

The Effect of Ramadan Fast on the Diurnal Change of Total Calcium, Parathyroid Hormone and Calcitonin

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Abstract

Calcium, parathyroid hormone, and calcitonin levels were measured at 9.00 a.m., 4.00 p.m., 9.00 p.m., and 4.00 a.m., in nine healthy subjects observing the dawn to sunset fast of the Muslims Holy Month of Ramadan. Similar measurements were undertaken in an ordinary non-fasting day for comparison.

Significant diurnal fluctuations was seen in calcium only. During fasting and non-fasting calcium peaks at 9.00 a. m. It also seems to be significantly lower during fasting. On the other hand, PTH is significantly higher at 9.00 a. m., during Ramadan fast. No significant differences were seen in calcitonin levels between fasting and non-fasting.

Introduction

FASTING during the Holy Month of Ramadan entails the abstention from food, drink, smoking and sex from dawn to sunset. It also stresses and trains the faster honesty and avoid gossiping and bad arguments. Still the number of studies

about this Islamic Pillar is scarce [1-30].

Up to the knowledge of researchers of this article, no work has been done about the effect of fasting this Holy Month on diurnal changes of calcium, PTH, and calcitonin. The study aims at monitoring plasma levels of calcium, PTH, and calcitonin over a 24-hour period during

an ordinary non-fasting day as well as a fasting Ramadan day.

Material and Methods

Nine healthy volunteers were recruited from teaching and technical staff at the College of Medicine, Riyadh. All were males aged between 27-48 yrs (40.11 ± 1.79), weights ranged from 63 to 91 Kgms (79.11 ± 2.89).

During Ramadan, abstention from food and drink is from dawn to sunset and the first meal (breakfast) is taken immediately after sunset (approximately 7.00 p.m.) and thereafter the subject is free to consume food and drink. Sleeping hours, which are between 11.00 p.m. and 8.00 a. m., are interrupted at 4.00 a. m. by the intake of a light meal "Suhur" and the "Fajr" (dawn) prayer. Daily working hours in Ramadan are from 9.00 a. m. to 3.30 p. m. Blood samples during Ramadan were collected in the middle of the month when adaptation to the change in food and sleep rhythm is assumed to be complete. In a non-fasting day, work starts at 7.30 a. m. and finishes at 4.30 p. m. Lunch is between 1-2 p.m., dinner is at 7.00 p. m., bed times approximately 10.00 p.m. The subjects wake up at 7.00 p.m., bed times approximately 10.00 p.m. The subjects wake up at 4.30 a. m. for the dawn prayer, then remain awake until they go to work, over a 24 hour period. Consecutive blood samples were collected at 9.00 a. m., 4.00 p. m. and 4.00 a. m. both during a non-fasting and a Rama-

dan fasting day. Plasma was separated in a refrigerated (4-8°C) centrifuge, and was stored at - 40°C until analysed. Total plasma calcium was measured [31], parathyroid hormone and calcitonin were measured by RIA using kits supplied from Diagnostic System Laboratory, Texas, U. S. A. Statistical significance was employed using the one way analysis of variance (ANOVA) to see significant fluctuations during the 24-hour interval and the paired t-test to see the difference between fasting and nonfasting. A P value of less than 0.05 is considered significant.

Results

Calcium:

During a non-fasting day total plasma calcium peaks were at 9.00 a. m. This is also seen during Ramadan fasting. On the other hand, significantly lower plasma levels were seen during Ramadan as in tables (1, 2).

Parathyroid Hormone:

No significant diurnal fluctuations were seen in plasma PTH both during a non-fasting and a fasting Ramadan day. There was a significant increase in plasma PTH both during a non-fasting and a fasting Ramadan day. There was a significant increase in plasma PTH during fasting at 9.00 a. m.

Calcitonin:

No significant diurnal fluctuations and/or differences were seen in plasma calcitonin

Table (1): Diurnal Levels of Plasma Calcium, Parathyroid Hormone and Calcitonin During Shaaban (non-fasting) [N=9].

Time	Non-fasting Levels			
	9.00 A.M.	4.00 P.M.	9.00 P.M.	4.00 A.M.
Plasma Calcium (M Mol/L)	2.493 ± 0.027 *	2.44 ± 0.033	2.46 ± 0.029	2.381 ± 0.014
Parathyroid Hormone (P Mol/L)	25.816 ± 2.89	36.872 ± 9.56	30.492 ± 1.75	30.191 ± 1.59
Calcitonin (P gm/ML)	34.98 ± 7.2	35.05 ± 6.1 N = 8	30.07 ± 4.1	36.8 ± 6.4 N = 8

* $P = < 0.05$ (one way analysis of variance).

Table (2): Diurnal Levels of Plasma Calcium, Parathyroid Hormone and Calcitonin During Ramadan (Fasting) [N=9].

Time	Fasting Levels			
	9.00 A.M.	4.00 P.M.	9.00 P.M.	4.00 A.M.
Plasma Calcium (M Mol/L)	2.154 ± 0.042 *	2.112 ± 0.036	2.151 ± 0.029	2.006 ± 0.034
Parathyroid Hormone	36.483 ± 2.98	32.172 ± 2.28	29.376 ± 1.75	39.014 ± 8.06
Calcitonin (P gm/ML)	39.52 ± 8.8 N = 7	33.45 ± 4.8 N = 8	32.88 ± 4.9	29.77 ± 4.9

* $P = < 0.05$ (one way analysis of variance).

levels during a non-fasting day and another fasting Ramadan (Tables 1&2).

Discussion

Markowitz et al [32] were the first to describe a significant diurnal variation in calcium characterized by U-shaped rhythm with Nadir around 16:30 h and maximum levels around 10:00h. Our results show a significantly ($P = 0.05$) higher levels of plasma calcium around 9.00 A. M. both during fasting and non-fasting. In this study the effect of Ramadan fasting seems to show significantly lower plasma calcium throughout the 24-hr cycle.

Previous reports about the effect of Ramadan fast are rather inconsistent. Some noted a significant increase in serum calcium [3] while other [4] showed no significant changes in calcium. It is worth mentioning that both studies [3,4] based on single estimations through the 24 hr cycle.

Regarding parathyroid hormone some reports [33] observed a biphasic PTH rhythm with peaks at 2000 and 4000 h and troughs in the mid morning and late evening, while others [34] demonstrated that physiological secretion of PTH is pulsatile with higher pulse amplitude of PTH at night and could not find a diurnal rhythm in their study.

This is the first report about fasting Ramadan and PTH. The effect of fasting on parathyroid hormone was that at 9.00

a. m., the level of PTH is significantly higher during fasting, while calcitonin did not reveal any significant difference between fasting and non-fasting. Now to relate all these changes together, a faster faces two intervals, abstention from food and drink from dawn to sunset, and free access to food and drink from sunset to sunrise. Therefore, the low calcium which is demonstrated in this study namely at 9.00 a. m., seems to be due to fasting. On the other hand the low total calcium level after breaking the fast may be due to higher cortisol levels in the evening reported previously [35]. Since cortisol inhibits the absorption of calcium from the gut [36], peak level of calcium at 9.00 a. m., during fasting seems to be due to significantly higher PTH value at that same time.

The clinical implication of these findings could be a protection from any condition where lowering of calcium is needed such as stone formation. On the other hand the practice of the Prophet (P. B. U. H.) when he breaks the fast with dates and yogurt, both being rich in calcium, helps to maintain calcium level.

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