

Original article

The responses of white blood cells to weight loss among young male judoists

Ardalan Shariat¹, Shamsul Bahri Mohd Tamrin¹, Mahmoud Danaee², Hossein Karimi³¹ University Putra Malaysia, Serdang, Malaysia² Islamic Azad University, Roudehen, Iran³ University of Sharjah, UAE

Received 28 June 2013, Accepted 15 July 2013

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Abstract: The *purpose* of this study was the assessment of white blood cells in response to acute and gradual weight loss among young male judoists. *Material and Methods*—Twenty four healthy young judoists aged 17.0±1.2 years (mean ± SD), with one year of experience in judo training, selected and they were randomly classified in two groups of acute weight loss and gradual weight loss. Blood sampling was conducted in three stages: 1) before weight loss, 2) 18 hours after weight loss, and 3) after the last phase of physical exercise performance tests. *Results*— The average amount of white blood cells in the phase 2 for both groups didn't increase meaningfully (Acute: P=0.53, Gradual: P=0.48) but the increase in the phase 3 for both groups was significant (P<0.01). *Conclusion*— This study concludes that acute weight loss can result in changing the level of white blood cells which are determined in immunity system and related disease.

Keywords: white blood cells, weight loss, young male judoists

Cite as Shariat A, Bahri MTS, Danaee M, Karimi H. The responses of white blood cells to weight loss among young male judoists. *Russian Open Medical Journal* 2013; 2: 0311.

Correspondence to Ardalan Shariat. Tel: 006-0173365494. E-mail: Ardalan_sh2002@yahoo.com

Introduction

Society's interest and need to improve healthy training is a subject that attracts researchers' attention to mechanisms that affect the abilities of the immune system during training. The studies on exercise immunology have mainly demonstrated that moderate exercise result in positive change in the immune system. In the long run, it results in better immunity to such common sickness as cold and respiratory tract infections [1]. This idea is also supported by the health guidelines that encourage the public to have about 30 minutes of daily physical activities [2]. Above normal physical activities can increase the risk of upper respiratory tract infections in the athletes. However, when such factors concerning the immune function as stress, lack of sleep or malnutrition are involved, this risk increase. Therefore most of immune cells will be increased in response to intensive physical activity, it occurs an immune system suppression that leads to increasing in readiness for infections [1]. Weight loss and its consequences are prevalent among the athletes particularly the judoists. On the other hand, using the different ways of weight loss in order to achieve proper weight near the competition, affect both athletic performance and immune system of the athlete. Based on the previous literature review, we hypothesized that acute weight loss cause to increase in white blood cells. In our knowledge, before this research, there was not a clear study about acute weight loss in young male judoists so the main objective of this study was to survey the responses of white blood cells to weight loss among young male judoists.

Material and Methods

For this purpose, 24 practiced judoists from Home of Judo in Isfahan, located in Iran during the February of 2012, aged 17.0±1.2 years (mean ± SD) selected voluntarily and they were randomly classified in two groups (acute weight loss =12 and gradual weight loss =12).

Prior to the testing, the protocol, objectives and potential risks were explained clearly for the participants and their parents. At first, they answered to a questionnaire about their training and blood sampling and then examined by a doctor [4].

The inquiries showed that none of the participants were the consumers of the supplements, such as proteins, amino acids, creatine, carbohydrate, etc. the schedule provided for the participant, consisted of 3 days of exercise in a week. In addition, their regular schedule as well s their diets were supervised by an experienced dietitian. They were also instructed how to practice the activity and the diet program during the testing period. During this period they were not involved in any extra physical training and did not change the normal sleeping pattern, which was considered to be 8 hours per night, either [5].

Blood sampling was conducted in three stages:

- 1) Before weight loss,
- 2) 18 hours after weight loss, and
- 3) After the last phase of physical exercise performance test. (plasma change percentage was calculated based on Dale and Castile formula in 1974), some tests were also taken (by taking judo simulated tests) to evaluate aerobic and anaerobic capacity

[2], and muscular strength and endurance[6]. The participants in the test were asked to lose 4 percentages of their weight. The first group started a weight loss conventionally through sauna and intensive diet in 48 hours, and the second group lost weight based on the gradual method [5].

Statistical Analysis

Descriptive statistics including means and standard deviation were calculated to explore the data. Normality test (Kolmogorov–Smirnov) and repeated measure ANOVA in a significant level of $P < 0.05$ method were utilized. Statistical analyses were done through SPSS (20th version, SPSS Inc., USA).

Results

According to the normality test all data were distributed normally so a repeated measure ANOVA as a parametric method was used. As all variables were quantitative in this research so they were presented as mean \pm SD as a commonly used method. The average amount of white blood cells in phase 2 for both groups didn't increase meaningfully ($P > 0.05$). But the acute one had 4.3% of the white blood cell increase in phase 2 relative to phase 1, and in contrast the gradual group represented 5.6% of white blood cell decrease in phase 2 than phase 1. White blood cells of both groups increased meaningfully in phase 3 ($P < 0.05$). The white blood cells of the acute group increased 54% in phase 3 than phase 1 (out of normal range), on the other hand the amount of increased white blood cell in gradual group was 41% in phase 3 relative to phase 1 (in the normal range). White blood cells changes are shown in *Table 1*.

