

## The Effect of Fasting on the Immune System of Athletes during Holly Ramadan

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Article information	Abstract
<p>Article history: Received: 9 Jan 2013 Accepted: 6 Feb 2013 Available online: 28 May 2013 ZJRMS 2014; 16(6): 44-46</p> <p>Keywords: Immune system Athletes Immunoglobulins Complements Fasting</p> <p>*Corresponding author: Department of Immunology and Hematology, Children and Adolescents Health Research Center, Zahedan University of Medical Sciences, Zahedan, Iran. E-mail: hkhazaei18@yahoo.com</p>	<p><b>Background:</b> Holly Ramadan is the ninth month of the Islamic calendar in which millions of mature and obligated Muslims fast many hours during a day in all over the world. This study was performed to evaluate some immune factors in fasting athletes during the month.</p> <p><b>Materials and Methods:</b> This cross sectional study was performed in 90 athletes with physical activity of 2-3 hours per day, age ranged of 16-36 years old, during holly Ramadan. Serum immunoglobulin levels of IgG, IgM, IgA and IgE, as well as serum complement components of C3, C4 and blood count cells with differential evaluation were measured at the beginning and end of holy Ramadan.</p> <p><b>Results:</b> Mean serum IgA level has significantly increased from 239.2±98.2 mg/dL before Ramadan to 262.8±88.6 mg/dL at the end of this month (<math>p=0.008</math>). Mean serum C4 level was 258.2±150.6 g/L and 330.7±127.6 g/L before and after Ramadan, respectively (<math>p&lt;0.001</math>). However, the percentage of lymphocytes was decreased from 37.81±4.14% before Ramadan to 36.50±5.98% at the end (<math>p=0.005</math>) and neutrophils was decreased from 60.0±4.2% before this month to 56.2±8.3% at the end of the month (<math>p=0.003</math>).</p> <p><b>Conclusion:</b> Fasting seems to have positive effects on increasing the serum levels of C4, IgA levels, which could have protective effect on the athletes' immune system against infection during exercise.</p>

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### Introduction

Millions of mature and obligated Muslims around the world fast, during the ninth months of the Islamic calendar (Hejri), named holly Ramadan. Fasting means avoiding from eating and drinking from sunshine to sunset per day [1]. Fasting in Islam has multi-disciplined and regular identity and is over emphasized, while various studies have been published on the physical and sanitarian utilities of fasting [2, 3]. In recent decades, several researchers showed that low calorie diets have useful effects on prolonging the length and decreasing autoimmune diseases and avoiding malignancies in laboratory animals [4-6]. Although the exact mechanism is not clear, it seems that changes in the immune system, cytoplasm, nucleic acids, endocrine glands and decrease in free radicals could be involved in this regard [7]. Mutual effects of the immune system with nutrition and nervous system are currently considered as one of important subjects in immunology and disease treatment. Immune system reactions to stress-inducing factors such as exercise and physical activities could affect the immune system function. Evaluation of extremely exhausting activities and their effects on the immune system may provide useful and valuable information on planning methods and performing physical activities for researchers, trainers and athletes [8]. Therefore some studies have been done to show the effects of fasting on public's immune system [9-11],

which showed that one-month Islamic fasting may cause augmentation of T-cells functions, decrease in inflammation, and may affect immunological reaction of humoral immunity [12], but such investigations have not been performed in special groups; e.g., athletes.

This study was performed to evaluate the effect of fasting on some immunological factors of athletes before and after a month fasting.

### Materials and Methods

This cross sectional analytical-descriptive study has been done on 90 athletes during Ramadan month (August 2011). These athletes were consequently selected from those who had regularly heavy exercise in different fields such as running, volleyball, basketball, karate, Judo, boxing, wrestling, gymnastic, and king boxing; all had heavy exercise before breaking fast. The inclusion criteria were as follow: 1) Athletes with average age of 16 to 40 years, who fast in Ramadan; 2) Athletes who have at least one year history of physical activity, and those who regularly exercised three or more times a week and at least have one hour heavy exercise per day; 3) Athletes who have no history of any cardiovascular, pulmonary, nephrotic, and immunodeficiency disease; indeed those who had no injury caused by physical activities (muscular spasm, tendon tearing, muscular injuries).

Some immune system components, including blood cell indices, serum immunoglobulins levels (IgG, IgM, IgA and IgE) and serum complement components (C3 and C4) were measured in athletes in two periods of before and after holy Ramadan, just after physical activities. The enrolled athletes continued their routine exercise during holy Ramadan. Data of laboratory investigations were analyzed using SPSS-17 software; *t*-Test method was applied to compare laboratory quantities between beginning and end of holy Ramadan. *p*-Value of less than 0.05 was considered as a criterion for acceptability of differences.

