



Original Article

Impact of sepak takraw practice on inflammatory markers in male athletes

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Abstract

The objective of this study was to investigate the impact of sepak takraw practice on interleukin-6 and creatine kinase concentrations. Twelve male sepak takraw athletes participated in this research. A cross-over design was created consisting of sepak takraw practice and resting trials. Venous blood samples were taken before, immediately after, and one hour after either control or sepak takraw practice trials. Serum interleukin-6 was measured using enzyme-linked immunosorbent assay. Creatine kinase, glucose, and triglyceride concentrations were assessed by using enzymatic colorimetric methods. Data was analyzed using two way repeated measures of ANOVA and a paired t-tests. Interleukin-6 and creatine kinase concentrations were increased significantly immediately after and one hour following sepak takraw practice. However, there was no alteration in circulating glucose, triglyceride, and glycogen concentrations. In conclusion, sepak takraw practice contributes to an increase in circulating interleukin-6 and creatine kinase concentrations. Intensity and duration of the practice should be a consideration.

Keywords: sepak takraw, interleukin-6, creatine kinase, glucose, triglyceride

1. Introduction

Sepak takraw or kick volleyball is a popular sport in Asia and is becoming more popular around the world. Sepak takraw training is very important in order to maintain sport performance. However, it has been suggested that overtraining together with lack of recovery and resting time might contribute to local muscle inflammation (Pedersen and Fischer, 2007). Lack of the energy available leads to muscle fatigue (Baird *et al.*, 2012). Little is known about the effect of a single sepak takraw practice on inflammation related to substrates available in the blood circulation. Consequently, research on the effects of sepak takraw practice on inflammatory markers, muscle damage, and substrates available in the blood circulation is very important for coaches and athletes to understand and make adjustments to sepak takraw practice in order to improve performance in competition.

Creatine kinase is an enzyme, which is linked to muscle damage and energy production (Baird *et al.*, 2012). Interleukin-6 (IL-6) is an example of inflammatory markers produced mainly from muscle and adipose tissue (Mohamed-Ali *et al.*, 1997; Steensberg *et al.*, 2000). The level of interleukin-6 was increased following soccer, volleyball, and futsal game (Ispirlidis *et al.*, 2008; Eliakim *et al.*, 2009; de Moura *et al.*, 2012). However, the impact of a single sepak takraw practice on interleukin-6 and creatine kinase concentrations are still unknown.

Infusion of interleukin-6 results in increased fatty acid oxidation, increased glucose uptake, and decreased sport performance (Pedersen *et al.*, 2001; Robson-Ansley *et al.*, 2004; Wolsk *et al.*, 2010). It is suggested that interleukin-6 is an energy sensor during muscle contraction as well as correlates with the energy available such as glucose and glycogen content (Pedersen, 2012). It is possible that one bout of sepak takraw practice might have an impact on circulating interleukin-6 concentrations affecting the levels of creatine kinase as well as the substrates available in blood circulation such as glucose, triglyceride, and glycogen con-

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centrations. Therefore, the objective of the present study was to investigate the impact of a single sepak takraw practice on the circulating interleukin-6 and creatine kinase concentrations and their relation to substrates available in Thai male sepak takraw athletes.

2. Materials and Methods

2.1 Participants

Twelve men ages between 20 and 39 years participated in this study, which had been approved by the Research Ethics Committee of the Srinakharinwirot University, Thailand. All participants were signed consent form before participation in this study. All participants were well trained. The data from the questionnaire indicated that they trained six times per week for three hours a day. Participant characteristics can be found in Table 1.

2.2 Preliminary test

Body mass index (BMI) was calculated using the ratio between weight and height in square meters. Waist and hip ratio was determined by the narrowest part of the waist and the widest part of the hip. Body composition (Dual-energy x-ray absorptiometry, Hologic Inc, United State), blood pressure (Omron, Japan), resting heart rate (Omron, Japan), and peak power (Cycle ergometer, Monark ergomedic, Monark 839E, Sweden) were measured seven days before main trial.

2.3 Research design

The experiment was a cross-over design with two main trials separated by at least 14 days. On one occasion participants rested in the laboratory. On another occasion

they participated in a sepak takraw practice which included 40 minutes of warm up followed by 60 minutes of a sepak takraw game. The warm up consisted of stretching as well as jogging. Afterwards, the twelve participants were divided into four teams in order to play sepak takraw for one hour. Each team consisted of three players in three positions: feeder, server, and killer. Players were allowed to use some part of their body includes feet, knee, chest, and head to make contact with the rattan ball. Participants were asked to complete a form describing their rate of perceived exertion (Borg, 1982) over the same period of time.

