

The Effects of Ramaḍān Fasting on the Levels of Gonadotrophins

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Abstract

FSH and LH levels were measured at 9:00 a.m., 4:00 p.m., 9:00 p.m. and 4:00 a.m. in eleven healthy subjects observing the dawn to sunset fast of the Muslim Holy Month of Ramaḍān. Similar measurements were undertaken in an ordinary non-fasting day for comparison.

Significant diurnal fluctuations of these hormones were noted. In a non-fasting day FSH levels peaked at 9:00 a.m., while the lowest level was at 9:00 p.m. During Ramaḍān, levels of FSH were highest at 4:00 a.m. (3.29 ± 2.72 IU/L) and lowest at 9:00 a.m. (1.28 ± 0.27 IU/L). The LH levels in an ordinary non-fasting day were highest at 9:00 a.m., while during Ramaḍān peak levels were noted at 4:00 a.m.

The significantly high gonadotrophin levels at 4:00 a.m. suggest that hypothalamic pituitary axis for gonadotrophin release exhibits peak activation in the early morning hours, more so in a Ramaḍān day than in a non-fasting day.

Key words: Ramaḍān, fasting, gonadotrophins

Fasting during the holy month of Ramaḍān entails the daily abstinence from food and drink from dawn to sunset, for approximately 15 hours. There are numerous studies on the biochemical as well as hematologic changes that accompany the Ramaḍān fast.¹⁻⁹ However, comparatively less information pertaining to changes in hormone levels is available.^{4,10} In spite of the scarcity of research on the effects of the Ramaḍān fast, most earlier studies were based on single estimations of the leutinizing hormones (LH), and follicle stimulating hormone

(FSH). This approach may not accurately reflect the dynamic alterations occurring throughout the day, in view of the changes in food intake and sleep during Ramadan as compared to an ordinary day.

This study aims at monitoring plasma levels of FSH and LH over a 24 hour period during an ordinary non-fasting day as well as fasting Ramaḍān day.

Material and methods

Eleven healthy volunteers were recruited from the teaching and technical staff and students at the College of Medicine, Riyadh. All were males aged between 24-46 (34.9 ± 1.6) years. Their weights ranged from 56 to 90 Kg (72.4 ± 10.4 Kg).

During Ramaḍān, abstinence from food and drink is from dawn to sunset. The first meal (breakfast) is taken immediately after sunset, approximately at 6:00 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. for the intake of a light meal and the dawn "Fajr"

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Table 1. FSH Levels in 11 healthy volunteers during a non-fasting compared to a fasting Ramadan day.

Time	9:00 a.m.	4:00 p.m.	9:00 p.m.	4:00 a.m.
	Non-fasting			
FSH (IU/L)	1.71 ± 0.50†*	1.40 ± 0.34	1.21 ± 0.38	1.25 ± 0.36
	N = 11	N = 10	N = 10	N = 11
	Fasting			
	1.28 ± 0.27	1.30 ± 0.43	1.31 ± 0.40	3.29 ± 2.72**
	N = 10	N = 11	N = 11	N = 11

