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Evaluation of Certain Biochemical Parameters of Wrestlers before and after the 20 m Shuttle Run Test

Mehmet Türkmen

Correspondence: Mehmet Türkmen, School of Physical Education and Sports, Mus Alparslan University, Mus, 49000, Turkey.

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Abstract

This study was conducted to determine the acute changes after the 20 m shuttle run test in the biochemical parameters and heart rates of wrestlers competing in international competitions on a study population of 21 wrestlers. The mean age of participants was 24.14±2.01years, mean heights 176±0.06 cm, body weight 76.48±14.76 kg, $MaxVO_2$ 52.78±3.20 ml/kg/min, and mean BMI 24.44±2.63 kg/m^2.

20-meter run and sit-up test was applied to measure the $MaxVO_2$ scores of included subjects. Heart rates were monitored using a Polar heart rate monitor before and after the tests. The blood samples that collected at the same time intervals from the vena cephalica were stored in tubes without anticoagulants. The samples were then centrifuged for 10 minutes at 5000 rpm to obtain serum samples, and analyzed. The data obtained were treated using SPSS 15.0 software.

This study showed that there was a significant increase ($p<0.05$) in post-test glucose, HDL-cholesterol and urea concentrations compared to pre-test levels. While the post-test LDL cholesterol concentration was significantly reduced ($p<0.05$), acute changes in other biochemical parameters were found to be statistically insignificant ($p>0.05$).

It can be concluded that mean glucose, HDL and urea were increased while LDL was reduced after the 20 m shuttle run test in wrestlers.

Keywords: wrestling, serum biochemistry, $MaxVO_2$

1. Introduction

Exercise causes stress on the human organism. This stress also comes with various physiological and metabolic impacts. One of such impacts is the changes in the blood (Hazar and Yilmaz 2008). A significant function of living systems, physical activity has been reported to affect biochemical parameters (Ozturk 2009) as well as many other systems.

There are numerous reports suggesting that exercise and biochemical parameters have become an important topic addressed by researchers during recent years (Ozturk 2009, Cakmakci and Pulur 2008). Studies have reported changes in biochemical levels depending on the type, intensity and duration of the exercise (Cakmakci and Pulur 2008). Exercise fitness in humans may play important roles in biochemical levels just like many other factors including the adaptation of cardiovascular activity and physical and physiological balance in improving physiological response (Arslan et al. 1997; Baltaci et al. 1998).

Hematological and biochemical parameters may vary depending on the type, intensity and duration of the exercise, as well as during and after intensive exercise due to a person's exercise performance, gender, age, environmental conditions and diet (Beydagi et al. 1992; Beydagi et al. 1993).

There are various exercise-dependent findings relating to the level of blood biochemistry. The literature contains studies reporting positive changes in blood biochemistry following an acute exercise as well as studies reporting changes following chronic exercises (Sekeroglu et al. 1997). Yamaner et al. (2010) indicated that wrestling training had an effect on insulin sensitivity with higher fasting insulin, HDL-cholesterol, triglyceride levels compared to sedentary males.

Some researchers have reported that excessively intensive and long-lasting exercises resulted in lower LDL, cholesterol, glucose and albumin levels (Lehmann et al. 1997: Ward 1993).

Conducted in the light of above-reported findings, this study was intended to identify the acute changes after the 20 m shuttle including fatigue change profiles of certain serum biochemical parameters in elite wrestlers and to contribute to the literature for further future studies.

2. Method

This study was performed on 21 wrestlers with a mean age of 24.14±2.01 years, mean height of 176±0.06 cm, and mean body weight of 76.48±14.76 kg. Data were collected from Turkish National wrestlers who were preparing for World University Wrestling Championship. The subjects were informed in detail about the study, who then signed the informed consent forms.

Height and body weight measurements

The subjects' body weights were measured bare foot and recorded in kg on a scale with 0.01 g readability wearing shorts kg, their heights were measured bare foot and recorded in centimeters with a steel tape measuring tape with 0.01 cm readability, with the subjects in standing position.

Heart rate measurement

Heart rates (HR) of subjects were measured twice using a Polar RS800CX heart rate monitor during the 20 min. fixed rest interval before the test and after the test, and the values (pulse/min) were recorded.

