

## Does Islamic Fasting Affect Gonadotropin around Female Ovulation?

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### Abstract

**Background:** The pattern of Islamic fasting differs from other forms of fasting, therefore its effect on health also differs. This research studies the effect of Islamic fasting on gonadotropin hormones around the time of the ovulatory cycle and ovulation.

**Materials and Methods:** This self-controlled study was performed on 24 adult females. Blood sampling was performed during Ramadan and two months later to determine the levels of follicle stimulating hormone (FSH), luteinizing hormone (LH), estrogen and progesterone. Ultrasonography was done in order to detect ovulation and the results were compared.

**Results:** The mean values of FSH, LH and estrogen during the 14<sup>th</sup> day of menstruation were comparable with non-fasting values. There was no significant difference in ovulation.

**Conclusion:** Islamic fasting causes neither significant variation in hormone secretion around ovulation nor does it influence the occurrence of ovulation.

**Keywords:** Fasting, Islamic, Gonadotropin, Ovulation

### Introduction

In Islam, fasting is compulsory for healthy adult Moslems in the month of Ramadan. Moslems who fast avoid eating, drinking, smoking, and intercourse from sunrise to sunset. The exception is for women who do not fast during menstruation. It is clear that Islamic fasting differs from other types of fasting. In usual fasting, one may consume fluids which contrasts with the Islamic type of fasting where drinking and eating is forbidden and the fast is only broken at the exact time of day (sunset). Additionally, in Islamic fasting, one should prepare himself for a slight change in his lifestyle (sleep, food and work) during the month of Ramadan which is unclear if it causes a variation in the function of the body's hormonal system (1, 2).

Some studies have reported a relationship between fasting and blood levels of glucose (3-5), blood lipids (6-9), and hormones such as cortisol, thyroid (10, 11), gonadotropin releasing hormone (GnRH) (12-14) and luteinizing hormone (LH) (15-17). Moreover, some studies have stated that severe malnutrition and periods of fasting affect GnRH and LH levels by con-

tinuous stimulation of one of the physiologic peptic neurotransmitters called Neuropeptide Y (NPY) (18-22). or estrogen receptors [ER $\alpha$ -immunoreactive (ir)] in female rats (23, 24) which lead to an alteration in the ovulatory cycle, particularly reducing the number of LH pulses. (25, 26). Nevertheless, some studies have demonstrated that the frequency of LH pulses depends on body energy status or the female reproductive axis during this phase of the cycle and is more resistant to an acute caloric deprivation (27). Unfortunately, not much data about the effect on gonadotropin in Islamic fasting has been published, however a study by Mesbahzadeh et al. have reported the mean LH level in young men did not change during Ramadan (28). In Islam, it is recommended that abstinence from eating and drinking leads to an improvement in both physical and psychological health during holy Ramadan. but the impacts of Islamic fasting on womens' ovulatory hormones have not been totally evaluated.

In this research, we studied the effect of Islamic fasting on ovulation and gonadotropin levels around ovulation [follicle stimulating hormone

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(FSH), LH, estradiol and progesterone] in young healthy females.

### Materials and Methods

In 2008, a total of 24 healthy college females with normal hormonal assays and regular ovulatory cycles were considered for this self-controlled study. This study was approved by the Ethics Committee of Research and Technology of Babol University of Medical Science. Initially, all participants, after a related description, signed an informed consent and were entered into the study. Women with irregular menstruation, pregnant, smokers, those with severe hirsutism and galactorrhea, hyperandrogenism, thyroidism, drug consumers (two month before study and within two months of study entry), severe psychological disorders, athletes, primary or secondary amenorrhea and females who could not fast were excluded from the study. Participants' last menstrual periods (LMP) were between the 5<sup>th</sup> to 7<sup>th</sup> day of Ramadan, continued for 7-8 days and then fasting was resumed. Thus, the duration of fasting was 22-23 days with an interruption of at least 7-8 days. The study was performed in two stages: Ramadan and then two months later (control). This interval was chosen because of the diminishing effects of fasting. The length of daily fasting was  $11 \pm 0.5$  hours and all participants consumed the same diet (university catering service).

#### First phase: blood sampling

Women were referred for blood sampling during the second day of their cycle, 2-3 hours after sunrise (9am) to confirm the normal baseline measurement of estradiol (Randox, German), FSH (FSH IRMA Kit, Immunotech a.s., Prague) and LH levels (LH IRMA Kit, Immunotech a.s., Prague).

#### First phase: ultrasonography

Abdominal ultrasonography (Mylab40, Esaote, Italy, probe 5 MHz) was performed on days 9-10 of patients' menstrual cycles in order to detect follicle growth. Dominant follicle emerges by day 8-12, grows 1-3 mm/day, more rapidly 1-2 days preceding ovulation and 80% of follicles make rupture in size of 19-20 mm (29, 30).

#### Second phase: blood sampling

Samples were taken at an estimated time based on primary ultrasonography at 6-7 pm and the probable time of LH surge, with the purpose of determining LH levels which were usually between the 12-14<sup>th</sup> days (31).

#### Second phase: ultrasonography

The second ultrasonographs were performed with the intent to assess signs of ovulation as determined by the disappearance of the pre-ovulatory follicle, fluid in the cul-de-sac and/or corpus luteum formation and irregularity of the follicular walls as usually noted during the 15<sup>th</sup> to 17<sup>th</sup> cycle days.