† Mean ± SD One way analysis of variance * = P < 0.05 ** = P < 0.0001

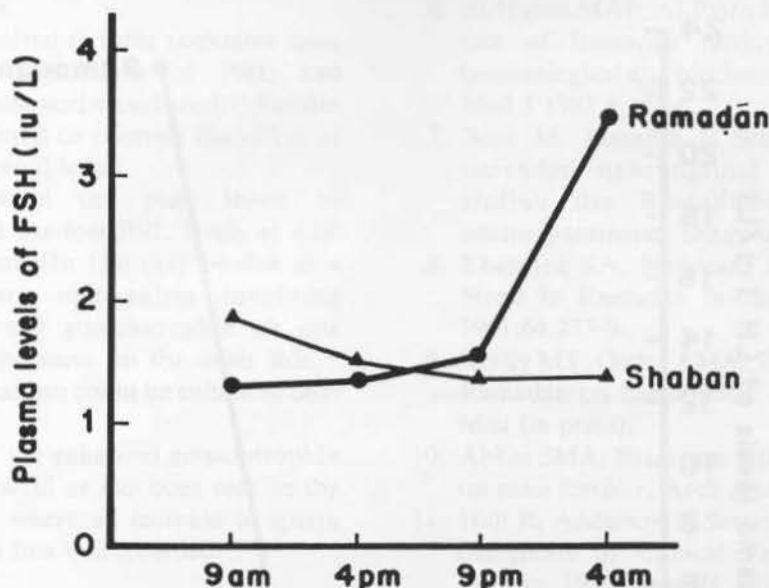


Figure 1a: Comparison between plasma levels of FSH during a non-fasting day (Sha'bān) versus a fasting day (Ramaḍān)

prayer. Daily working hours in Ramaḍān are from 9:00 a.m. to 3:30 p.m. Blood samples during Ramaḍān were collected in the middle of the month when adaptation to the change in food and sleep rhythm was 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 1:00 and 2:00 p.m., dinner is at 7:00 p.m. and bed-time is 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.

Consecutive blood samples over a 24 hour period were collected at 9:00 a.m., 4:00 p.m., 9:00 p.m. and 4:00 a.m. during both a non-fasting and a Ramaḍān day. Plasma was separated in a refrigerated (4-8 °C) centrifuge, and was stored at -40 °C until analysed. Hormone assays were conducted in a radioimmunoassay laboratory, where FSH and LH were analysed using RIA kits supplied by Pharmacia Diagnostics. All measurements were conducted in duplicate with appropriate quality control samples being simultaneously run.

The one way analysis of variance was employed to

examine the significance of the differences in hormone levels at various time intervals. A P value of < 0.05 was taken to be of significance.

Results

FSH: During a non-fasting day FSH levels peaked at 9:00 a.m. (P < 0.05). The other successive three measurements, taken through the rest of the day were of comparable magnitude. On the other hand, during a fasting day more marked fluctuations were noted; FSH levels reached maximum levels at 4:00 a.m. (3.29 ± 2.72 IU/L, P < 0.0005) and lowest levels at 9:00 a.m. (1.28 ± 0.27 IU/L). Levels at 4:00 p.m. (1.30 ± 0.43 IU/L) and 9:00 p.m. (1.31 ± 0.4 IU/L) were not significantly different. (Table 1, Figure 1a)

LH: During a non-fasting day, LH concentrations reached peak levels at 9:00 a.m. (2.78 ± 0.96 IU/L) and were lowest at 9:00 p.m. (1.61 ± 0.51 IU/L) (P < 0.005). On the other hand, LH levels during a fasting Ramaḍān day, peaked at 4:00 a.m. (22.83 ± 21.45 IU/L) and were lowest at 9:00 a.m. (1.48 ± 0.53)(P < 0.0001). (Table 2, Figure 1b)

Table 2. LH Levels in 11 healthy volunteers during a non-fasting day compared to a fasting Ramaḍān day.

Time	9:00 a.m.	4:00 p.m.	9:00 p.m.	4:00 a.m.
	Non-fasting			
LH (IU/L)	2.78 ± 0.96†*	1.97 ± 1.29	1.61 ± 0.51	1.163 ± 0.25
	N = 11	N = 10	N = 10	N = 11
	Fasting			
	1.48 ± 0.53	1.963 ± 0.50	2.12 ± 0.93	22.83 ± 21.4**
	N = 10	N = 11	N = 11	N = 11