Fatigue Protocol (20 m Shuttle Run)

The 20 m shuttle run test applied to measure the subjects' estimated maximal O_2 consumption capacities is a multi-stage test, with the first stage run at a warm-up tempo. The initial running speed is 8.5 km/hour and the run is gradually increased by 0.5 km/hour every minute. The subjects ran the 20 m distance to and fro. The running speed was dictated by audio signals. The subjects were expected to start running with the first signal and reach the other line before the second signal. On the second signal, they were expected to return to the start line and repeat the pattern. Hearing the first signal, the subjects adjusted their tempo themselves so as to reach to the other end of the track on the second signal. The speed which was initially slow was then accelerated every 10 seconds. The subjects continued the test if they missed one signal and caught the other. The test was ended if the subjects missed two signals consecutively. Test results were evaluated based on the number and level of shuttles using the level form.

Biochemical analyses

Anticoagulant-free blood samples were collected from the vena cephalica of wrestlers five minutes before and one minute after exercising. After the anticoagulant-free blood samples were kept in room temperature for 30 minutes, they were centrifuged at 5000 revolutions for 10 minutes to obtain serum samples. Serum samples were then kept at -20 ^{0}C until biochemical analyses were performed. Glucose, total cholesterol, HDL cholesterol, triglyceride, blood urea nitrogen (BUN), and LDL cholesterol analyses were made with the serum samples using an auto analyzer (Mindray Perfect Plus 400).

Statistical analysis

Statistical analysis was performed using the SPSS statistical program. Normal distribution of the data was determined using Shapiro Wilk Normality test. Values were expressed as mean ± standard deviation (SD). İndependent t test was used to compare the parameters between pre and posttest of wrestlers. Significant level was set at $P<0.05$. İn addition, a graph was presented to show the acute effects of a training session.

3. Findings

Physiological profile of wrestlers is given in Table 1.

Table 1. Physical characteristics of wrestlers (n=21)

Variable	Mean ±SD
Age (years)	24.14±2.01
Body Height (cm)	176±0.06
Body Weight (kg)	76.48±14.76
Body Mass Index (kg/m^2)	24.44±2.63

Table 2. Heart Rates Before and After Exercising and MaxVO_2 levels in wrestlers

Parameters	Before the 20 m Shuttle Run Test (Mean ± SD)	After the 20 m Shuttle Run Test (Mean ± SD)
Heart Rate - beats/min	73.43±8.81^b	172.86±4.72^a

a, b: *The difference between mean values with different letters on the same line is significant (P<0.05).*

The mean MaxVO_2 of participants was 82.07 ± 5.7 ml/kg/min according to the 20 m shuttle run test.

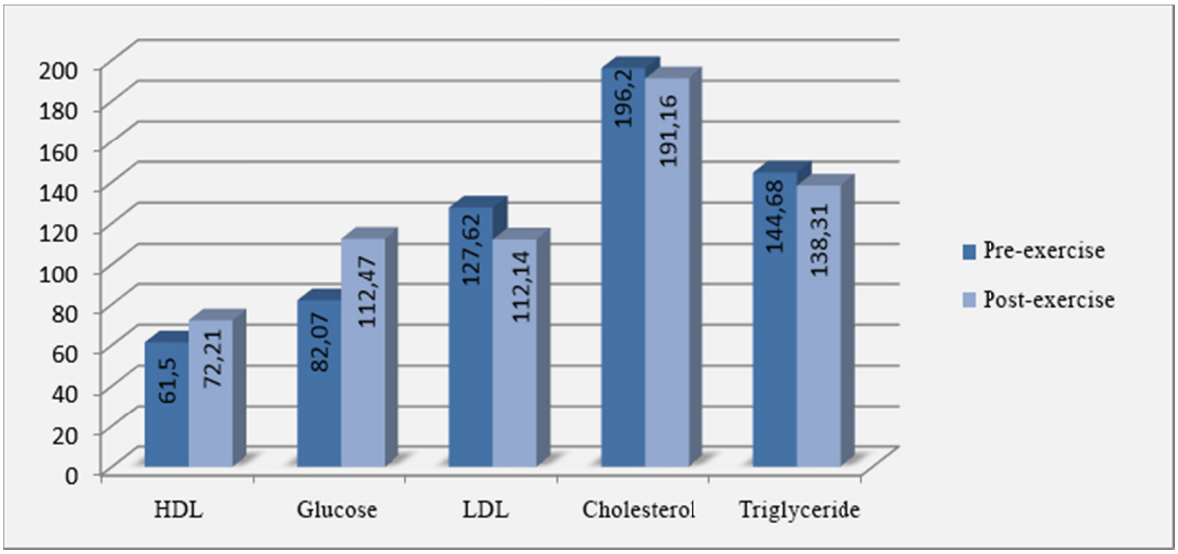
As seen in Table 2, the wrestlers' heart rates before the training were found significantly higher ($p<0.05$) compared to their heart rates after the training. Besides, the mean MaxVO_2 values of subjects were found to be 52.78±3.20 after the 20 m shuttle run test.

