, 0.73 SD 0.3 mmo1/L, for insulin and lactate in the 2 nd days Vs 90.0 SD 20.0 pmo1/L, 81.3 SD 17pmo1/L and 0.64 SD 0.5mmo1/L, 0.5 SD 0.6 at 14 th and 28 th days respectively).

Serum of hydroxybutyrate levels was identical in the two groups of mothers at the enrollment of the study (2nd day), however, by the 28 th days of Ramadan, the serum hydroxybutyrate levels were significantly increased ($p < 0.001$) in the RFG.

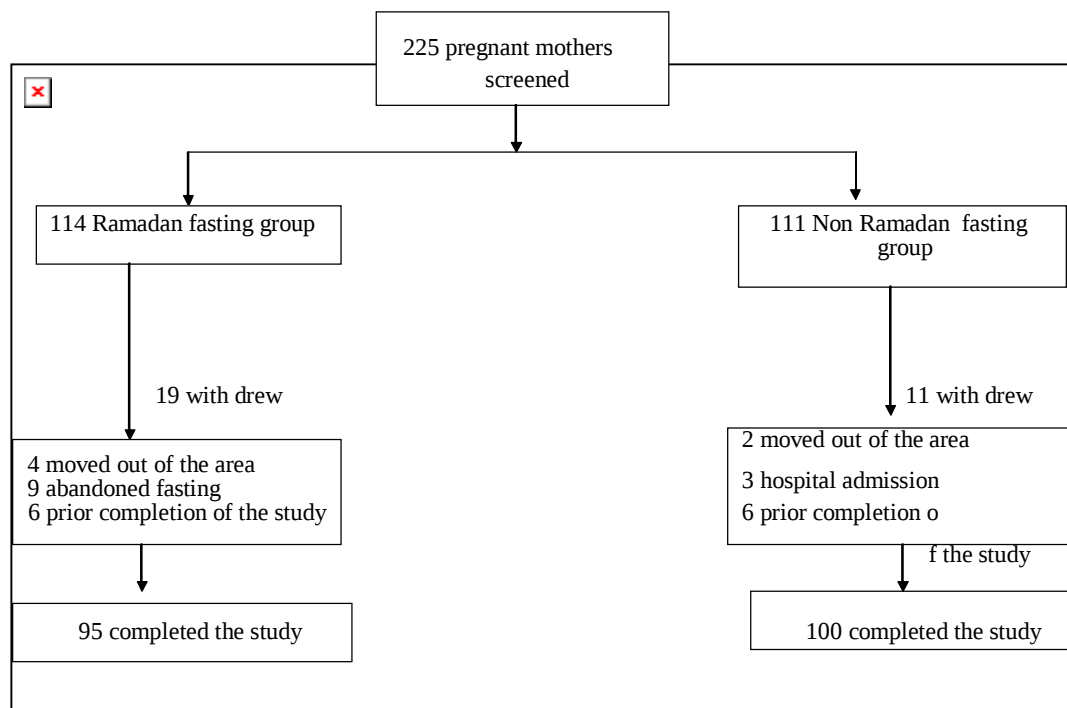


Figure 1. Study profile of pregnant mothers enrolled in the study

Table (1):. Demographic profile of pregnant mothers enrolled in the study

Characteristic	RFG	NRFG
Age 18 –35 (years) mean: (SD)	0.7 ± 21.6	0.6 ± 21.9
Body mass index (Kg/ m ²)	6.7 ± 26.9	6.2 ± 26.2
Marital status (%):		
Married	95.8	96.0
Others	4.2	4.0
Educational attainment (%):		
Illiterate	21.0	22.0
Primary school or less	52.7	56.0
High school	21.0	19.0
College or higher	5.3	3.0
Annual household income (%):		
< 5,000		
5,000 – 10,000	60.0	60.0
> 10,000	20.0	19.0
	20.0	21.0

RFG = Ramadan fasting group, NRFG = control group (overnight fasted).

