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The Investigation of Efficiency of Lactic Acid Elimination Training on Elite Wrestlers Done on The Same Day After Intense Strength Training

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Abstract

Objectives: The purpose of this study is to examine effectiveness of wrestlers' recovery and regeneration process on the following day of the intensive training in terms of accelarating the elemination of lactic acid (sweat training).

Methods: Twenty elite athletes (n:20) voluntarily participated in research. Two groups were divided as elimination group (n:10) and control group (n:10). The average age of the elimination group was 19.7±1.2 years, the average sport experience 7.4±2.5 years, height 1.77±0.1 cm., body weight 82.2±9.6 kg. The average age of the control group was 20.5±1.3 years, the average sport experience 8.6±2.2 years, height 1.72±0.1 cm, and body weight 72.4±12.2 kg. In research, before and after training, the data of lactic acid, (passive) rest and (active) maximal pulse were measured.

Results: When the values of the elimination and control groups were compared, a significant difference was statistically found among the values of lactic acid before training, the rest (passive) pulse before training ($p<0.05$).

Conclusion: Based on the data acquired, in the result of our study, it is determined that the reference values that the athletes, who perform lactic acid elimination training in wrestling, will be able to use in the future. We consider that it would be useful to perform additionally lactic acid training for the athletes who perform an intense wrestling training.

Keywords: Elimination, Wrestling, Lactic Acid.

Introduction

Performance results from the combination of physical, biomotoric, physiological and technical characteristics (Kılınç, 2008). The score a sprinter gains in 9.58 secs in 100 meter run, the score a long-distance runner gains in 2.15.25 secs, the score, pass, rebound etc. a basketball player gains, the pass a footballer makes, the distance he runs, the goal he kicks etc. are the indicators of their performances. The purposes of raising the performance on

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higher levels and keeping the performance limits that reach higher levels lie behind the science of training (Kılınç, 2011).

The wrestling is defined as the struggle of two wrestlers or people for achieving superiority over each other by fairly using their biomotoric (strength, power, flexibility, endurance, agility) psychology, social, technique, tactical, skill, and mind on a mat which has a particular size without using any means. The operation of body systems at a maximum rate is essential to supply the increasing energy (aerobic and anaerobic) requirement and resist the fatigue which occurs in the course of that effort. The organization of modern wrestling according to the rules caused to the development of two different styles defined as free and greco-roman. Contrary to the forms such as sumo wrestling and pancreas wrestling, the wrestling, one of the classical wrestling forms, is performed at a quick pace and with a high physical power. The performance of wrestling on an elite level results in the development of new methods by a great number of academicians, sports scientists and trainers to succeed in that sport. That situation brings about a range of scientific studies and necessitates some researches in different fields. The large amount of energy comes to light through anaerobic glycosis on transient hard exercises (Akgün, 1989).

The regulation of lactic acid production has been of interest to exercise physiologists and biochemists for many years. The oxygen deficit continues to rise on such kind of intense trainings and because the anaerobic metabolism dominates, the amount of lactic acid (LA) in blood increases with the severity of the exercise (Lellan, 1991). The highest values in blood lactate are usually seen when the maximal training time exceeds 3 or 4 minutes and that accumulation of lactic acid brings out the fatigue. The accumulation of LA, low pH and high muscle heat can be regarded as the reason of fatigue (Akgün, 1989). The lactate threshold or anaerobic threshold is the limiting factor for the performance. In the of course an exercise which is submaximal and whose intensity rises, when the anaerobic power generation cannot meet the energy requirement of the work or while the submaximal exercise goes on (in spite of the absence of adequate oxygen) regardless of rising the fatigue, when the pyruvate, resulted in glucose degradation, goes beyond the capacity of citric acid cycle, it meets the energy deficit through anaerobic ways. The extra pyruvate that cannot enter the citric acid cycle is transformed into lactic acid; in the meantime, the accumulated lactic acid leads to fatigue and limits the performance (Korkmaz, 1995).

