Effects of Rapid Weight Loss on Electrolytes in High School Wrestlers

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Abstract 본 연구는 고등학교 레슬링 선수의 급성 체중감량이 체내 전해질(Na+, K+, Cl−)에 어떠한 영향을 미치는지를 알아보기 위한 것으로, 그 지역 고등학교 레슬링 선수 8명을 대상으로 체로 운동과 본 운동 및 식이 제한을 병행한 체중감량 방법을 사용하여 2주에 걸쳐 자기 체중의 3%, 5%의 감량을 실시하였다. 3%와 5% 체중감량 각각에 대하여 감량 전, 감량 후 및 회복기(감량 15시간 후)의 전해질 농도를 분석한 결과는 다음과 같다. Na+과 Cl−는 3% 감량 시에는 감량 전, 감량 후 및 회복기에 유의한 차이가 없었으나, 5% 감량 시에는 감량전과 감량 후 및 회복기에 유의한 차이(p <0.05)가 나타났으며, 회복기에 감량 전 수준으로 되돌아갔다. K+은 3% 감량 시 감량전과 후에 유의한 차이(p <0.05)가 나타났고 회복기에 감량 전 수준으로 되돌아갔으나, 5% 감량 시에는 감량전과 후에 유의한 차이(p <0.05)가 나타났으며, 회복기에도 감량 전과 유의한 차이(p <0.05)가 나타났다. 5% 감량 시에는 세 가지 체중감량 변인 모두에서 유의한 차이가 나타나고 고등학교 레슬링 선수들은 대상으로 5% 이상의 급성 체중감량은 체내 전해질의 불균형을 초래하여 선수들의 경기력에 부정적인 영향을 미칠 수 있으므로, 향후에는 선수들의 성장 발달 및 경기력에 부정적인 영향을 미치지 않는 과학적이고 체계적인 체중감량 방법과 조절되여야 할 것으로 사료된다.

Keywords : 급성체중감량, 전해질, 레슬링 선수

I. Introduction

Regulation of body weight becomes a critical issue not only in medical and nutritional science, but coaches training the players. More specifically, major concern is how to maintain an efficient weight loss in accordance with the individual physical state without hurting players’ capability. For the players’ weight limit games, weight loss has a close correlation with the result of a game.

Reducing weight stimulate various physical changes a physiological, biochemical and histochemical transformations. Radical weight loss of weight can cause negative effects; decrease of blood amount, decline of cardiac capability, drop of oxygen consumption, irregular body temperature, exhaustion of liver glycogen, and weight loss of electrolytes (Shaver, 1981; Maughan & Shirreffs, 1997).

When weight loss occurs, the amount of water decreases and hence the amount of electrolytes can also be changed (Roemmich & Sinning, 1996). Therefore, we have to understand various physical changes resulting from the change in the amount of electrolytes and to carry out scientific analysis about the efficient degree or period of weight loss which will not cause negative effects. With this, we can give a hand to high school players not only in their health and physical development but also in the increase of their playing capabilities.

Electrolytes play a role to regulate appropriate electronic change, in and out of cell membrane, which contributes muscle contraction caused by conduction and stimulus of neural impulse. It also delays fatigue in protecting acidification of tissues, maintaining permeability of cell membrane and balancing acid-base (Mcarth, 1991).

Maintaining sufficient amount of electrolytes in body is very critical. Because it makes a direct effect on players’ activity and hence on the result of a game. Also, it helps players’ recovery their original capability with assisting rapid recovering from fatigue. In particular, to give and aid for their health, development and maintaining playing capability, the high school wrestlers in growing-up period should reduce their weight on the basis of scientific methodology to maintain adequate amount of electrolytes in their body.


In this research, we observed the changes of electrolytes concentration when high school wrestlers experimented lost rapidly their weight through limited food provision, training methods. The purpose of this research lies in suggesting scientific basis for

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weight loss maintaining adequate concentration of electrolytes without making negative effects on players capability, development and their health.

II. Method

1. subjects

As subjects of this research, we selected eight high school wrestlers attending A high school in P city. Their career as a player was over three years and they never tried to intentionally reduce weight before this experiment. Subjects' physical data are shown at Table 1.

