

## ORIGINAL STUDY

# Changes in Testosterone Levels During the Fasting Month of Ramadan

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## Abstract:

*During the month of Muslim fasting (Ramadan) many people alter their sleeping habits and stay awake most of the night. In this study I looked into the effect of this alteration as well as the effect of fasting on testosterone and its circadian variation in fifty-eight (58) healthy adults. Forty-six (46) of the subjects showed alteration of the diurnal variation during the third week of fasting. Thirty-eight (38) males showed significant increase in evening testosterone level and eight (8) females showed significant decrease of morning testosterone level ( $P < 0.001$  in both). These findings suggest that alteration in sleeping pattern during Ramadan has a significant effect on testosterone levels.*

## Introduction:

The secretion of testosterone is variable during life. In healthy young boys of pubertal age, the testosterone level starts increasing and exhibits a diurnal variation in early puberty whereby the serum testosterone levels are higher during the night and low or immeasurable during the day<sup>(1)</sup>. In adult life, that is from puberty to around the age of 70, there is an increase of the serum testosterone levels but the circadian rhythm is now changed whereby the early morning level is highest and the evening level is low<sup>(2,3)</sup>. After the age of 70 the serum testosterone level decreases again<sup>(4)</sup>. In healthy women the testosterone levels are much lower than adult men and the diurnal variation in the level is similar to that found in early pubertal boys (high in the evening and low in the morning)<sup>(5)</sup>.

One of the most important obligations for adult Muslims is the observance of the fasting month of Ramadan which falls annually during the ninth month of the Islamic lunar year. During this month, Muslims abstain from drinking, eating, smok-

ing and sexual intercourse from dawn until sunset every day. This causes some changes in the sleeping pattern, as the meals would be taken early in the day and late at night. During this month many people stay awake most of the night and do not sleep until after dawn. This is especially marked if Ramadan coincides with one of the holidays like summer holiday or mid-term holiday. The daytime working hours are reduced during this month in many Muslim countries and many companies and firms resort to later and longer evening shifts with the majority of shops staying open at night until 2-3 AM.

Although, there are several reports on the metabolic and biochemical changes during Ramadan<sup>(6, 7, 8, 9, 10)</sup>, there have been only a few on testosterone changes during Ramadan<sup>(11, 12)</sup>.

This study was aimed to observe whether the alteration of working and sleeping patterns, coupled with intermittent Ramadan fasting, has any effect on testosterone levels.

## Subject and Methods:

Fifty eight adults were investigated during Ramadan (forty eight men and ten women) all of whom agreed to this investigation. The age range was 19-56 years (mean  $37.05 \pm 9.87$ ). The physical examination of all subjects was normal and they were not taking any medications. All of them maintained the Muslim fasting and followed their usual life style for this month. Their sleeping pattern prior to Ramadan was from about 12-1 midnight to 7-8 AM, but during Ramadan they all stayed awake all through the night and slept after performing dawn prayers. They returned to their pre-fasting sleep pattern after the end of Ramadan.

Blood samples were taken just prior to the start of Ramadan and then on days 7 and 21 of Ramadan and two weeks after the end of Ramadan. On each occasion 10 ml of venous blood was collected in plain glass tubes from each subject at 10AM and midnight. 10:00 AM was chosen as this is the official starting time for work during Ramadan. Specimens were centrifuged immediately and sera stored at  $-18^{\circ}\text{C}$  until analysis in batches.

Testosterone was measured by a radio-immune assay technique. Using the reference ranges of 10-30 mmol/l for males and 0.8-2.8 mmol/l for females.

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**Table 1:**  
Level of 10AM Serum Testosterone of Subjects at Different Time of Study  
Mean  $\pm$  Standard Deviation, (Minimum - Maximum) and Paired Samples t-Test (2-tailed Sig.)

	Male	Female
Age (years)	38.75 $\pm$ 9.79	28.9 $\pm$ 5.15
Pre-Ramadan	15.95 $\pm$ 4.56 (7.7 – 28.1)	2.1 $\pm$ 0.56 (1.4 – 3.1)
7th Day of Ramadan	16 $\pm$ 5.27 (8.2 – 35.5)	1.95 $\pm$ 0.64 (0.9 – 2.9)
21st Day of Ramadan	15.76 $\pm$ 4.24 (9.8 – 25.5)	1.74 $\pm$ 0.43 (1.1 – 2.4)
2 Weeks Post-Ramadan	15.52 $\pm$ 4.56 (9.1 – 26.2)	1.77 $\pm$ 0.48 (1.1 – 2.4)
Pre-Ramadan vs 7th Day of Ramadan	- 0.097 (0.923)	0.85 (0.418)
Pre-Ramadan vs 21st Day of Ramadan	0.434 (0.666)	2.648 (0.027)
Pre-Ramadan vs 2 weeks Post Ramadan	0.879 (0.384)	4.714 (0.001)

**Table 2:**  
Level of Midnight Serum Testosterone of Subjects at Different Time of Study  
Mean  $\pm$  Standard Deviation, (Minimum - Maximum) and Paired Samples t-Test (2-tailed Sig.)