The importance of acute mechanic (rigorous training-intensity effects, the type of muscle contraction, etc.) (Crewther, 2005) and hormonal stimulants (testosterone, growth hormone-GH, insulin, cortisol, etc.) for the adaptation of force/ power are described very well (Kraemer, 1992; Kraemer, 1996). At the same time, it is emphasized that the acute metabolic stimulants (e.g. lactic acid) may also be important for the adaptation of force (resistance) practices (Gentil, 2006). It is stated that the accumulation of those products in the muscle or out of the muscle increases the secretion of different anabolic hormones (Growth Hormone) or the number of motor units, which are active for an ascribed intense training (Takarada, 2000; Taylor, 2000; Takarada, 2002). The wrestling is defined as a sports branch in which anaerobic energy system is predominately used and that the factors such as strength, power, agility, flexibility, balance, muscular and aerobic endurance, anaerobic capacity coordination, affect the performance. It is important that the athlete be rested to determine the intensity of combined (power- technique) training carried out on elite wrestlers. When regeneration (rest-regeneration) is not sufficiently occurred, the efficiency of the training decreases. The purpose of this study is to examine effectiveness of wrestlers' recovery and regeneration process on the following day of the intensive training in terms of accelarating the elemination of lactic acid (sweat training).

Methods

Experimental approach to the problem

The purpose of this study is to examine effectiveness of wrestlers' recovery and regeneration process on the following day of the intensive training in terms of accelarating the elemination of lactic acid (sweat training). Wrestlers that they have made consist of lactic acid as a result of heavy training. Day body workout to increase productivity from next lactic acid removal will advantage. After an intense workout for the removal of lactic acid from 30 minute workout sweat is thought to be beneficial.

Participants

Twenty male wrestlers (10 for elimination group, and 10 for control group), who gained national and international achievements, voluntarily participated in research. It is stated that the average age of the elimination group who participated in research is 19.7±1.2 years, height 1.77±0.1 m, body weight 82.2±9.6 kg. and sports experience 7.4±2.5 years; the average age of the control group is 20.5±1.3 years, height 1.77±0.1 m, body weight 72.4±12.2 kg. and sports experience 8.6±2.2 years.

All of the tests were carried out in the performence laboratory of Sports Sciences Department at Süleyman Demirel University. During the measurements and the tests, the athletes were requested to use their maximal capacities. It is confirmed that they voluntarily participated in research by making them fill out an informed consent form.

Measuring height and body weight

The ages of all athletes are registered as the year of birth on their identity card. The height of the athletes in research group is determined as centimeter with a height measuring SCALA 0.1 cm. accuracy of measurement. In our research, the body weight of the athletes is measured as kg by a digital weighting machine for 1 gr. accuracy of measurement with their sportswear (shorts) but without shoes (Tamer, 2000).

The measurement of lactic acid

Every morning, before and aftertraining, measuring lactic acid involved taking blood samples from the earlobes of the athletes with a sensor lactate device (Senslab lactat Analyzer) for 6 times during 3 days. The levels of lactic acid were measured and registered under the control of a nurse in Laboratory Performance Sports Science Süleyman Demirel University.

How *to measure the heart rate*

The heart rates were measured with a POLAR RS 400 (made in Finland) heart rate measuring device worn on the left wrists of the athletes like a watch and an elastic band being smoothly wrapped around their chest and the heart rates were followed on device measured for 6 stopwatch registered as passive pulse before training and active (maximal) pulse after training every morning during 3 days.

The one maximum repetition tests (1RM)

The athlete was ensconced in described conditioning devices (PRECOR USA) in a suitable technical position. For determining the maximum weight that an athlete could lift, a preliminary test was carried out in a weightless position. After the maximum (1RM) weight was inferentially determined, the maximum weight an athlete could lift was registered as kilogram. The devices whose maximum repetitions known are; shoulder press, leg extension, triceps pres, leg curl, latt pully, biceps curl, chest press, upper back.

The applied training method

In research, the (passive rest) heart rates of the control and elimination groups who kept preparation stage practices were firstly measured, and then, the values of lactate were

measured by taking blood samples from their earlobes at 10 o'clock in the morning during 3 days. The groups limbered up for 10 mins and then, at 8 stations determined on elliptical devices, the values of 1RM were firstly taken and with the %80 of 1RM the hard training was made. After that, the athletes were requested to run with %80 pace until it finished. In the end of training, the maximal heart rates and lactate values were taken and recorded. The elimination group had %30 lactate elimination (aerobic) training for 30 minutes at 5 o'clock in the evening. The control group did not have any practice at that time.

Table 1. Wrestlers applied in the morning and afternoon training program.

