EFFECT OF TWO TAPERING METHODS ON INTERLEUKIN-6, CORTISOL AND PERFORMANCE IN ELITE MALE WRESTLER

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Abstract

The purpose of this study was to compare the effect of two types of tapering on interleukin-6(IL-6), cortisol and performance in elite male wrestler. After 4 weeks of progressive training, wrestler was randomly divided into three equal groups, 1-control group (N=10) continued performing progressive training for one week, 2-taper group 1 (N=10) continued with a 50% reduction in training volume for one week, 3-taper group 2 (N=10) continued with a 75% reduction in volume of training for one week. Plasma blood IL-6 and cortisol levels were assayed from analysis obtained via standard ELISA. Also general strength muscle was recorded (N=10) continued with a 75% reduction in volume of training for one week. Plasma blood IL-6 and cortisol levels were assayed from analysis obtained via standard ELISA. Also general strength muscle was recorded (N=10) continued with a 75% reduction in volume of training for one week. Plasma blood IL-6 and cortisol levels were assayed from analysis obtained via standard ELISA. Also general strength muscle was recorded (N=10) continued with a 75% reduction in volume of training for one week. Plasma blood IL-6 and cortisol levels were assayed from analysis obtained via standard ELISA. Also general strength muscle was recorded.

Result: There were significant reduction IL-6 and cortisol levels among both tapering group with control group (P≤0.05). There was significant reduction of IL-6 and cortisol levels among tapering 50% and tapering 75% after tapering period (P≤0.05). Also there was significant increase in general strength muscle between tapering 75% and control group (P≤0.05). Hence, one week tapering with 75% reduction in training volume after progressive training while the intensity kept high is effective strategy for reduction IL-6, and cortisol levels and also increase performance. It seems that higher reduction of training volume when the intensity kept high is a good strategy for wrestler before main competition.

Key words: Tapering, Interleukin-6, Cortical, wrestling, performance

Introduction

Over training may be defined as an increase in the training volume or intensity which results decrease performance (Petibois et al., 2002). Six percent of endurance runners, 21% of Australian swimmers and more than 50% of soccer players complained about over training (Smith et al., 2000) and it is estimated that 70% of high level endurance athletes experienced over training during their training (Michael et al., 2014). Tapering is a recovery technique that is used prior to competition to reverse the fatigue caused by intense training with the aim of optimizing performance (Farhangimaleki et al., 2009). During the taper, the intensity, volume and frequency of training may be altered depending upon factors such as previous conditioning, level of fatigue, and the type and significance of the competition (Coutts et al., 2007). Some research indicate that Reductions in training volume have varied from 44 to 100% in majority of sport (Houmard et al., 1994). Tapering could effect on reduce physiological and psychological stress of daily training and increase sport performance (Mujika et al., 2004). One of the important goals for coaches and wrestler is to increase the competitive abilities in maximal levels, and to design a well- training program to ensure that peak performance is attained at each point of a major wrestler competition (Mirzai et al., 2009). In fact there is no definitive training theory that describes the type, quantity or pattern of training and tapering that guarantees a given level of athletic performance (Neary et al., 1992). One of the mainly suggest physiological mechanisms of exercise –induce impaired immune function is the elevated levels of stress hormones (catecholamine, cortisol and growth hormone) during and after heavy exercise (Bethin et al., 2000). On the other hands tapering usually consists of high intensity exercise, with low volumes (Neary et al., 2003). After a period of good tapering, improved performance times have been reported in numerous athlete groups including swimmers (Mujika et al., 2002) runners (Shepley et al., 1992) and cyclists (Neary et al., 2003). However, some coaches and athletes still believe that tapering could lead athletes to detraining. They believe that the tapering period has negative effects on performance (Houmard et al., 1994). Intense and prolong exercise induce high levels of circulation inflammatory cytokine, especially IL-6, and it has been suggested that release of IL-6 in exercise is related to the occurrence of muscle damage and depletion of muscle glycogen (Steenberg et al., 2003; Smith et al., 2000). Some research indicates that subjects with the higher plasma IL-6 concentration had higher cortisol response to ACTH stimulation (Nemet et al., 2002; Smith et al., 2002). It is known that elevation in cortisol may affect cytokine production (Smith et al., 2000). Decrease in cortisol levels during the taper have been proposed as a mean of monitoring positive performance capacity in athletes. In order to improve performance and to decrease symptoms of overtraining (Petibois et al., 2002).
Some studies have suggested that reduction of training volume should be substantial, somewhere near 85% of normal training volume, whereas others have reported similar improvement after 31% reduction of training volume (Papacostae et al., 2013; Michelle Bartlett et al., 2006). Many wrestlers reduce their training volume some days before the major competition (Mirzaei et al., 2009). Some studies have suggested that reduction of training volume should be near 85% of normal training volume, others have reported similar improvement after 31% reduction of training volume (Hovanlo et al., 2012; Andre et al., 2013). Although tapering techniques are widely used in a variety of sports, guidelines for the programming of optimal tapering regimens in wrestling have not been well studied. Research data on different types of workload reduction are limited. The overall aim of this study was to determine effects of two types of tapering periods (50% and 75%) on the concentration of post-exercise plasma levels of IL-6 and cortisol and performance in wrestler. We hypothesized that increase reduction of training volume in tapering period could more benefit effect for elite wrestler before main competition.