Table(2).The levels of selected biochemical variables in pregnant mothers enrolled in the study
(Mean ± SD)

Variables	NRFG Control group	RFG			
		(1)	(2)	(3)	Mean ± SD
Glucose (mmol / L)	4.9 ± 0.5	4.6± 0.5	4.2±0.6	3.8±0.6	4.2±0.28
Insulin (pmo1/ L)	117.0 ± 21.0	101.0 ±19.0	90.1±20		81.3±17.5 90.8±18
Lactate (mmol /L)	0.72 ± 0.2	0.73 ±0.3	0.64±0.5	0.59±0.16	0.65±0.2
3- hydroxybutyrate (mmol/ L)	0.28 ± 0.04	0.30 ±0.2	1.9±0.2		2.64±0.20 1.61±.20b

RFG = Ramadan fasting group, NRFG = control group (overnight fasted)
Mean for 3 separate measurements.

Discussion

In Iraqi pregnant mothers, the changes (fall in glucose, insulin, lactate and rise in 3-hydroxybutyrate) during Ramadan fast have not been described previously.

Preliminary results presented in this work show that the response of circulating glucose, insulin, lactate and 3- hydroxybutyrate to Ramadan fasting is exaggerated and accelerated in pregnant mothers. Our findings demonstrate that there are significant differences in biochemical results between pregnant mothers observed Ramadan (RFG) and the non –Ramadan fasting pregnant mothers (NRFG) results.

The mean values of glucose, insulin, lactate and 3- hydroxy butyrate values in our study are similar to these found among Muslim pregnant mothers observing the Ramadan fast in Britain [10]. These changes commonly accompany prolonged fasting in non- pregnant individuals and mothers fasted during the second trimester of pregnancy up to 84 h [11].

Some of the metabolic changes associated with Ramadan fasting have also been described in Gambian pregnant mothers [12].

A reduction in plasma glucose in healthy individuals during Ramadan fast has been also observed elsewhere.

Ansari [13] showed that there was a decrease in plasma glucose level in Iranian Muslims on the 11 th and 29 th days. Ravanshad et al [14] reported the same results regarding the metabolic change of Ramadan on blood glucose in men subjects.

However some other studies showed that fasting plasma glucose response to Ramadan fasting is variable. In an earlier study, it was noticed that fasting blood sugar of healthy Saudi subjects increased after Ramadan fasting [15]. In another study in Iran, the significant decrease in blood glucose did not exist during Ramadan [5].

The discrepancies may be explained by several possibilities. Bias in the selection of subjects could be an explanation, the length fast, therefore depends of the exact time of sunrise and sunset in the country where the subject lives, and the period of starvation may be particularly long if Ramadan falls during the summer months.

The time of blood sample collection may also be a determining factor a.0 possible explanations for the differences between studies findings. There is marked diurnal variation in the values of fasting plasma glucose and insulin levels.

Troisi et al [16] showed that the mean fasting plasma glucose and mean fasting serum insulin levels were significantly higher in subjects examined in the morning (5.4 mmol/ L and 61.9 pmol/L, respectively), compared with those examined in the afternoon (5.12 mmol/ L and 6,65 pmol/L)($p < .001$ for both analyses).

Changes in several factors besides fasting, such as lifestyle habits. These include changes in daily activity and feeding schedules. Another factor is the type of food consumed during Ramadan.

Evidence from Saudi Arabia [17] is that during Ramadan there is a reduction in feeding frequency but that each meal is nutritionally denser than that taken outside Ramadan.

There is a tendency towards increased of carbohydrate and fat. The high intake of carbohydrates, especially sweetened foods, may explain the insignificant change in fasting blood sugars.

Accompanying a fall in plasma glucose there was a fall in serum insulin, blood lactate and a rise in B- hydroxybutyrate. Near the end of pregnancy the woman's insulin requirement may double.