Participants had breakfast between 7.00-7.30 a.m. after a 10 hours overnight fast and they were asked to repeat this routine for each main trial. Venous blood sample (10 ml) was taken before, immediately after, and one hour after either control or sepak takraw practice. Venous blood samples were collected in serum clot activator vacuette tubes (Greiner bio-one, Austria) and sodium fluoride vacuette tubes (with EDTA K3, Greiner bio-one, Austria). The vacuette tubes were spun at 5,000 rpm at 5°C for ten minutes. Serum was removed and the sample stored at -20°C for analysis.

Serum interleukin-6 (Enzyme-linked immunosorbent assay, R&D systems, Abingdon, United Kingdom) and glycogen (Bioelectric impedance, BioScan, Maltron, United Kingdom) were assessed in two main trials. In addition, triglyceride, creatine kinase, and glucose concentrations were measured using the enzymatic colorimetric method (Cobas 6,000 analyzer series, Switzerland).

2.4 Statistical analysis

All data was analyzed using Statistical software. Two-way repeated measures ANOVA and paired t-tests were used to analyze differences of serum interleukin-6, creatine kinase, glucose, triglyceride, glycogen, and rate of perceived exertion between trials. Paired t-tests were used for post hoc comparisons using the Bonferroni method. Paired t-tests were used to examine changes over time within each trial. Statistical significance was accepted at the 5% level ($p < 0.05$). Data was presented as means \pm SE.

Table 1. Participant characteristics. Values are means \pm SE (n=12).

	Mean \pm SE
Age (years)	26 \pm 2
Body mass (kg)	71 \pm 2
Height (cm)	175 \pm 2
Body mass index (kg/m ²)	23 \pm 0
Waist (cm)	76 \pm 1
Hip (cm)	95 \pm 2
Waist/Hip ratio	0.8 \pm 0
Total percent body fat (%)	15 \pm 1
Total fat mass (kg)	10 \pm 1
Total lean mass (kg)	61 \pm 1
Blood pressure: systolic / diastolic (mmHg)	119 \pm 1 / 71 \pm 2
Resting heart rate (beats /min)	59 \pm 3
Peak power (w/kg)	10 \pm 0

3. Results

3.1 Interleukin-6 and creatine kinase

Serum interleukin-6 and creatine kinase concentrations showed no significant difference between the control and sepak takraw trials at the baseline sample (Figure 1). Serum interleukin-6 concentrations increased significantly immediately after ($p=0.01$) and 60 minutes after ($p=0.01$) sepak takraw practice (two-way ANOVA: trial x time interaction, $p < 0.01$; trial, $p < 0.01$). The level of creatine kinase increased significantly at immediately after ($p=0.01$) and 60 minutes after ($p=0.01$) sepak takraw practice (two-way ANOVA: trial x time interaction, $p < 0.01$; trial, $p=0.02$).

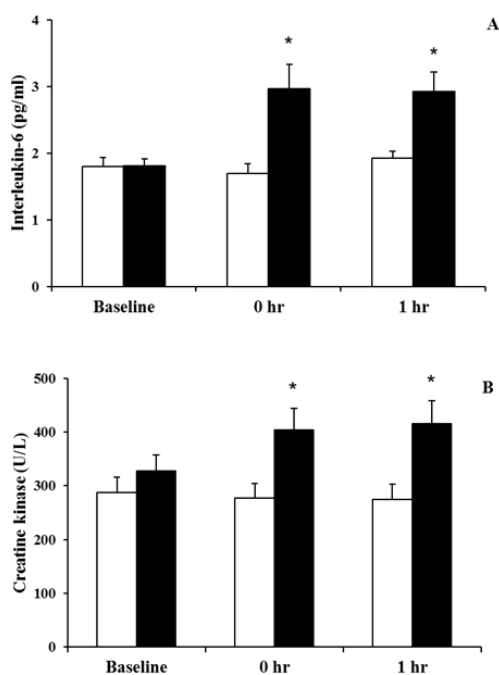


Figure 1. Interleukin-6 (A) and creatine kinase (B) concentrations in control (□) and sepak takraw (■) trials at the baseline, immediately after (0 hr), and 1 hr following either control or sepak takraw practice. Values are means \pm SE (n=12). *Significantly different between control and sepak takraw trials ($p<0.05$).