## Results

Ninety athletes with age range of 16-36 years old enrolled in this study, who regularly exercised 2-3 hours per day. Based on the results showing in table 1, the mean serum IgA level at the end of Ramadan was significantly increased in comparison to the level before the month (262.8±88.6 mg/dL after Ramadan vs. 239.2±98.2 mg/dL before Ramadan ) (*p*=0.008). Mean serum IgE level before and after Ramadan was 168.0±157.3 IU/mL and 161.8±156.4 IU/mL, respectively, without any significant difference (*p*=0.187). Mean serum IgG before Ramadan was 1685.5±4.4 mg/dL with no significant difference (*p*=0.753) to the level after the month (1667.5±4.6 mg/dL). Indeed there was no any significant difference between mean serum IgM level before and after Ramadan (173.7±75.5 mg/dL vs. 181.8±97.9 mg/dL) (*p*=0.247).

Mean serum C4 level was 258.2±150.6 g/L and 330.7±127.6 g/L before and after Ramadan, respectively (*p*<0.001). However, there was no significant difference on mean C3 serum level before and after the month (147.5±62.2 g/L vs. 151.1±49.0 g/L) (*p*=0.411). Analysis of lymphocyte count showed that percentage of lymphocytes was decreased from 37.81±4.14% before Ramadan to 36.50±5.98% at the end of the month (*p*=0.005) and neutrophils count was decreased from 60.0±4.2% before Ramadan to 56.2±8.3% at the end of the month (*p*=0.003). Other statistical results did not have significant differences.

## Discussion

The results of our study showed that immunoglobulin and complement components levels varied before and

after Ramadan, which may have protective effect on athletes' immune responses to infection and other pathogenicity such as autoimmunity and anaphylaxis statuses during exercise at holly Ramadan. Significant increase in IgA level could have some benefits in protection of athletes from infectious diseases in gut and lung tissues. To our best knowledge, this is the first study investigating this condition, while similar findings have not been found in other studies. On the other hand significant increase in C4 level may have role in induction and maintenance of immune response during exercise but how this has been correlated with fasting during Ramadan, needs to be investigated in future.

To our best knowledge, this is the first study investigating this condition, while similar findings have not been found in other studies. Significant changes in population of lymphocytes and neurophils counts before and after Ramadan in athletes, are the another finding of this study. Mutual effects of the immune system with nutrition, nervous system and endocrine are considered as one of important subjects in the field of immunology. There are some evidences in laboratory animals, showing the effects of prolonged hunger along with extreme physical activity. In a study on two groups of male and female mice in fasting condition for 8 weeks, an increased immunoglobulin levels in colon mucus and cortisol, interleukin 10 (IL-10), and interferon gamma (IFN- $\gamma$ ) in plasma were shown in male mice. Testosterone plasma levels equal to apoptosis in each testicle were considerable increased in male mice, while estradiol and apoptosis levels in ovary were less [13].

Exercise and physical activities could affect the immune system function based on the type, extremity, duration, distance and frequency of activities. A study showed that extreme physical activity may decrease IgG level and may increase NK cells population (CD56). It also may cause a meaningful increase in CD4 and CD8 cells in professional athletes [14].

Another study on exercise in hot, cold and mild temperature on blood leucocytes and platelets in athletes revealed an accumulation and stimulation of the immune cells [15]. The results of our study showed that immunoglobulin and complement components levels could be varied before and after Ramadan, which may have protective effect on athletes' immune responses to infection and anaphylaxis during exercise at holly Ramadan.

**Table 1.** Mean and standard deviation of parameters before and after Ramadan fasting

Time Parameters	Before	After	Changes before/after	<i>p</i> -Value
	Mean±SD	Mean±SD	Mean±SD	
WBCs	7.83±1.81	7.92±1.79	-0.93±1.74	0.600
Lymphocytes	37.81±4.14	36.50±5.98	1.32±6.58	0.005
Neutrophils	60.16±4.21	57.24±8.33	2.91±9.37	0.003
IgA	239.22±98.21	259.18±90.73	-19.95±70.63	0.008
IgG	0	0	407.90±1179.28	0.001
IgM	175.17±74.857	182.41±102.44	-7.24±58.67	0.247
IgE	168.02±157.38	161.81±156.43	6.21±46.94	0.187
C3	147.56±62.27	152.13±50.04	-4.57±52.70	0.411
C4	258.28±150.64	330.00±131.34	-71.72±157.20	<0.001

For example, a significant increase in IgA level could have some benefits in protection of athletes from infectious diseases in gut and lung tissues. To our best knowledge, this is the first study investigating this condition, while similar findings have not been found in other studies. Obtained results may pave a way for more efficient sport planning for athletes during Ramadan by relevant organization; and at the same time, they may provide valuable information for other researchers on more study to the effects of fasting on athletes' immune system. On the other hand, as of Islamic belief on the importance of fasting in purification of self, body and soul health, this research provides useful information on athletes immune system changes during holy Ramadan, especially in hot months of year, in which there is more losing of water and electrolyte during the exercise. So, relevant executors and also relevant organizations, especially physical education, may have more applicable

and better decision makings and planning for this crucial group during this holy month. Further studies are needed to depict the precise role of the immune functions of athletes during holly Ramadan.

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### Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

### Conflict of Interest

The authors declare no conflict of interest.

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