In about (1-3 %) of all pregnancies, the increased need for insulin, as pregnancy progresses may cause gestational diabetes; some of these women may develop diabetes within the next 5-15 years. Therefore the control of blood glucose and acidosis can help lessen the associated risks (18).

Although pregnant women, consuming sufficient amount of calories can be assured that fasting will not endanger their health [19], it may be recommended that mothers should take up the dispensation from fasting during Ramadan which is allowed according to our Holly Quran, Surat Al-Bakarah.

References

1. Saker AH., "Fasting in Islam," *Journal of American Diabetic Association*, Vol.67, pp. 17-21, 1975.
2. Husain R., et al. "Effects of fasting in Ramadan on tropical Asiatic Moslems," *British Journal of Nutrition*, Vol. 58, pp. 41-48, 1987.
3. *The Holly Quran*, Sura Al – Bakarah.
4. Cheah SH, et al. "Effect of fasting during Ramadan on urinary excretion in Malaysian Muslims," *British Journal of Nutrition*, Vol.63,pp. 329-37, 1990.
5. Sarraf – Zadegan N, et al. "The effect of fasting in Ramadan on the values and interrelations between biochemical, coagulation and hematological factors," *Annals of Saudi Medicine*, 20 (5-6), pp.377- 81,2000.
6. Allawi N., et al. "Some of the effects of fasting Ramadan on the blood and urine chemistry," *Iraqi Medical Journal*, Vol. 33, pp.14- 21, 1985.
7. Hussain A., et al. "Ramadan fasting and duodenal ulcer," *Journal of Faculty of Medicine, Baghdad*, Vol. 40 (1),pp .101 –4, 1998.
8. Varly H., et al. *Practical clinical biochemistry*, vol.1.London: William Heinemann.
9. Maislos M., et al. "Marked increase in plasma high-density lipoprotein cholesterol after prolonged fasting during Ramadan," *American Journal of Nutrition*, Vol. 57,pp. 640-2,1993.
10. Malhotra A., et al. "Metabolic changes in Asian Muslim pregnant mothers observing the Ramadan fast in Britain," *British Journal of Nutrition*, Vol.61,pp. 663-673. 1989.
11. Feling, P. & Lynch, V. "Starvation in human pregnancy; hypoglycemia, hypoinsulinemia, and hyperketonemia," *Science*, Vol.170,pp.990 – 992,1970.
12. Prentice, A M. et al. "Metabolic consequences of fasting during Ramadan in pregnant and lactating women," *Clinical Nutrition*, Vol.37 C:pp. 283-294, 1983.
13. Ansari KMH. *Effect of fasting on serum glucose, lipids, apolipoprotein AI, B and total protein*. The Congress on Health & Ramadan, Abstract book., Iran. 2001.
14. Ravanshad SH, et al. "Effect of fasting on serum glucose, lipids and keton bodies concentration during Ramadan in Arsenjan, Iran. The Congress on Health & Ramadan," *Abstract book.*, Iran. 2001.
15. Scott TG. "The effect of Muslim fast Ramadan on routine laboratory investigation. King Abbulaziz" *Medical Journal*, Vol.1,pp. 23-35,1981.
16. Troisi RJ., et al. "Diurnal Variation in fasting plasma glucose, implications for diagnosis of diabetes in patients examined in the afternoon," *Journal of American Medical Association*, Vol.284, pp.357-9,2000.
17. Frost G., & Pirani S., "Meal frequency and nutritional intake during Ramadan: a pilot study. Human Nutrition," *Applied Nutrition*, Vol.41 A,pp. 47-50,1987.
18. Sardesai VM. *Introduction to clinical nutrition*. New York, Marcel Dekker Inc. 1998.

19. ArabM . *Can ketonuria and on serum glucose of fast pregnant women at the end of a day in Ramadan be predicated based on clinical symptoms and calorie deficiency?* The Congress on Health & Ramadan, Abstract book., Iran.2001.