1st Day	**2nd Day**	**3rd Day**
MORNING **Elimination-ControlGroup** Training Program (10:00) **Strength training** *Warm-up for 10 mins *The measurment of 1RM repetition. *The number of 1RM repetition with %80 loading until it finishes. *Running with %80 pace until it finishes. *Cool Down **AFTERNOON** **EliminationGroup Training Program**(17:00) **Elimination Training(30 mins)** * Warm up-stretching activities for 5 mins. * Running with %20-30 pacefor 10 mins (110-120 pulse/min). *10 min. technical (passive) working *Cool Down Stretching exercises for 5 mins.	**MORNING** **Elimination-Control** Group Training Program(10:00) **Strength training** *Warm up for 10 mins *The measurment of 1RM repetition. *The number of 1RM repetition with %80 loading until it finishes. *Running with %80 pace until it finishes. *Cool Down **AFTERNOON** **EliminationGroup Training Program**(17:00) **Elimination Training(30 mins)** *Warm up-stretching activities for 15 mins. *Running with %20-30 pace for 30 mins (110-120 pulse/min). *10 min. technical (passive) working *Cool Down Stretching exercises for 5 mins.	**MORNING** **Elimination-ControlGroup** Training Program(10:00) **Strength training** *Warm up for 10 mins. *The measurment of 1RM repetition *The number of 1RM repetition with %80 loading until it finishes. *Running with %80 pace until it finishes. *Cool Down **AFTERNOON** **EliminationGroup Training Program**(17:00) **Elimination Training(30 mins)** *Warm up-stretching activities for 15 mins. *Running with %20-30 pace for 30 mins (110-120 pulse/min). *10 min. technical (passive) working *Cool Down Stretching exercises for 5 mins.

Statistical analysis

The independent t-test and Kruskal-Wallis H Test from nonparametric tests were applied to the athletes who participated in research and their comparisons were made on p=0.05 level.

Results

Table 2: The values of physical measurement of elimination and control groups

Variables	**Elimination Group (n:10)**	**Control Group (n:10)**
Age (year)	19.7±1.2	20.5±1.3
Body weight (kg)	82.2±9.6	72.4±12.2
Height(cm)	1.77±0.1	1.72±0.1
Sports Age (year)	7.4±2.5	8.6±2.2

Table 3. The values of lactate of elimination and control groups for 3 days before and after training

Times	**EliminationGroup** (n:10)	**Control Group** (n:10)
1st day The value of lactate before training mMol/L	3.2±1.2	2.9±1.1
1st day The value of lactate after training mMol/L	3.4±1.1	4.8±3.2
2nd day The value of lactate before training mMol/L	1.9±0.7	1.9±0.7
2nd day The value of lactate after training mMol/L	8.4±4.1	6.4±3.1
3rd day The value of lactate before training mMol/L	1.5±0.4	**2.1±0.5***
3rd day The value of lactate after training mMol/L	7.1±2.1	7.4±1.9

**p<0.05*

Table 4. The pulse rates of elimination and control groups for 3 days before and after training.

Times	**Elimination Group** (n:10)	**Control Group** (n:10)
1st day rest pulse/min	65.0±6.3	72.4±9.6
1st day maximum pulse/min	103.9±21.0	112.1±29.2
2nd day rest pulse/min	59.6±5.2	**68.6±8.3***
2nd day maximum pulse/min	178.2±15.8	176.6±7.4
3rd day rest pulse/min	62.8±6.5	**68.8±7.5***
3rd day maximum pulse/min	177.5±7.8	181.0±6.6

**p<0.05*

Discussion

According to results of the study, the lactic acid values of the athletes participating in research; 1st day of pre-training group elimination was determined as 3.2±1.2 mmol/l. The control group was determined as 2.9±1.1 mmol/l, elimination of post-training group was determined as 3.4±1.1 mmol/l., control group 4.8±3.2 mmol/l.; 2nd day elimination of pre-training group was determined as 1.9±0.7 mmol/l., the control group was determined as 1.9±0.7 mmol/l post training of of elemination group was determined as 8.4±4.1 mmol/l., and the control group was determined as 6.4±3.1 mmol/l.; 3rd day of pre- training elimination group 1.5±0.4 mmol/l. the control group as 2.1±0.5 mmol/l.,the post-training group elimination as 7.1±2.1 mmol/l., the control group as 7.4±1.9 mmol/l., were determined. In our study,in 3rd day, pre- training lactate values and elimination of the group 1.5±0.4 mmol/l., 2.1±0.5 in the control group were recorded and it was determined that no statistically significant differences among them ($p<0.05$). In our study, a statistically significant difference in lactate levels, in 3rd day, prior to training emergence is important in terms of achieving the purpose of our study. In 1st and 2nd days, statistically significant difference in the days of the inability of the wrestlers that they have made enough active recreation as a result of intensive training (elimination training) is thought to result from done. Gupta et al (1996), decided that, blood lactate half-life of maximum oxygen consumption (VO_2max) of 30% corresponding to the intensity of exercise performed in active at rest as 15.7±2.5 min sitting position, the passive rest as 21.5 ± 2.8 min. and short leg massage as 21.8±3.5 min is shown. Dodd et al (1984), while 35% of VO_2max for 40 min and 33 min. at 35% of VO_2max and 65% VO_2max in the seven min of active rest commissioned load corresponding to 65% of active and passive recreation than the rest is effective for the removal of lactate that emphasizes no difference. In researchs on the agreement although unexpected results, 35% of VO_2max more active recreation is regarded as a burden (Sahlin, 1992). This is because up to 40% of VO_2max workout intensities is that aerobic metabolism. At the same intensity, unchange of blood and intramuscular lactate concentration has been shown (Sahlin, Katz, Henriksson, 1987). Therefore, based on these findings that up to 40% of VO_2max on intensity of exercise, the muscle is not the manufacturer of lactateis the consumer. According to the findings in literature after intense exercise takes up the rest of the type and severity of the impact being seen that the rate of elimination of lactate. Rest period at 15 to 40 min. is seen to range. The purpose of this study, an intense workout followed by 30 minutes of active rest is to investigate the effects of the elimination of blood lactate.