† Mean ± SD One way analysis of variance. * = P < 0.005 ** = P < 0.0001

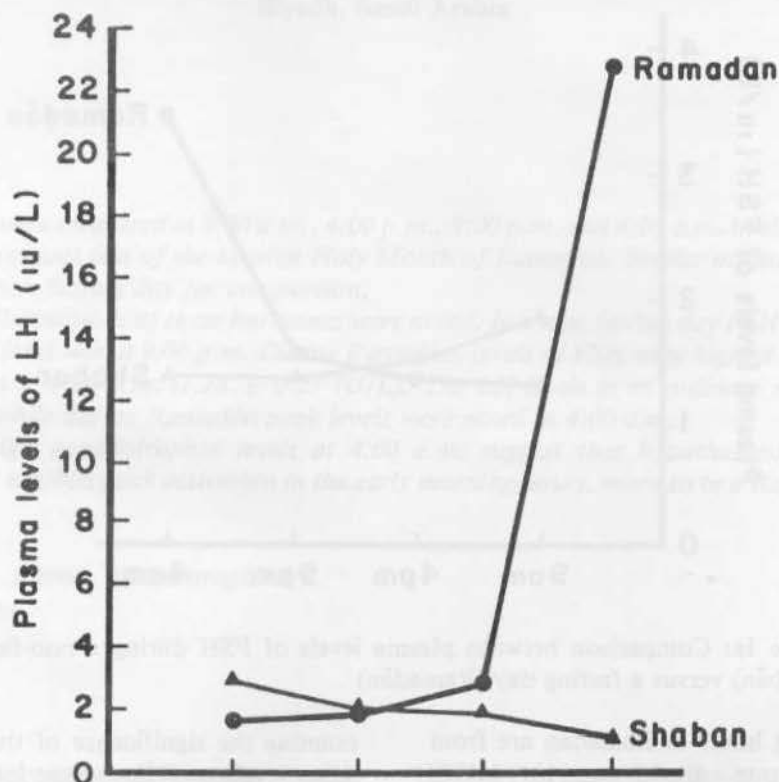


Figure 1b: Comparison between plasma levels of LH during a non-fasting day (Sha'bān) versus a fasting day (Ramaḍān)

Discussion

The mechanisms controlling the release of gonadotrophins are poorly understood. In males, only negative feedback influences are believed to operate and gonadotrophin secretion is relatively constant.¹²

This study shows significantly higher values for FSH and LH at 4:00 a.m. during the fasting month of Ramaḍān when compared to non-fasting measurements. In a previous study, 9 days starvation were accompanied by a blunt LH response during the starvation period.¹² On refeeding, the level of LH was higher than that before the starvation program. On the other hand, FSH levels did not return to normal upon refeeding. The study attributed the blunted gonadotrophin response to altered sensitivity of the pituitary to hypothalamic control.

In the present study the level of gonadotrophins at 4:00 p.m. (which is about 12 hours after the commencement of fasting) were not significantly different from a non-fasting day. This finding contradicts other studies where starvation led to a reduction in LH and FSH levels.¹² One study has looked into the effect of Ramaḍān fast on the levels of gonadotrophins; however, only single estimations were performed and these will not reflect the pulsatile nature of hormone release.¹⁰

Unpublished data indicate that low levels of prolactin (PRL) are recorded at 4:00 p.m. during Ramaḍān fast.¹³ It has also been suggested that the release of endogenous opiates, by suppressing hypothalamic dopamine secretion, mediate both an increase in PRL levels during exercise and an inhibition of the pulsatile secretion of gonadotrophin

release hormones.^{14,15} Others have shown that LH is under inhibitory opioid control both in normal subjects and in widely differing pathological states of gonadotropic axis.¹⁶ Additionally, dynamic studies of endorphins levels show that peak values occur between 4:00 a.m. and 10:00 a.m.¹⁷

To explain the high values of gonadotrophins which were recorded at 4:00 a.m. during Ramaḍān in this study we propose the following mechanisms:

1. An enhanced early morning responsiveness in the hypothalamic-pituitary axis since Ramaḍān fast is an intermittent daily fast unlike prolonged starvation lasting few days.
2. Opioids may be involved in these responses since their role in the regulations of PRL and gonadotrophins is now well-established.¹⁶ Further studies may be required to examine the effect of Ramaḍān fast on opioid levels.
3. The overlap between the peak levels of gonadotrophins and the low PRL levels at 4:00 a.m. during the Ramaḍān fast may be due to a common regulatory mechanism involving pituitary prolactin and gonadotrophin on one side, and the hypothalamus on the other side.¹³ Such a control mechanism could be enhanced during Ramaḍān.

It is unclear whether the enhanced gonadotrophin response is clinically useful as has been seen in the study of Abbas et al, where an increase in sperm count during Ramaḍān fast was recorded.¹⁰

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