	Male	Female
Age (years)	38.75 $\pm$ 9.79	28.9 $\pm$ 5.15
Pre-Ramadan	10.38 $\pm$ 3.78 (2.3 – 19.3)	1.28 $\pm$ 0.48 (0.9 – 2.3)
7th Day of Ramadan	11.76 $\pm$ 5.03 (5.4 – 30.7)	1.19 $\pm$ 0.24 (1 – 1.8)
21st Day of Ramadan	12.22 $\pm$ 4.34 (5 – 23.3)	1.27 $\pm$ 0.25 (1 – 1.8)
2 Weeks Post-Ramadan	12.93 $\pm$ 4.36 (5.4 – 25.3)	1.3 $\pm$ 0.22 (1 – 1.6)
Pre-Ramadan vs 7th Day of Ramadan	- 3.075 (0.004)	0.777 (0.457)
Pre-Ramadan vs 21st Day of Ramadan	- 4.453 (0.001)	0.093 (0.928)
Pre-Ramadan vs 2 weeks Post Ramadan	- 6.814 (0.001)	- 0.156 (0.879)

## Results:

Of the fifty eight (58) subjects, 46 (79%) showed variation in diurnal testosterone level by the third week in Ramadan which persisted into post-Ramadan. This variation was significant ( $p < .001$ ) (Table 1).

By the third week of Ramadan, thirty eight males (79%) showed significant increases in evening testosterone level ( $p < 0.001$ ) (Table 2) and eight females (80%) showed significant decreases of morning testosterone level ( $p < 0.001$ ) (Table 1). Both new variations persisted two weeks after Ramadan.

## Discussion:

Islam is one of the major religions in the world requiring its followers to fast but it is the only one in which the fasting is intermittent and over a period of one month. This has stimulated several workers to study the effect of such intermittent

fasting on the various biochemical and hormonal levels.

In this study, 38 males (79%) had higher evening levels of testosterone which could be explained by the alteration in the 24-hour sleep pattern and activities. This has been reported in Metabolic changes during Ramadan<sup>(6)</sup>. This increase in evening testosterone level contrasted with decreased testosterone levels found in patients who fasted totally<sup>(13)</sup>.



The decreased testosterone levels seen in the eight (8) females (80% of female subjects) could be of importance as it may imply that intermittent fasting in women with increased testosterone levels (such as those with hirsutism) could reduce these testosterone levels and may be of value in the management of such patients.

The testosterone levels did not revert to the pre-Ramadan levels at two weeks post-Ramadan which probably means that the body takes a little longer to return to its normal pattern.

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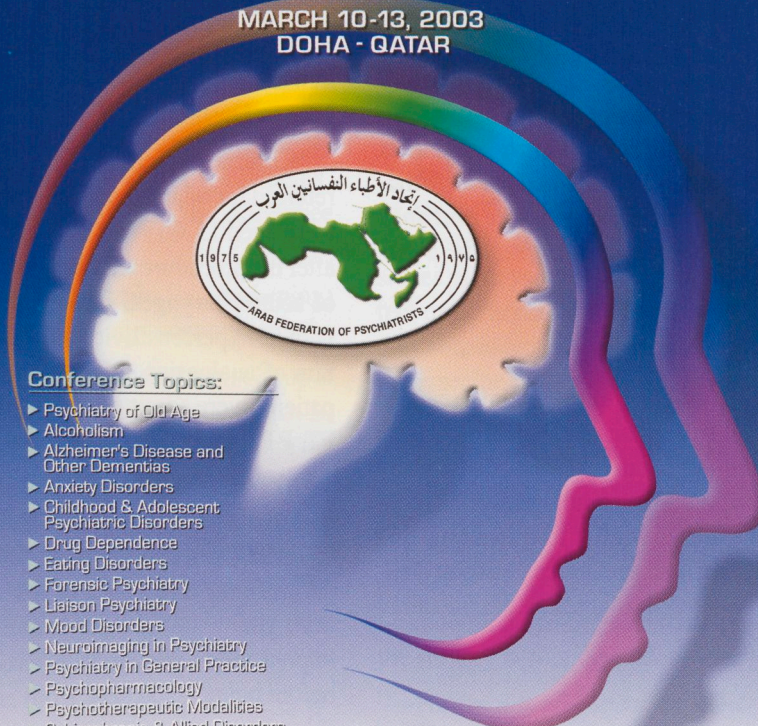



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