Harbili et al., (2007) after intense exercise activates the rest of the blood lactate elimination to examine the effects in their study of active and passive recovery of blood lactate levels compared with active rest group lactate values, in rest time2.25±0.27 mmol/l, the end of the test 11.57±2.28 mmol/l., 5 min. later 7.15±2.83 mmol/l., 10 min. later 13.58±2.97 mmol/l lactate values of the passive recovery group was 2.48±0.99 mmol/l at the end of the test was 12.27±2.76 mmol/l.,5 min. then was 14.34±3.16 mmol/l., 10 min. later 6.14±3.07 mmol/l were identified as. In another study, Filiz (1999) reported, wrestlers maximal loading as a result of the accumulated lactic acid levels in the blood have been made regarding maximal loading of the wrestlers in the study of lactic acid after averaging 12.40±2.30 mmol/l were found. McKenna et al., (1997) have applied on healty young men a 7-week training program at the beginning of the program pre-exercise blood lactate average respectively 1.5±0.2 mmol /l, 11.5±2.1 mmol/l, as and after 7 -week program the mean number of pre- exercise and post-exercise is 1.7±0.2 mmol/l, 12.0±3.3 mmol/l have identified. After exercise, significant increase in blood lactate levels have reported. In another study Sharratt (1984), make maximal loading to elite 49 wrestlers on the treadmill, the blood lactate 14 mmol/l were found. Savranbaşı et al., (1996), in their study on nine wrestlers, after the competitions (World Championships) 5 min later the lactate concentration was 14.9±4 mmol/l, after training in the initial measurement of the lactate value was 11.9±2.l mmol/l , the second was 11.3±3.3 mmol/l were found. In a similar study Savranbaşı (1992), over 18 wrestlers in his doctoral thesis, after training lactate level was 9.56 mmol/l., the amount of lactic acid after competitions 13.11 mmol/l. were found.

Kurt (2009) found the rested blood lactate as respectively 1.6±0.3 ve 1.8±0.5 mM in the morning and evening, in “early riser and about early riser group”in a study in which he evaluated the concentration of maximal blood lactate in the view of chronotrope in the morning and evening. He found the rested blood lactate in the morning and evening as respectively 1.4±0.5 ve 1.9±0.6 mm in “evening group”. He found the maximal blood lactate as respectively 14.8±1.6 mm ve 15.5±2.2 mm in the morning and evening in “morning group”. Evening/Evening Close "group, maximal blood lactate in the morning and evening, respectively, 15.3±1.4 mm and 16.1±1.5 mm have been detected. Carter et al. (2000) found as (2.1±0.5 mmol/l -1.9±0.4 mmol/l)the blood lactate concentration in the study in which they compared the threshold values that they obtained from lactate minimum test and standard incremental exercise test. In another study Nose et al., (1991), the level of blood lactate was reported to increase extremely after the exercies carried out with %95 MaxVO_2 pace. Smekal

et al., (2003) found the maximum lactate as 10.61±2.04 mmol/l in the study about respiratory gas change and the measurement of blood lactate.