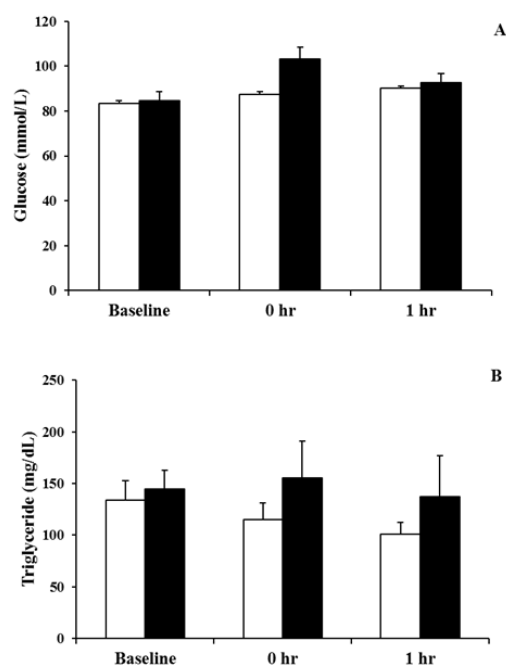


Figure 2. Glucose (A) and triglyceride (B) concentrations in control (□) and sepak takraw (■) trials at the baseline, immediately after (0 hr), and 1 hr following either control or sepak takraw practice. Values are means \pm SE (n=12). *Significantly different between control and sepak takraw trials ($p<0.05$).

3.2 Glucose, triglyceride, and glycogen

There were no statistical differences in glucose, triglyceride, and glycogen (data not shown) concentrations at the baseline. Blood glucose concentrations at immediately following sepak takraw practice tended to be higher than resting (two-way ANOVA: trial \times time interaction, $p=0.06$; trial, $p=0.04$). There was no statistical differences in triglyceride and glycogen concentrations between two trials over a period of time (Figure 2).

3.3 Heart rate and rate of perceived exertion

Heart rate between trials did not differ significantly before and following sepak takraw practice (data not shown). In addition, rate of perceived exertion following sepak takraw practice was higher than control at immediately after and one hour after sepak takraw practice (two-way ANOVA: trial \times time interaction, $p=0.01$; trial, $p=0.02$).

3.4 Relationships

Interestingly, there was a relationship between interleukin-6 and triglyceride concentrations at the baseline ($r=0.6$, $p=0.04$). Interleukin-6 tended to be correlated with glucose ($r=0.49$, $p=0.11$) and glycogen ($r=0.54$, $p=0.07$) concentrations at the baseline. Moreover, there was no rela-

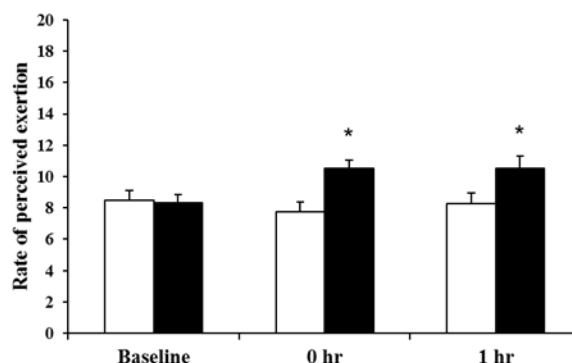


Figure 3. Rate of perceived exertion in control and sepak takraw trials at the baseline, immediately after (0 hr), and 1 hr following either control (□) and sepak takraw (■) practice. Values are means \pm SE (n=12). *Significantly different between control and sepak takraw trials ($p<0.05$).

tionship between interleukin-6 and creatine kinase concentrations at the baseline as well as following sepak takraw practice at any time point.

4. Discussion

The objective of this study was to investigate the impact of a single sepak takraw practice on the level of serum interleukin-6 and creatine kinase concentrations in Thai male sepak takraw athletes. Interestingly, the circulating serum

interleukin-6 and creatine kinase concentrations did increase following sepak takraw practice immediately after and remained increased for one hour. However, there was no change in the triglyceride, glucose, and glycogen concentrations following sepak takraw practice.

There was a low response of interleukin-6 following sepak takraw practice in the present study. It had been demonstrated that there was a slight increase of interleukin-6 following volleyball and rowing (Ramson *et al.*, 2008; Eliakim *et al.*, 2013). In contrast, there was a high response of interleukin-6 following strenuous exercise (Ostrowski *et al.*, 1999; Bernecker *et al.*, 2013). It is suggested that increases in the level of interleukin-6 were related to intensity, duration, and type of exercise (Fischer, 2006; Reihmane *et al.*, 2013). Previous research revealed that there was a relationship between interleukin-6 concentrations and intensity of exercise (Ostrowski *et al.*, 1999). Interleukin-6 concentration following running at high intensity exercise was greater than low and moderate intensity exercise (Scott *et al.*, 2011; Sim *et al.*, 2013). It appears that high intensity exercise induced the change in interleukin-6 concentrations more than light and moderate exercise.

