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THE EFFECT OF RAPID AND GRADUAL WEIGHT LOSS ON SOME HEMATOLOGICAL PARAMETERS IN TRAINED WRESTLERS

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ABSTRACT

Introduction: Weight loss is a common issue among athletes, especially wrestlers. It is important that the various methods of weight loss be studied relative to the effect on athletic performance as well as the athletes’ immune systems. The purpose of this study was to compare the effects of rapid and gradual weight loss methods on white blood cells in trained wrestlers.

Materials and Methods: 22 trained wrestlers (age 20-25 years) volunteered to participate in the present research and were randomly assigned into one of two groups: Group 1 used rapid weight loss in a 48 h period, and Group 2 used gradual weight loss over a 12 day period. All subjects were asked to reduce 4 percent of their weight. Before and after weight loss intervention, blood sampling was performed, as well as the physical performance tests (simulated wrestling competition).

Results: White blood cells increased significantly in both groups (p<0.05). The amount of this increase was out of normal range in the rapid group, but remained within the normal range in the gradual group. Neutrophils increased significantly while Lymphocyte decreased significantly in the rapid group (p<0.05).

Conclusion: Comparing this two weight loss protocols showed that rapid weight loss method had more deleterious effects on the immune systems of wrestlers.

Key Words: weight loss, white blood cell, Neutrophil, Lymphocyte, wrestler.

INTRODUCTION

There is great interest in the need to improve community health through exercise. A topic attracting researchers is an understanding of the mechanisms that improve health or cause damage to the immune system during exercise (Nieman and Pedersen 1999, Gleeson 2007). In many cases, high-intensity exercise may induce significant changes in leukocyte distribution and function, causing temporary impairment of immune function during recovery period (Braun and von Duvillard 2004). Although most immune cells increase during exercise but during recovery after intense exercise, a suppressed immune system or window opening stage (open window) occurs; in this case the risk of infection increases (Shephard 2003, Smith 2003). In addition to exercise intensity, repeating that exercise just after several hours, also may cause changes in immune system by nervous-hormonal-stress responses. It may increase the risk of an open window in recovery period (Nielsen, Secher et al. 1996, Eliakim, Wolach et al. 1997, Nieman and Pedersen 1999, Bishop 2006). Heavy exercise causes a temporary suppression of the cellular and hormonal immune system; it means a reduction of peripheral blood Neutrophils, killer cells (Natural Killer cell) and lymphocytes and it will be resolved two weeks after heavy exercise (Steen and Brownell 1990, Bishop 2006). Hematologic indexes in sports medicine are vital and necessary. These indexes are used for the diagnosis, management and prevention goals (Younesian, Mohammadion et al. 2004). Effect of exercise on Hemostasis system depends on some parameters such as intensity, duration and the initial state (Habibian, Moosavi et al. 2010). In long-term physical activity, redistribution of body fluids in order to maintain efficiency in sport skills is very important and vital, not only during practice and competition but also for maintaining good health (Amir-Sasan R and V. 2002). Many studies have been done on the effect of exercise on Hematological indexes that suggest different results (Hemat Far 2001). Wu et al (2004) observed an increase in white blood cells after a 24-hour ultra-marathon race (Wu, Chen et al. 2004). Weight loss makes a reduction of resistance to infection such as upper respiratory tract infection besides a drop in athletic performance (Steen and Brownell 1990, Oppliger, Landry et al. 1993). In addition to the type and intensity of exercise, dehydration and weight loss repeatedly during a season of hard exercise can have adverse effects on the immune system and the ability of athletes (Nielsen, Secher et al. 1996). Weight loss may cause lack of fitness and ability to participate in the competition; the internal organs of the body including the kidneys, liver and heart are exposed to damage, so weight loss should be based on scientific principles, diet and proper training (Rashid Lamir 2009). Many studies have been done on the impact of rapid weight loss techniques on physiological and psychological factors in...
weight category sports, with little difference between the results indicating the negative effects of rapid weight loss on the above factors (Fogelholm, Koskinen et al. 1993).