#### Third phase: blood sampling

On the 21<sup>st</sup> cycle day (7-8 days following the second phase), blood samples were obtained prior to sunset (6-7 pm) to measure progesterone (Randox, German) levels with which to document ovulation (progesterone  $>3$  ng/ml) (32).

Within each phase, plasma was immediately separated from serum. Serums were frozen and then transferred to the laboratory for the determination of hormone levels. Results were compared with each other.

#### Statistical analysis

Data was analyzed by SPSS version 15, Wilcoxon tests for the comparison between two variations in one population. Results were considered as mean $\pm$ SD.

### Results

A total of 24 healthy normal cycling women were considered for this study whose mean ages were  $20.45 \pm 0.99$  years. Table 1 was shown demographic criteria in group under study. Two women did not return during the fasting period and two during the non-fasting period for their ultrasonography tests. Therefore, they were excluded from the analysis. Fasting and non-fasting hormones during the second and third day of menstruation shows significant difference (Table 2). LH, FSH and estradiol levels around ovulation (14<sup>th</sup> day) (Table 3) and progesterone (21<sup>st</sup> day) (Table 4) were not statistically significant ( $p < 0.05$ ).

Table 1: Demographic criteria in the study group

Demographic criteria	Mean $\pm$ SD
Age (year)	20.45 $\pm$ 0.99
Weight (kg)	58.45 $\pm$ 6.9
Menarche (year)	13.44 $\pm$ 0.99
Menstruation duration (days)	6.8 $\pm$ 1.5
Menstruation interval (days)	27.5 $\pm$ 2.96

Table 2: Fasting and non-fasting hormones during the second and third day of menstruation

Hormone	Fasting	Non-fasting
FSH (mIU/ml)	8.33 $\pm$ 2.76	9.44 $\pm$ 3.79
LH (mIU/ml)	5.8 $\pm$ 1.088*	12.24 $\pm$ 10.5
Estradiol (pg/ml)	23.6 $\pm$ 12.24*	33.3 $\pm$ 11.5

\* Significant at  $\alpha=0.05$

**Table 3: Fasting and non-fasting hormones on day 14 of menstruation**

Hormone	Fasting	Non-fasting
FSH (mIU/ml)	10.25 ± 7.05	12.05 ± 6.09
LH(mIU/ml)	20.1 ± 19.56	22.84 ± 17.75
Estradiol (pg/ml)	292.3 ± 122.38	334.7 ± 134.94

**Table 4: Fasting and Non-fasting progesterone levels at the 21<sup>st</sup> cycle day**

Hormone	Fasting	Non-fasting
Progesterone (ng/ml)	6.12 ± 4.63	7.2 ± 4.02

The only hormones that were significantly reduced were LH and estradiol at days the 2-3<sup>th</sup> of menstruation ( $p < 0.05$ ). The rate of ovulation was 2% more in the fasting state relative to non-fasting, but it was not significant.

**Table 5: Ovulation rate in fasting and non-fasting states**

Ovulation	Fasting	Non-fasting
Yes	86%	84%
No	14%	16%
<b>Total</b>	<b>100%</b>	<b>100%</b>

## Discussion

In this study, considering our lesser numbers of fasting days and interrupted fasting, with the exception of a reduction of some hormones, the ovulatory hormones between the fasting and non-fasting states were comparable with each other. Therefore, no influence by Islamic fasting was seen. However, in a study by Chen et al. study on rhesus monkey, during 24 hour fasting, Hypoglycemic 'stress' inhibits the GnRH pulse generator and that ovarian products hormones showed a significant reduction in LH relative to the controls (15). Additionally, Estacio et al. reported that after 48 hours fasting in ovariectomized rats, an increase in estrogen receptors in the hypothalamus was seen, which may suppress the reduction of LH secretion (18). Tanaka et al. have reported that short-term fasting effects on LH secretion were related to body energy states and during a 72 hour fasting period in goats they observed a change in LH pulse only at days two and three (16).

Mesbahzadeh et al. in their study on gonadotropin levels in 52 healthy single males (at the 10, 20 and 28<sup>th</sup> days of Ramadan in comparison with two days prior to Ramadan), concluded that the variation in secretion of gonadotropin and testosterone were within the normal range. In his study, LH levels did not change significantly relative to the control, whereas FSH significantly increased only on the

20<sup>th</sup> day of Ramadan (28). Also, Soules reported that basal mean LH concentrations did not show any significant variation throughout the study period in 18 normal cycling women (72-hours fast). Therefore he concluded that the female reproductive axis during this phase of the cycle would be more resistant to an acute caloric deprivation than that of men or male monkeys (27). However, Olsen et al. noted a significant decrease in the number of LH pulses on the last day of a 72 hour fast and a lack of increase over time of mean LH values; however he concluded that an alternation in LH secretary dynamics which occur during a three day fast was not sufficient to decline follicle development and cycle lengths in normal-weight sedentary women (26). Of course our study was performed on a young population rather than women in various ages, and in a selected month (Ramadan cycles because of the lunar calendar). Accordingly, we suggest additional research that contains all aspects of Ramadan fasting, such as different fasting hours in different months of the year in order to clarify the impact of Ramadan on Muslim women's health.

Some limitations to our study were noted; we think our sampling should have been undertaken prior to Ramadan to rule out any interventive bias. Unfortunately, to prove absolute ovulation occurrence, we didn't evaluate LH pulse by serially LH kit that is more valuable.

## Conclusion

We concluded that Islamic fasting causes neither significant variation in the secretion of hormones around ovulation nor does it influence the occurrence of ovulation.

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