Neuroendocrinology Letters Nos.1/2, Feb-Apr Vol.25, 2004
 ISSN 0172–780X **www.nel.edu**

ORIGINAL ARTICLE

Effect of fasting during the month of Ramadan on serum levels of luteinizing hormone and testosterone in people living in the below sea level environment in the Jordan Valley

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Submitted: *December 1, 2003*
Accepted: *December 7, 2003*

Key words: **ramadan; fasting; luteinizing hormone; testosterone; human; below sea level**

*Neuroendocrinol Lett 2004; **25**(1/2):75–77 NEL251204A08 Copyright © Neuroendocrinology Letters **www.nel.edu***

Abstract

OBJECTIVES: To study a possible effect of Ramadan fasting on luteinizing hormone and testosterone in people of the Jordan Valley.
METHODS: A comparative study (n=40) of serum levels of luteinizing hormone (LH) and testosterone (T) between people living in the Jordan Valley (JV), n=20, 360 meters below sea level, and those living in Ramtha City (RC), n=20, 600 meters above sea level, was conducted in December, 1998. A similar study (n=40) was also done during January 1999 in fasting people during the month of Ramadan.
RESULTS: Serum levels of LH in non-fasting people of the JV were statistically similar to those in people of RC. There was also no difference in serum levels of T between non-fasting people of the JV and those in RC. Serum levels of LH in fasting people of the JV were statistically indifferent from those fasting in RC. Serum T levels in fasting people of the JV, on the other hand, were higher than those in fasting people of RC (76±18.3 ng/ml compared to 62.7±24.2 ng/ml).
CONCLUSIONS: It is probably the environmental factors such as the higher barometric pressure of the JV compared to that at above sea level that play a role in higher serum levels of T in people of the JV. Other factors, such as genetic background and/or the cultural and nutritional characteristics of the people of the JV, may also contribute to this difference in serum T levels.

Introduction

The pituitary secretion of adrenocorticotropic hormone (ACTH) and plasma levels of cortisol (F) in male high-school students were shown to be significantly-increased by fasting during the month of Ramadan (1). This effect of stress from fasting in Ramadan on plasma levels of ACTH and F seems to be altitude-independent. Another report by our laboratories had suggested that exercise in trained athletes, another stress factor, causes an increase in serum levels of luteinizing hormone (LH) and testosterone (T) in an altitude-dependent fashion (2). These changes in hormonal homeostasis by exercise and fasting seem to be different in people of the below sea level environment in the Jordan Valley (JV) from those changes in people of above sea level environment. Ramadan fasting seems to alter the rhythmic pattern of a number of steroid and pituitary hormones as well as thyroid hormones (3).

North and South Shouna are located 320–360 meters below sea level in the JV. As control, Ramtha and Irbid cities were chosen as locations for above sea level (550–650 meters). In this study, the effect of fasting during the month of Ramadan on serum levels of LH and of T was investigated. The subjects were chosen from male high-school students of both above and below sea level towns. These experiments were done twice, once in during Ramadan in 1998–1999 and another time during Ramadan 1999–2000. There were minimal differences in the air temperature between the North and South Shouna in the JV and the locations above sea level (Ramtha and Irbid) during December 1998 (and December 1999) and January 1999 (and January 2000).

Experimental design and Methodology

A group (n=20) of adult, clinically healthy male students, aging 17–25 years old was selected from high schools in Ramtha and in Irbid; another similar group (n=20) was also selected in North and South Shouna in the JV. Sample collection and hormonal measurements were done on December, 1998 (non-fasting) and on January 1999 (fasting). This experiment was repeated, using other similar in gender and age groups of students, on December 1999 and on January 2000. Five milliliters of venous blood (antecubital) was withdrawn from each non-fasting students between 3 p.m. and 4 p.m.; from fasting people, following at least 12 hour-fast, also between 3 p.m. and 4 p.m. Serum was prepared from the collected blood samples. Serum levels of T and LH were determined by radioimmunoassay (RIA) using the available commercial Kits from DPC (Los Angeles, CA, U.S.A.).

The data for each group were averaged for the two years (n=40) and expressed as mean ± standard deviation (SD). Differences in the values of means were subjected to unpaired Student *t*-test. P values were considered significant where P is less than 0.05.

Table 1. Effect of fasting during the month of Ramadan on serum levels of luteinizing hormone (LH) in male high-school students

Hormone	Ramtha and Irbid		North and South Shouna	
	Non-fasting	Fasting	Non-fasting	Fasting
LH	2.3±1.6	3.3±1.9	1.4±0.7	3.3±1.3*

*p value < 0.05 compared to that in non-fasting students of North and South Shouna.