Rashidlamir et al (2009) proposed a new method of weight reduction in wrestlers (Rashid Lamir 2009). Unfortunately no was found regarding the effects of weight loss on Hematological indices. So, the aim of this research is compare the effects of acute and gradual weight loss methods on some hematological parameters.

MATERIALS AND METHODS
This study is a semi-experimental study. Among trained wrestlers living in Khorasan-Razavi province, 22 wrestlers with mean age of 22.5 ± 2.3 and BMI of 23.9 ± 2 volunteered to participate in the study. Then, they were randomly assigned into two gradual (proposed) and acute (rapid) groups. Blood samples were collected in three phases: before weight loss (A phase), 14 hours after the weight loss period (B phase) and after the last test (C phase) (Percent of changes in plasma volume were calculated according to the Dill and Costill formula 1974) (Dill and Costill 1974). Prior and 14 h after the weight loss, body composition was analyzed using bioelectric impedance analysis. Also, aerobic capacity and anaerobic power were measured by Bruce and Wingate (arms and legs) tests (Table 2). All subjects were required to lose 4% of their body weight. Participants in rapid group reduced their weight during 48 hours via traditional methods (severe diet, fluid restriction and using sauna). Participants in gradual group were monitored and evaluated to determine the amount and type of food intake. Then, they were asked to reduce their weight according to the Rashidlamir’s method during 12 days (Table 1). In this method, there are three four-day phases. In the first three days of each phase, food intake is decreased and on the fourth day there is a return to the diet from the previous phase. In the first phase, the subjects decreased their food intake by 10% for three days (lunch and dinner) and then they returned to their usual eating habits on the fourth day (daily dietary habit before the protocol). In the second phase, they decreased their food intake by 20% for three days, then they returned to the 10% decrease on the fourth day. In the third phase, first they decreased their food intake by 30% for three days and then they returned to the 20% decrease on the fourth day. There was no limitation on drinking water and no decrease in breakfast, but the subjects avoided fat in all meals.

<table>
<thead>
<tr>
<th>Pre-test</th>
<th>4% weight loss</th>
<th>Post-test 1</th>
<th>Rest (20 min)</th>
<th>Post-test 2</th>
<th>Rest (20 min)</th>
<th>Post-test 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>Evening</td>
<td>Morning</td>
<td>Arm</td>
<td>Evening</td>
<td>Arm</td>
<td>Evening</td>
</tr>
<tr>
<td>Body composition</td>
<td>Arm Wingate</td>
<td>Body composition</td>
<td>Arm Wingate</td>
<td>Leg Wingate</td>
<td>Leg Wingate</td>
<td>Blood sample</td>
</tr>
<tr>
<td>Blood sample (A phase)</td>
<td>Leg Test</td>
<td>Blood sample (B phase)</td>
<td>Leg Wingate</td>
<td>Bruce Test</td>
<td>Bruce Test</td>
<td>(C phase)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction in lunch</th>
<th>1st day</th>
<th>2nd day</th>
<th>3rd day</th>
<th>4th day</th>
<th>5th day</th>
<th>6th day</th>
<th>7th day</th>
<th>8th day</th>
<th>9th day</th>
<th>10th day</th>
<th>11th day</th>
<th>12th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>Eating as usual</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction in dinner</th>
<th>1st day</th>
<th>2nd day</th>
<th>3rd day</th>
<th>4th day</th>
<th>5th day</th>
<th>6th day</th>
<th>7th day</th>
<th>8th day</th>
<th>9th day</th>
<th>10th day</th>
<th>11th day</th>
<th>12th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>Eating as usual</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>30%</td>
<td>30%</td>
<td>30%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

PARTICIPANTS
The population of this study was the trained wrestlers with a history of at least 5 years of continuous practice. In addition they often have participated in national competitions and all of them had at least a provincial or national championship rank.
STATISTICAL ANALYSIS
The data were analyzed using Kolmogorov-Smirnov, one-way ANOVA and repeated measures tests, at the minimum significant level of p<0.05 using SPSS software (version 16).