Akça et al., (2010), found the rested lactate of the athletes as 1.18 ±0.25 mmol/l, the maximal lactate as 12.39 ±1.59 mmol/l., in the study in which they examined the oxygen consumption and lactate profile on Turkish elite young oarsmen. Bouhlel et al (2006), found the average level of blood lactate after the test of sit-up running for 20 metres as 12.81±1 mmol/l, 10.2±1.2 mmol/l after the competition in a study on 8 elite tae-kwon doers whose average age is 20±1 year. Bayrak (2008) in a study on investigating the effects of the activities performed in big league table tenis competition on heart rate, concentration of blood lactate acid and the degree of difficulty, found the values of blood lactate as 1.4 mmol/1 at minimum, 3.1 mmol/1 at maximum and average 2.1 mmol/1 before competition, and after the competition while he found the levels of blood lactate as 2.2 mmol/1 at minimum, 5.4 mmol/1 at maximum and average 3.8 mmol/1, the levels of blood lactate were found as 1.0 at minimum, 4.3 maximum and average 2.4 mmol/1 5 mins later after the competition. Çınar (1990), found the values of lactate of Turkish and foreign wrestlers (n=19) participating in European Wrestling Championship in 1989 as 11.59 mmol/l after the competition. This value and maximum training level have supported eachother. Gentil et al. (2006) examined the blood lactate answers of four power trainings 12 experienced volunteer males participated in study on those four power training method before. (age: 24.83±3.27age, height 177.83±5.96 cm, body weight 78.94±8.13 kg, 1RM intensity 109.58±16.58 kg, the training experience is for 2 years at least.

The action of leg extension was applied with force which is equaled to 1RM (excluding super low method) at normal pace (concentric contraction for 2 secs and eccentric contraction for 2 secs, no resting in break) until it finished (the point at which the knee could not come to extension for promply 24 hours). The concentration of blood lactate increased tremendously after each power training 3 minutes later. At the same time, they found a statistically marked difference among the answers of blood lactate four different power training method. Because some measurements have some differences as device, time, environment and conditions, their comparison may not be useful.

According to the study results, before and after training the levels of pulse rates of the athletes participating in research are determined 1st day passive (resting) pulses for the elimination group as 65.0±6.3 pulse/min., as 72.4±9.6 pulse/min for the control group, 178.2±15.8 pulse/min. minimum pulses for the elimination group, as 176.6±7.4 pulse/min for

the control group, as 103.9±21.0 pulse/min. maximal pulses for the elimination group, as 112.1±29.21 pulse/min; 2nd day, as 59.6±5.2 pulse/min passive (rested) pulses for the elimination group, as 68.6±8.3 pulse/min. for the control group, as 178.2±15.8 pulse/min. maximal pulses for the elimination group, as 176.6±7.4 pulse/min., 3rd day, as 62.8±6.5 pulse/min. passive (rested) pulses for the elimination group, as 62.8±6.5 pulse/min. for the control group, maximal pulse as 177.5±7.8 pulse/min for the elimination group, as 177.5±7.8 pulse/min. for the control group. In our research, there is a statistically marked difference between 2nd passive (rested) pulse and 3rd passive (rested) pulse ($p<0.05$). Thus, It could be said that the elimination trainings which are additively done after rigorous exercises may contribute to the rested situation before training next day. In a similar study to examine the effects of the active resting on blood lactate elimination after a rigorous training, Harbili et al. (2007) determined the heart rates in active and passive resting as 69.9±5.5 pulse/min. heart rate, in the end of the test as 69.9±5.5 pulse/min., as 141.7±14.3 pulse/min 10 mins later for the active resting group; the heart rates for the passive resting group as 72.5±5.6 pulse/min, in the end of the test as 178.4±11.5 pulse/min., as 118.8±10.9 pulse/min. 10 mins later.

In a study about the levels of lactic acid accumulated in blood as a result of maximal training of the wrestlers, Filiz (1999) found the average pulse rate of the wrestlers before maximal training as 66.2±6.77 pulse/min, the average pulse rate after training as 185.4±3.73 pulse/min. In a study about comparisons of the threshold values obtained from lactate minimum test and standard incremental exercise tests, Carter, Jones and Doust (2000) registered the number of heart rate as 167±15 pulse/min.-168±11 pulse/min. In a study about comparing MaxVO_2 and the lactate values and two different incremental treadmill protocol on elite athletes, Özgür (2005) found the maximal heart rates of the athletes as (191.14±8.18 pulse/min).

Practical Applications

Short intense strength training before competitions during the regeneration period or a faster heart rate 110-120 to perform a 30-minute workout can be effective in the removal of lactic acid (Table 3).

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