2. Experimental Design

For this study, we defined the degree of weight loss(3%, 5%) as independent variables, electrolytes(Na⁺, K⁺, Cl⁻) as dependent variables. weight loss was carried out with ordinary methods of the players, over two steps. First step was carried out May 12th to 14th by 3% and second step, July 7th to 9th by 5%. To compare concentration difference among three dependent variables by the degree of weight loss and before and after weight loss, we carried out paired t-test.

3. Experimental Methods and Procedures

This experiment was carried out collaborated with the public medical center near the A high school. Before the experiment, the subjects and their parents were made to understand the experiment.

Following over 8 hours' deep sleep and 12 hour of fast, about 5 ml of blood of the testee's forearm vein was gathered with injector. After collecting blood, the subjects took a rest for two hours and tried to reduce weight through running, side-training and main training in training wear at playground and gym.

Subjects were started training for weight loss at 4 p.m. After running for 30 minutes with 65%-75% of their maxi-mum intensity, they moved gymnasmium to have one hour of main training related to wrestling and 30 minutes of side-training for power, flexibility and agility. Time to reduce weight can not be simultaneous because of individual difference. So, gathering blood was carried out from those who reach targeted weight first.

After collecting blood, the subjects were provided drinks containing ions and without medical elements to supply water. And they eat foods about 70% of their ordinary amounts avoiding stimulus food like meats and flour-containing foods. After meal, they eat some fruits and go to bed at 22:00

Next morning, they got up at 6:30 and warm up with soft physical training and running. After 30 minutes rest, blood was gathered. Blood collected was put into a tube which had subjects' name and kept refrigerator until it was separated from blood serum with a centrifuge. With blood analyzer, individual concentration of electrolytes(Na⁺, K⁺, Cl⁻) in the time of before weight loss, after weight loss and recovery was measured.

4. Data Analysis

Collected data was statistically arranged through the SPSS 10.0. Mean and the standard deviation of Na⁺, K⁺, Cl⁻ in each weight loss of 3%, 5% in the time of before and after weight loss, and recovery were measured. And then paired t-test was carried out to compare electrolyte concentration of 3% and 5% weight loss. Level of significance defined as α = .05.

III. Results

1. Changes of Na⁺ Concentration

As a result, all of the subject's electrolyte concentration levels fall within normal range before they reduce weight. Na⁺ concentration level changes after losing 3% of body weight show as in Table 2, Pre, Post and Rec are respectively as 138.71±1.52 mEq/L, 140.23±2.03 mEq/L, 139.45±1.27 mEq/L and there appeared to be no significant differences between the times. K⁺ concentration level changes after losing 3% of body weight show as in Table 3, Pre, Post and Rec are respectively as 3.95±0.97 mEq/L, 4.52±1.91 mEq/L, 4.27±1.58 mEq/L and more significantly different Post than Pre(p<.05). Cl⁻ concentration level changes after losing 3% of body weight show as in Table 4, Pre, Post and Recovery are respectively as 100.18±1.28 mEq/L, 103.04±1.96 mEq/L, 102.32±1.54 mEq/L and there appeared to be no significant differences between the times.

2. Changes of K⁺ Concentration (Table 3.)

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre</th>
<th>Post</th>
<th>Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>138.71±1.52</td>
<td>140.23±2.03</td>
<td>139.45±1.27</td>
</tr>
<tr>
<td>5%</td>
<td>139.18±1.47</td>
<td>144.51±1.73</td>
<td>141.33±1.84</td>
</tr>
</tbody>
</table>

Values are Mean±S.D. * : p < .05

Table 3. Changes of K⁺ Concentration

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre</th>
<th>Post</th>
<th>Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>3.95±0.97</td>
<td>4.52±1.91</td>
<td>4.27±1.58</td>
</tr>
<tr>
<td>5%</td>
<td>4.17±1.73</td>
<td>5.32±2.06</td>
<td>4.43±2.23</td>
</tr>
</tbody>
</table>

Values are Mean±S.D. * : p < .05, ** : p < .01