RESULTS
The average of white blood cells count in both acute and gradual groups in phase B (14 hours after weight loss) did not increase significantly. However, in the acute group in phase B we observed a 4.7% increase in white blood cells as compared to the phase A (before weight loss); however the gradual group in phase B (14 hours after the weight loss) showed a reduction of 5.4% in white blood cells as compared to phase A (before weight loss). White blood cells in both acute and gradual groups in phase C (after the final stage of athletic performance test) were significantly increased (p≤0.05). This increase in white blood cells in the acute group (after the last performance test) was 53% (out of the normal range) as compared to phase A (before weight loss); on the other hand the increase of white blood cells in gradual group in phase C (after the last performance test) was 42% (in the normal range) as compared to phase A (before weight loss).

The average of neutrophils in both acute and gradual groups in phase B did not significantly increase, but in acute group, it increased by 1% in phase B, as compared with phase A; although in gradual group a reduction of 4% was observe in phase B as compared to the A phase. However in the acute group in phase C we observed a significant increase (p≤0.05); but in the gradual group in phase C they did not significantly increase.

The average of lymphocytes in neither of the acute or gradual groups in phase B decreased significantly. However, there was a 1.7% decrease in the acute group in phase B as compared to phase A. Additionally, in gradual group in phase B, an increase of 4.7% was observed as compared to phase A, but in the acute group in phase C there was a significant decrease (p<0.05); however, in the gradual group there were no significant decreases.

Table 3. The average of WBC, significance level and changes in different phases.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Group</th>
<th>A phase</th>
<th>B phase</th>
<th>Sig level</th>
<th>Change in B phase</th>
<th>C phase</th>
<th>Sig level</th>
<th>Change in C phase</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC</td>
<td>Acute</td>
<td>7.04</td>
<td>7.39</td>
<td>P=0.44</td>
<td>4.7% ↑</td>
<td>15.19</td>
<td>P&lt;0.01</td>
<td>53% ↑</td>
<td>4-11</td>
</tr>
<tr>
<td></td>
<td>gradual</td>
<td>6.20</td>
<td>5.88</td>
<td>P=0.42</td>
<td>5.4% ↓</td>
<td>10.83</td>
<td>P&lt;0.01</td>
<td>42% ↑</td>
<td>50-70</td>
</tr>
<tr>
<td></td>
<td>Acute</td>
<td>51.09</td>
<td>51.60</td>
<td>P=0.863</td>
<td>1% ↑</td>
<td>66.45</td>
<td>P=0.013</td>
<td>30% ↑↑</td>
<td>20-40</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>gradual</td>
<td>49.97</td>
<td>48.04</td>
<td>P=0.096</td>
<td>4% ↓</td>
<td>56.31</td>
<td>P=0.161</td>
<td>12.6% ↑</td>
<td></td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>Acute</td>
<td>39.53</td>
<td>38.84</td>
<td>P=0.793</td>
<td>1.7% ↓</td>
<td>25.61</td>
<td>P=0.013</td>
<td>54.3% ↓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gradual</td>
<td>39.66</td>
<td>40.60</td>
<td>P=0.061</td>
<td>4.7% ↑</td>
<td>35.03</td>
<td>P=0.384</td>
<td>10.3% ↓</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION
The results showed that the average number of white blood cells increased in both acute and gradual groups. This increase was reported to be 53% (out of the normal range) and 42% (normal range) in the acute and gradual groups respectively. These changes in both groups were statistically significant (p≤0.05). The possible mechanism explaining this phenomenon could be that acute weight loss is a severe physiological stress that can be associated with disorders in immune variables and individuals who are more prone to specific diseases such as upper respiratory tract infections. This issue for competitive athletes may be of particular importance. That is because they must be in the optimal physiological condition to do their best in performance (Steen and Brownell 1990, Nielsen, Secher et al. 1996).