Table 3. Wrestlers' Biochemical Parameters Before and After the 20 m the Shuttle Run Test.

Parameters	Before the 20 m Shuttle Run Test (Mean ± SD)	After the 20 m Shuttle Run Test (Mean ± SD)
Glucose (mg/dl)	82.07 ± 5.7[b]	112.47 ± 25.96[a]
T. Cholesterol (mg/dl)	196.2 ± 23.97[a]	191.16 ± 14.91[a]
HDL mg/dl)	61.5 ± 11.79[b]	72.21 ± 10.15[a]
LDL (mg/dl)	127.62±11.11 [a]	112.14±8.54 [b]
Urea (mg/dl)	32.83 ± 12.92[b]	36.98 ± 15.08[a]
Triglyceride (mg/dl)	144.68 ± 33.9[a]	138.31 ± 9.22[a]

a,b,c: The difference between mean values with different letters on the same line is significant (P<0.05).

A review of the biochemical analyses of wrestlers in Table 3 shows a significant pre-exercise increase ($p<0.05$) in glucose, HDL cholesterol, and urea concentrations compared with post-exercise, with the LDL cholesterol concentration being significantly lower ($p<0.05$). Pre- and post-exercise changes in other biochemical parameters were not found to be statistically significant ($p>0.05$).



Graph 1. Level graph of pre- and post-fatigue biochemical parameters of subjects

4. Discussion and Conclusion

This study was conducted to examine the certain pre- and post-fatigue biochemical parameters wrestlers competing in national and international competitions. The study also investigates the pre- and post-fatigue heart rates of wrestlers, establishes their $MaxVO_2$ levels and reports the current situation through literature review.

The mean age of included wrestlers was 24.14±2.01 years, with the mean height being 176±0.06 cm, mean weight being 76.48±14.76 kg, and mean BMI being (24.44±2.63) kg/m2 (Table 1).

The wrestlers were subjected to a 20-meter shuttle run test, which is used in determining aerobic power and also gives an idea about anaerobic threshold, during the second week of the preparatory period to reveal their current fitness levels. Following the test, the mean $MaxVO_2$ values of subject were found at (52.78±3.20) ml/kg/min (Table 2), and their pre-test heart rates measured to be 73.43±8.81 beats/min were measured to be 172.86±4.72 beats/min after the test (Table 2). Significantly higher heart rate values ($p<0.05$) compared to rest measurement were interpreted as a natural reflection of exercise. As a matter of fact, Blasco et al. (2013) found higher heart rates after a supramaximal judo test compared with pre-test heart rates. A study by Demirhan (2014) reported the mean pre-fatigue heart rate at 74.25±1.98 beats/min and post-fatigue heart rate at 177.50±11.40. Another study by Saad (2012) on Egyptian wrestlers found the mean pre-loading heart rate at 68.67 beats/min, and the post-loading heart rate at 181.92 beats/min. Similarly, Kaya found the rest heart rate values at 66.2 beats/min, and at 183.1 beats/min following maximal loading. İncreased heart rate findings by authors compared with pre-exercise heart rates are consistent with the findings of this study. İncreased post-loading heart rates in athletes were interpreted to be a natural response of the organism to meet the increasing O2 and other metabolic needs in tissues (Demirhan 2014).