Materials and Methods

Subjects

Table 1: Anthropometric and experience data for the subjects at the start of study.

<table>
<thead>
<tr>
<th>Group</th>
<th>Control (n = 10)</th>
<th>Tapering 50% (n = 10)</th>
<th>Tapering 75% (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs.)</td>
<td>23 ± 1</td>
<td>22 ± 2</td>
<td>22 ± 1</td>
</tr>
<tr>
<td>Body Mass (kg)</td>
<td>73 ± 6</td>
<td>70 ± 8</td>
<td>67 ± 6</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>174 ± 3</td>
<td>170 ± 5</td>
<td>167 ± 6</td>
</tr>
<tr>
<td>Training experience</td>
<td>6 ± 1</td>
<td>5 ± 2</td>
<td>6 ± 2</td>
</tr>
<tr>
<td>Fat percentage (%)</td>
<td>12 ± 1</td>
<td>11 ± 2</td>
<td>11 ± 1</td>
</tr>
</tbody>
</table>

 Experimental procedure

Subject consists of 30 Iranian high-level male wrestlers, after receiving oral and written information about the study plans and all procedures and measurement of baseline and performance tests. All participants completed 4-week progressive training period.

After four-week progressive training and before the one week tapering period began, the subjects randomly divided into three equal groups: 1- Non-tapering group that continued progressive training for one week, 2- Tapering with 50% reduction in training volume for one week and, 3- Tapering with 75% reduction in training volume for one week. All performance data were collected before and after progressive training and also after one week tapering period.

Performance Test

For estimate general strength of upper and lower limb of wrestler, bench press and squat test were used. For doing these tests First of all correct performance of bench press and squat test showed to the wrestler and after warm up maximum effort were recorded. Performance tests were collected before and after 4 week progressive training and also after tapering period.

Blood sampling

Before and after progressive training program and the end of tapering period blood sample of wrestler was drawn in order to determine IL-6 and cortisol levels. And every session Plasma was immediately blood plasma immediately separated from blood cells by centrifugation at 2150 g at +4ºC for 15 min, and was transferred into Eppendorf tubes and immediately frozen at −80ºC until later analysis. Use a high-sensitivity Enzyme-linked immune sorbent assay (ELISA) kit from Rand D systems (Minneapolis, MN, USA).

Training Program

Training Program designed in five weeks that included four weeks progressive training and one week tapering. Training design in five weeks but all wrestlers were pass general fitness training at least two month before this research. And this protocol of training were before main wrestling competition. program training include six session exercise per week and they were exercise with mean 90 minute per session and exercise started with warm up and finished with cold down every session and all procedures were done under control of researcher.

Table 2. Training programs: Values in parentheses denote the number of sessions for each item per week.