It should be noted that sepak takraw is a combination of soccer and volleyball. Although the perceived exertion rating showed an increase following sepak takraw practice in this study but heart rate was very low at immediately after and one hour after sepak takraw practice. Therefore, the change in the circulating serum interleukin-6 concentrations in the present study may have been influenced by the intensity and duration of sepak takraw practice.

The response of interleukin-6 might have been affected by exercise training. There was a low level of interleukin-6 at the baseline. Regular physical exercise results in low level of interleukin-6 at the baseline (Ispirlidis *et al.*, 2008; Cunniffe *et al.*, 2010). Interleukin-6 is released from the muscle, therefore, the amount of interleukin-6 production might correlate with muscle mass and muscle contraction (Steensberg *et al.*, 2000; Fischer, 2006). It has been suggested that the response of interleukin-6 is associated with training status (Fischer, 2006; Pedersen and Fischer, 2007; Serrano *et al.*, 2010). Participants in this study were well trained as well as lean correlating with a previous study showing that sepak takraw players were leaner than other types of sports (Jawis *et al.*, 2005). Furthermore, there was a low response of interleukin-6 following training (Gokhale *et al.*, 2007; Eliakim *et al.*, 2013). Few studies reported any difference of interleukin-6 response to exercise between sedentary and active participants (Scott *et al.*, 2013; Landers-Ramos *et al.*, 2014). It appears that the impact of exercise training on the responding of interleukin-6 remains unclear and needs to be investigated further. Consequently, a low response of interleukin-6 were found following sepak takraw practice.

Serum creatine kinase concentrations were elevated immediately after and remained elevated for one hour after sepak takraw practice. This data is consistent with a previous studies showing that the level of creatine kinase increased

following several type of sports and exercises (Ispirlidis *et al.*, 2008; Cunniffe *et al.*, 2010; Scott *et al.*, 2013; Tajra *et al.*, 2014). Some studies showed a delayed increase in the circulating creatine kinase concentrations following rugby and soccer games (Ispirlidis *et al.*, 2008; Cunniffe *et al.*, 2010). However, circulating creatine kinase at that time point was not measured in the present study, and therefore, it needs to be investigated in the future.

In the present study, there was no relationship between creatine kinase and interleukin-6 concentrations at the baseline, immediately after, and one hour after sepak takraw practice. Previous study showed no relationship between peak creatine kinase and interleukin-6 concentrations (Ostrowski *et al.*, 1999). Increases in creatine kinase concentration is associated with sarcolemma and Z- disks damage due to mechanical and metabolic stress (Brancaccio *et al.*, 2007; Koch *et al.*, 2014). It has been suggested that there was no relationship between muscle damage and the level of interleukin-6 (Fischer, 2006; Pedersen and Fischer, 2007). It appears that sepak takraw practice contributes to increased circulating creatine kinase.

There was evidence that the level of interleukin-6 associated with substrate available such as fatty acid and glucose metabolism (Febbraio *et al.*, 2004; Wolsk *et al.*, 2010; Jurimae *et al.*, 2011). Consequently, there was no impact of interleukin-6 administration on fat metabolism during low intensity exercise (Hiscock *et al.*, 2005). In the present study, although the level of triglyceride, glucose, and glycogen following single sepak takraw practice were higher than resting but there was still no significant difference. It is likely that the lack of change in substrate available might be explained by the fact that sepak takraw is light exercise. Although interleukin-6 concentrations tended to be correlated with glucose at immediately following sepak takraw practice but there was no statistical difference. Moreover, there was a relationship between interleukin-6 and triglyceride at the baseline. It is possible that the elevation of triglyceride and glucose might be related to the type and intensity of exercise. However, this study showed lack of impact on triglyceride, glycogen, and glucose concentrations.

5. Conclusions

A single sepak takraw practice induced increases in circulating serum interleukin-6 and creatine kinase concentrations but there was no impact of sepak takraw practice on substrates available such as glucose, triglyceride, and glycogen concentrations. However, the findings in the present study indicate that the elevation of interleukin-6 may not be associated with muscle damage due to no relationship between interleukin-6 and creatine kinase. This research investigated only the single practice of sepak takraw, therefore, we might not see the same effect of interleukin-6 following repeated sepak takraw practices. Future research needs to investigate the effect of repeated sepak takraw practice on the circulating interleukin-6, creatine kinase, and substrates

available which is related to sport performance and recovery time. Intensity and duration of the sepak takraw practice is very important for coaches and athletes to be consideration in order to prevent the production of inflammatory markers and improve sport performance in competition.

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