However, increase in leukocytosis in this research was similar to some other studies (Wu, Chen et al. 2004, Ghanbari Niaki, Tayebi et al. 2005, Hulmi, Myllymäki et al. 2010), that may also be due to neutrocytosis that is affected by changes in catecholamines and cortisol (Wu, Chen et al. 2004). According to the role of neutrophil
phagocytosis during inflammation and their increase, this result is plausible because intense exercise can cause muscle damage and as a result of this injury, white blood cells levels are increased. Maybe some factors such as increased activity of the sympathetic nervous system, increased cardiac output and changes in endothelial cells of capillaries are effective in releasing cells attached to the walls of the capillaries into the bloodstream (Tayebi, AGHA et al. 2011). Neutrophils are also increased in both acute and gradual groups; it was statistically significant in the acute group (p≤0.05). Although lymphocytes decreased in both acute and gradual group and there was a significant reduction in the acute group (p≤0.05). In this study, the athletes underwent a 20-day weight loss and physical activity intensity was reached. Weight loss was divided into two groups: mild group (with a weight loss of less than 4%) and severe group (more than 4% weight loss). The result in this study was similar to our study; neutrophils had increased (Rowbottom, Keast et al. 1996, Imai, Seki et al. 2002). Increase the number of white blood cells in this study was associated with increased numbers of neutrophils; because the results showed a significant increase in the percentage of neutrophils same as to white blood cells. Other studies have also shown that the increase in neutrophils during exercise is greater than the increase in total white blood cell (Eliakim, Wolach et al. 1997). In other studies, lymphocytes changes were reported to be similar to changes in white blood cells and neutrophils that contradicted our findings (Roberts 1998, Shephard 2003). Although it is generally believed that the lymphocyte count elevated immediately after exercise and after about 24 hours and after recovery, it decreases and reaches the lower limit of normal (Eliakim, Wolach et al. 1997). Reducing the number of lymphocytes is very important; in the acute group, athletes are susceptible to viral infections during weight loss. In acute group, increase in white blood cell count may be related to stress, weight loss, physical activity or concentration cells due to dehydration and not the number of cells. Differences between our findings with other studies could be due to differences in the diet, and the weight loss method and length . Additionally, the increase in white blood cell count can be due to increased catechol amines, particularly adrenaline and increase in cortisol during exercise (Eliakim, Wolach et al. 1997, AK. 2006). In some studies, the difference between weight loss and exercise and physical activity are not seen, so the theoretical effects of catechol amines and cortisol is considered as one of the strong factors in this regards (Eliakim, Wolach et al. 1997, Imai, Seki et al. 2002). This increase can be sustained within minutes or hours after exercise and gradually return to normal levels (Steen and Brownell 1990, Eliakim, Wolach et al. 1997). Imai et. al reported same changes in two groups of with and without weight loss in Judo (Imai, Seki et al. 2002). Increase in WBC count and neutrophils were observed in acute group. Methods of weight loss (acute versus gradual) can be effective in these domains because acute weight loss, as compared to gradual weight loss, has more damaging effects on the immune system and may lead to severe repression of the immune system following rapid weight loss method. Rapid weight loss, as compared to gradual weight loss, has a more damaging effect on the immune system and may lead to severe repression of the immune system following this method. Therefore, we may conclude that acute weight loss can seriously threaten the wrestlers’ health.

PRACTICAL ADVICE FOR COACHES AND WRESTLERS
Therefore, coaches and athletes of weighing fields especially wrestlers are recommended to avoid acute weight loss methods and use replacements such as the recommend method in this research (gradual method) so that they can preserve their health status, successfully lose their weight, preserve their sporting performance and gain better results.

REFERENCES