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Monocycle</th>
<th>progressive training</th>
<th>Tapering sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Warm-up (min)</td>
<td>15 (6)</td>
<td>15 (6)</td>
<td>15 (6)</td>
</tr>
<tr>
<td>Interval training (min)</td>
<td>20 (3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Resistance training (min)</td>
<td>45 (3)</td>
<td>45 (3)</td>
<td>45 (3)</td>
</tr>
<tr>
<td>Speed training (m)</td>
<td>160 (2)</td>
<td>190 (2)</td>
<td>210 (2)</td>
</tr>
<tr>
<td>Plyometric training (j)</td>
<td>-</td>
<td>30 (3)</td>
<td>36 (3)</td>
</tr>
<tr>
<td>Technical training (min)</td>
<td>16 (3)</td>
<td>18 (3)</td>
<td>20 (3)</td>
</tr>
<tr>
<td>Wrestling competition (min)</td>
<td>10 (3)</td>
<td>12 (3)</td>
<td>14 (3)</td>
</tr>
<tr>
<td>Warm-down (min)</td>
<td>10 (6)</td>
<td>10 (6)</td>
<td>10 (6)</td>
</tr>
</tbody>
</table>

Data analysis

Mean and standard deviation were used for every one of variables. Kolmogorov-Smirnov test was applied to determine homogeneity of data. With respect to normality of data distribution, data analyses were performed by test of analysis of variance with repeated measures. Bonferroni test was used when significance results had been observed. Statistical calculations were performed by SPSS 20 software in p<0.05 significance level.
Results

IL6
At the baseline, there was no significant difference in IL6 levels between trials. There was significant difference in IL-6 concentration after tapering period among both tapering group with control group (P<0.05) and among tapering 50% and tapering 75% group (P<0.05).

Figure 1. The comparison of the IL-6 plasma levels before, after training phase as well as after tapering period in three groups.

Significant differences between tapering 50% and control group are indicated with (a) where P<0.05; Significant differences between tapering 75% and control group are indicated with (b) where P<0.05, Significant differences between tapering 50% and tapering 75% group are indicated with (c) where P<0.05, Significant differences from baseline are denoted by (d) where P<0.05. Values are mean ± SD.

Cortisol
At the baseline, there was no significant difference in cortisol levels between trials. There was significantly difference after tapering period among both tapering group with control group (P<0.05) and among tapering 50% and tapering 75% group (P<0.05).

Figure 2. The comparison of the cortisol plasma levels before, after training phase as well as after tapering period in three groups.

Significant differences between control and tapering 50%) are indicated with (a) where P<0.05, Significant differences between control and tapering 75% are indicated with (b) where P<0.05, Significant differences between tapering 50% and tapering 75 are indicated with (c) where P<0.05, Significant differences from baseline are denoted by (d) where P<0.05. Values are mean ± SD.