Discussion

Nowadays, with improving on the level of competition and as the participating in the competition and win is changed to a business for the athletes [7], the athletes try to earn the best results in less time.

Judo is a martial art with high intensity that the categories for the competition are based on the weight, therefore the athletes try to keep their weight in their suitable category. For this purpose, they use different ways to lose weight near the competitions of sauna and some medicine, that affect their health and especially their immune system [8].

Exercise can increase the stress hormones in both children and adults [9]. The measurement of these stress hormones, including adrenaline (epinephrine) and noradrenaline (norepinephrine) was not the concern of this study [2]. And those can affect the immune system in response to this action. White blood cells increasing that is seen in most of the researches [10] like the present one, may result from Neutrophils related to the effect of catecholamine and cortisol changes and some factors resulting from intensive exercise

like judo. In the adult participants, there is an initial increase after the exercise, in the natural killer cell number. This increase, which normally persists for a few hours is followed by a decrease (exercise associated lymphopenia)[1].

This study shows that the increase in energy consumption during the competition results in a rapid-weight-loss in more than 60% of all types of combat sport athletes. The age at which a sudden reduction of body mass starts for the first time in these athletes, especially the strikers, was considered as a disturbing factor. This study showed that many of the athletes experience the rapid-weight-loss slightly slower than 89%, which was reported by Artioli, Gualano, et al. (2010) in Brazilian judoists [11], and the similar reports by Steen and Brownell (1990) in Olympic wrestlers in the United States [12]. The findings were more similar to 60–70%, the reports made by Kinningham and Gorenflo (2001) in high school Olympic wrestlers [8] and the reports of Kordi et al. (2011) as the results of the studies on Iranian wrestlers [9].

Regarding the above results, we can conclude that comparing two groups, the increase amount of white blood cells of acute group in phases 2 and 3 is more than gradual group and the increase amount of white blood cells in phase 3 is out of normal range, but white blood cells changes of gradual phase are in normal range. We can demonstrate the influencing mechanism as the following. Acute weight loss is an intense physiological stress which can be accompanied by disorder in security system variables and in response to these changes the number of white blood cells will be increased, that, makes the potential for some diseases such as upper respiratory tract infection [13].

Considering neutrophil phagocytosis and their growth during inflammation, this result was not far-fetched. Since intense exercise damages muscle as a result of which white blood cells increase. It is likely that some factors like increased activity of sympathetic nervous system, increased cardiac output, and change in capillary endothelial cells plays an important role in releasing the cells adjacent to the capillary wall and sending them into the blood flow [14].

Conclusion

Finally, compared to gradual weight loss, acute weight loss has a more destructive effect on the immune system and weakens it in a cute way. To put in sum, this study has provided first handed data regarding the important impact of field physical activities, on the subsets of the immune cell in healthy adults.

Acknowledgment

Hereby, the authors of this article wish to express their special thanks to Prof. David Pyne for his generous support and invaluable guidance. Our deepest gratitude also goes to our editorial board Ms. Roya Jabarouti.

Conflict of interest: none declared

Table 1. The mean \pm SD of white blood cells and P-value during phase 1, 2 and 3 (9/L¹⁰)

Group	1 (Before weight loss)	2 (After weight loss)	P-level	3 (After test)	P-level	Reference Range	
White blood cells	Acute	6.80 \pm 1.23	7.24 \pm 2.11	0.532	14.18 \pm 1.82	<0.01	4-11
	Gradual	6.21 \pm 1.03	5.68 \pm 2.35	0.481	11.70 \pm 1.77	<0.01	4-11
Neutrophil	Acute	49.12 \pm 9.55	48.95 \pm 10.73	0.745	63.23 \pm 9.90	0.011	50-70
	Gradual	49.14 \pm 8.66	48.37 \pm 9.08	0.833	55.43 \pm 11.44	0.108	50-70
Lymphocyte	Acute	40.12 \pm 9.39	39.43 \pm 8.81	0.653	23.34 \pm 10.31	<0.01	20-40
	Gradual	36.21 \pm 3.55	39.30 \pm 4.40	0.071	36.01 \pm 6.55	0.162	20-40
Monocyte	Acute	7.14 \pm 1.63	7.65 \pm 1.44	0.425	6.07 \pm 1.39	0.012	3-12
	Gradual	7.90 \pm 1.01	7.34 \pm 1.59	0.314	6.20 \pm 1.02	0.048	3-12

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Authors:

Ardalan Shariat– PhD student, Department of Physical Education and Sport Sciences, Faculty of Educational Studies, University Putra Malaysia, Serdang, Malaysia;

Shamsul Bahri Mohd Tamrin – Associate Professor, Department of Environment and Occupational Health, Faculty of Medicine and Health Science, University Putra Malaysia, Serdang, Malaysia;

Mahmoud Danaee – PhD, Department of Biology, Roudehen Branch, Islamic Azad University, Roudehen, Iran;

Hossein Karimi – Associate Professor and Chair, Department of Physiotherapy, College of Health Sciences, University of Sharjah, UAE.