Table 2. Effect of fasting during the month of Ramadan on serum levels of testosterone (T) in male high-school students

Hormone	Ramtha and Irbid		North and South Shouna	
	Non-fasting	Fasting	Non-fasting	Fasting
T	66.3±11.4	62.7±14.3	54.9±7.3	76.2±8.1*

*p value < 0.05 compared to that in non-fasting students of North and South Shouna and to that in fasting students of Ramtha and Irbid.

Results and discussion

Serum levels of LH in male non-fasting high-school students of North and South Shouna were statistically similar to those living in Ramtha and Irbid (Table 1). During fasting in the month of Ramadan, LH levels were also similar in students of the two areas (North and South Shouna compared with Ramtha and Irbid). Fasting, on the other hand, caused a significant increase in serum LH levels only in students of the North and South Shouna, as seen in Table 1. It seems likely that pituitary secretion of LH is enhanced during fasting in the below sea level environment in the towns of the Jordan Valley, North and South Shouna. The environmental and genetic factors of the Jordan Valley may both contribute to the effects of the fasting in Ramadan in the people of this location. However, the mechanism by which this effect is expressed is yet to be investigated.

In similar fashion to serum levels of LH, serum T levels in male non-fasting high-school students of North and South Shouna were similar to those of living in Ramtha and Irbid (Table 2). It seems likely that LH secretion plays a major role in serum levels of T in male subjects. This is in agreement with the known facts and what is reported in the literature (4–7). Serum levels of T in fasting students of the Jordan Valley (North and South Shouna) were significantly higher than those in fasting students of Ramtha and Irbid (76.2±8.1 vs. 62.7±14.3). In addition, fasting caused a significant increase in serum levels of T only in male students of North and South Shouna of the Jordan Valley, as evident from the data in Table 2 (76.2±8.1 vs. 54.9±7.3). This is similar to the effect of fasting on LH levels in North and South Shouna (Table 1). It is perhaps LH levels that play a major role in T secretion during fasting. However, the mechanism, by which this process is regulated, seems to be more complex. This is based on the fact that T levels in fasting people of the below sea level environment in the Jordan Val-

ley is higher than those levels during non-fasting, and also higher than those levels in fasting people of above sea level environment in Ramtha and Irbid. Fasting, is suggested here, to be a major contributing factor to the pituitary LH secretion as well as to T levels in both locations of the Jordan Valley towns, North and South Shouna, and of Ramtha and Irbid. The magnitude of increased T levels during fasting seems to be different than that of increased LH levels. It is difficult to explain and interpret this piece of data by the data reported from these experiments alone. The relatively- and significantly-low T levels in non-fasting students of North and South Shouna compared to T levels in non-fasting of Ramtha and Irbid (54.9±7.3 vs. 66.3±11.4) as well as the relatively- and non-significantly-lower LH levels in non-fasting of North and South Shouna to those in non-fasting of Ramtha and Irbid (1.4±0.7 vs. 2.3±1.6), can not, solely, explain why fasting causes an increase in LH and T levels in the towns below sea level and why fasting does not cause a similar effect in students of the above sea level environment in Ramtha and Irbid.

Other stress factors, such as exercise, were suggested by our group to cause a significant increase in serum levels of both LH and T only in athletes of North and South Shouna (2). The higher secretion of LH is suggested to play a major role, at least in part, for the higher serum levels of T following exercise in athletes and fasting in Ramadan in male students. Taken together, these data suggest that stress factors (fasting in Ramadan and exercise) have an effect on LH and T secretion. The below sea level environmental factors, such as the high barometric pressure, as well as the genetic background of the male people in the Jordan Valley (7) may also contribute to these effects on LH and T levels. Environmental factors, stress levels, drugs, cultural and nutritional characteristics, alcohol and others, are all, suggested to influence T release in humans (8, 9). Other experiments investigating the effects of these factors must take place before one can explain their mechanisms. An important recommendation can be deduced from these experiments, relieve the stress from fasting in Ramadan and exercise before measurements of testosterone in male subjects residing in the Jordan Valley. This is of significant value for urologists and clinical chemists in order to avoid misjudgments in the evaluation and management of male infertility.

Acknowledgments

The authors wish to thank Mr. Moaweyeh Shatnawi for his technical assistance in radioimmunoassays. This work has been primarily accomplished using funds from Grants # 99/99 and 167/2000 from the Deanship of Scientific Research of the Jordan University of Science and Technology, Irbid, JORDAN.

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