Discussion

Results of present study showed that there were significant reductions in plasma IL-6 and cortisol levels in both tapering group relative to the control group at the end of one week tapering period. While this decrement in taper 75% were significant to compare with tapering 50%. High levels of plasma IL-6 and cortisol in the control group may result of high volume of training and thereby contribute to a higher rate of infection in wrestler. These findings are similar to those reported by (Mujika et al., 2011 ; Mujika et al., 2002 ; Ronsen et al., 2003) and disagree with those reported by (Coutts et al., 2007). Elevation of IL6 concentration prevents protein synthesis due to muscular proteolysis, which finally leads to impairment of performance (Peake et al., 2005). The cytokine theory of overtraining suggest that repetitive trauma to the musculoskeletal system, because of high intensity and training volume, related with insufficient rest and recovery time, in other hand inadequate rest is the important cause of overtraining. IL6 level indicators of exercise stress reflect changes in training load in various stages of tournament season (Ostrowski et al., 1998). High Plasma IL6 and cortisol levels as known as sign and symptom of tissue catabolic actions. In many researches, high cortisol and IL-6 is proposed as indicator of training pressure, but response of these hormones to tapering in wrestler and athlete is not completely certain. According to our result higher reduction of training volume (75% reduction of training volume) enhanced performance hormones. Results of this part are compatible with research results of (Rietjen et al., 2001 ; Mujika et al., 2002; Neary et al., 2003) but are not compatible with research results of Stone et al (1996).
Different results in studies probably are associated with many factors for example exercise type, intensity and volume of exercise, age and design of training program and also rate of athletic fitness. Some research indicate that increasing of training volume result in increase of cortisol plasma levels, elevating of free fatty acids releasing and so prevent of immune system and inflammation response.(Yuichi et al., 2013; Kubukeli et al., 2002). Cortisol could increase protein catabolism in body. Combination of increase training volume, IL-6, cortisol levels and inadequate recovery finally can lead to creation of overtraining conditions (Laurent et al., 2007). It seems that the main reason of increasing cortisol concentration in stress conditions and physical pressures is changing in performance of hypothalamic–pituitary–adrenal axis. This performance stimulated in response to heavy exercises and stressful conditions and increased its activity which results in increasing secretion of ACTH hormone and then increasing secretion of cortisol (Bethin et al., 2013). Also variation of immune function related to variation of plasma cytokine "cortisol" catecholamine’s hormone and growth hormone (Petersen et al., 2005; Pedibois, 2002). Higher levels of IL6 and cortisol representative of segment of inflammatory phase and catabolic situation in body induce exercise. Systematic inflammatory could influence of creation catabolic situation (Pedersen et al., 1995). As our findings showed that after one week of tapering plasma levels of IL-6 decreased. This is most likely related to the increasing muscle glycogen during the tapering period. Another finding of present study showed that there was significant increasing in strength muscle (squat and bench press) after tapering period in tapering 75% relative to control group. Accordance with previous research maximal gains of performance are obtained with a tapering intervention of 6-21 days duration, where the training volume is exponentially decreased by 41–60%, without any modification of either training intensity or frequency (Mujika., et al 2011 ). Result of this part are compatible with research result of (Hovanloo et al., 2012; Coutts et al., 2007). And are not compatible with research results of (Houmard., et al 1994). Different results in studies probably are associated with result of some studies that indicate that some variable of performance could be improve with tapering, but is depend on chose a suitable time and type and length of tapering strategy, because bad tapering cold result of detraining (Mujika et al., 2003; Coutts., et al., 2007). On the other hand Cortisol is one of the important catabolic hormones that increase during mental and physical stress. Increases in plasma cortisol levels can cause an immune response during incremental training and leading to the overtraining syndrome. Also over increasing of cortisol and IL-6 levels can result in performance reduction in sports. Studies demonstrate that a low cortisol concentration were a prerequisite for improved performance in athletic. (Mujika et al., 1996). Our finding from this research support suggestions that a higher reduction in training volume prior to competition may reduce the negative effects of overtraining for example Regulation of cytokine (IL-6) and cortisol levels and increase performance.

**Conclusion**

One week tapering with 75% reduction in training volume, while the intensity kept high, is more useful tapering strategy for wrestling. Its seems that one week tapering with higher reduction of training volume(75%) before main competition is effective strategy for decrease sing and symptom of over training and also improve performance in elite male wrestler.

**References**


**UTJECAJ DVJЕ METODE KONCENTRACIJE NA INTERLEUKIN-6, KORTIZOL I IZVEDBU KOD ELITNIH HRVAĆA**

**Sažetak**

Svrha ovog istraživanja bila je usporediti učinak dvije vrste koncentracije na interleukin-6 (IL-6), kortizol i izvedbu kod elitnih hrvaća. Nakon 4 tjedna progresivnog treninga, hrvaći su nasumcno podijeljeni u tri jednake skupine, 1-kontrolne skupine (N=10) s nastavkom obavljanja progresivnog treninga za jedan tjedan, 2-konus skupina 1 (N=10) s nastavkom ali uz smanjenje od 50% u volumenu treninga za tjedan dana, i 3-konus skupina 2 (N=10) s nastavkom ali uz smanjenje od 75% u volumenu treninga na tjedan dana. Plasama krvi IL-6 i kortizol zase blizazajenje kao test izvedbe. Svi podaci prikupljeni su prije i nakon treninga i nakon tjedan dana. Rezultat: Bilo je značajno smanjenje razina IL-6 i kortizola između obje konusne skupine u odnosu na kontrolnu skupinu (P<0.05). Značajno su smanjene razine IL-6 i kortizola između 50% i 75% nakon analiziranog razdoblja (P<0.05). Također je došlo do značajnog povećanja opće mišićne snage između konus grupe 75% i kontrolne skupine (P<0.05). Dakle, tjedan dana koncentracije sa 75% popusta volumena treninga nakon progresivnog treninga, dok je intenzitet zadržava visokim, učinkovita je strategija za smanjenje IL-6, i razine kortizola i povećanje performansi. Čini se da je veća redukcija volumena treninga, kada je intenzitet zadržavan visoko, dobra strategija za hrvaće prije glavnog natjecanja.

**Ključne riječi:** koncentracija, Interleukin-6, Cortisol, hrvanje, izvedba

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