The mean $MaxVO_2$ of 52.78±3.20 ml/kg/min in participating wrestlers reflected lower values compared with studies made on wrestlers. İn fact, Ziyagil et al. (1994) found the mean $MaxVO_2$ value of Turkish wrestlers who took the first place at their respective weights to be 53.59±2.78 ml/kg/min. A study by Arslanoglu (2015) found the mean $MaxVO_2$ of young wrestlers to be 56±8.24. İn another study, Utter et al. (2002) reported the mean $MaxVO_2$ of wrestlers at 57.1 ml/kg/min. Obviously the mean values reported by authors are higher than those reported in this study. The reason for such difference was interpreted to be because the measurements were taken immediately at the start of the prep season and the athletes were not yet prepared for the exercises.

A review of the biochemical analyses of wrestlers in Table 3 shows a significant pre-exercise increase ($p<0.05$) in glucose, HDL cholesterol, and urea concentrations compared with post-exercise, with the LDL cholesterol concentration being significantly lower ($p<0.05$). A study on athletes conducted on the same subject by Kratz et al. (2002) reported a significant increase in blood glucose levels after a marathon race. Likewise, Stuart et al. (2004) reported that acute exercise resulted in increased blood glucose levels. Another study on elite athletes by Howlett et al. (1998) also reported increased blood glucose levels following acute exercise. Glucose at rest is formed by glycogen destruction in the liver with the help of glucagon and amino acids. Glucose at exercise increases with the help of catecholamines that are increasingly released from adrenal medulla together with glycogenolysis and glucagon. The severity and duration of exercise increase the release of such hormones. The significantly increased glucose levels during exercise found in this study are consistent with the literature (Gunay and Cicioglu 2001). Urea concentration, which is another increased post-exercise parameter of this study, is consistent with the finding of Cevik et al. (1996) who reported a significant post-exercise increase in urea levels after intermittent runs of 400 m x 12 laps (4800m), as well as with the findings of another study by Gures et al. (2009) who reported significantly increased post-exercise urea levels compared with pre-exercise levels.

This increase found in urea concentration is reduced during renal blood intake and blood pumped to the muscles during an exercise. Acute exercise has been associated with increased serum creatinine, urea, and uric acid concentration (Ward 1993) and increased urea has been associated with protein catabolism.

İn this study, post-exercise LDL concentrations were found to be significantly lower ($p<0.05$) compared with post-exercise levels. Gures et al. (2009) found a significantly lower post-acute exercise LDL level compared with pre-exercise. Kara et al. (2010), in their study on 15 wrestlers, found a statistically significant decrease in post-exercise LDL levels. Another study by Kocyigit et al. (2011) concluded that HDL cholesterol level increased, and LDL cholesterol level decreased following a 10-minute treadmill exercise with a vitamin C supplementation. The triglyceride level, another parameter of the study, did not vary significantly during the post-exercise period compared with the pre-exercise baseline ($p>0.05$). Many studies reported that certain changes could be expected following both acute and chronic adaptation in exercising individuals (Kocyigit et al. 2011), as well as decreased total cholesterol, LDL cholesterol, triglyceride levels and increased HDL cholesterol level following regular long-lasting and mild exercises (Arslan et al. 2001: Kavak et al. 2006). There are reports suggesting that the significant decrease in cholesterol level and no difference in triglyceride level could be because of the increased lipoprotein lipase association in the muscle and fatty tissue during exercise and because the energy consumed was due to the use of blood lipids and free fatty acids. Ozhan et al. (2000) concluded that exercising had a direct effect on HDL cholesterol level as a result of variations in lipid parameters and had a restricted effect on other lipid parameters despite a significant increase in the wrestlers' post-exercise HDL cholesterol levels. The findings of this study confirm that the wrestlers' pre- and post-test biochemical parameters after the 20 m shuttle run test were consistent with the results of previous studies. Generally, it can be concluded that mean glucose, HDL and urea were increased while LDL was reduced after the 20 m shuttle run test. There was also no significant change in the total cholesterol and triglyceride after this test.

Further research is required to assess whether the acute effects of submaximal and maximal loading associated with biochemical parameters and physiological variables including $maxVO_2$ and hearth rates, can differentiate among wrestlers from different levels and styles in both genders.

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