CHARACTERISTICS OF THE FUNCTIONAL CAPABILITIES OF NATIONAL COMPETITORS IN GRECO-ROMAN WRESTLING AFTER SPECIALIZED TRAINING – PRE-COMPETITION MODELED WRESTLINGS

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ABSTRACT

Winning medals by our wrestlers of the international Championships is of great importance for the Bulgarian school and the high esteem of Bulgarian sport. In recent years, intensive interval-variable training, modelled wrestling that simulate a competition, has been included in the contest period of our wrestlers' preparation. Purpose: Our goal is to construct a high-intensity modelled training (wrestling) suitable for the functional preparation before a competition and to determine their biochemical and physiological load characteristics by measuring heart rate and lactate concentration in the peripheral blood. Methods: The study involved five medallists in Greco-Roman wrestling in the last European and World Championships, who in six modelled rounds with tasks and with elements of wrestling and tactical ideas showed the following results: - Heart rate varied after each round with values exceeding182 bpm, and at breaks dropped to 89 bpm; - The concentration of lactate in the blood was also high in each session between the first and the second match. Conclusions: In conclusion, the intensity of this constructed model of modelled training is very high, compared to the values reported in the competitive conditions of the international tournament "Nikola Petrov" values of the concentration of lactate in the blood.

Key words: Greco-Roman wrestling, lactate, heart rate, modeled training.

INTRODUCTION

In Greco roman wrestling, in addition to technical and tactical training, the development of physical qualities (1), provided by the relevant biochemical and physiological mechanisms, is also required (2). Therefore, complex trainings are applied for loading of different muscle groups (3) and physical qualities and activation of the energy supply systems in aerobic and anaerobic conditions.

According to the understandings back in the years (4,5) the dominance of anaerobic metabolism during this type of training load was accepted. Based on the reporting of the ratio (active work) / (passive movements), it is currently assumed that between the simulated struggles in one workout the main energy supplier is the aerobic system with a share of $75.0 \pm 6.0\%$ of the total energy supply (6). In the periods of active tactical actions (search for a technical point or activity for downloading to the ground floor), the main energy supply mechanism is the system for immediate energy supply ATP and CF (adenosine tri phosphate - creatine phosphate) and the anaerobic - lactate system (7). The need of our wrestlers for aerobic and anaerobic support in the fight during Wrestling competitions requires to work in a mixed training regime, which causes the adaptation of all metabolic pathways (8). This requires the use of high-intensity simulated training in the competition period, because they develop both aerobic and anaerobic energy mechanisms (9).

Modeling Wrestling training, at present, is often used to mimic future competition. It performs the exact number of wrestling, for example two wrestling in the morning session, two in the afternoon and two the next day, as

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in the competition and sets tactical tasks for performance in aerobic mode with supramaximal intensity (170% of VO2max) or strength movements with maximum power performed in a given minute of the part with 30 seconds rest between parts with a total duration of 6 minutes, designated as one wrestling match. For one modeled training we can perform six wrestling in three sessions, 10 am in the morning, 5 pm in the afternoon. and the next day also in the morning 10 o'clock. Breaks between contractions of 12 minutes, forming a 24-minute session. In a similar study in karate for two weeks, performing the simulated training once a week resulted in an increase in VO2max of 7 mL / kg / min, and anaerobic capacity increased by 28% (10). These results give us reliability and the opportunity to develop various programs modeled high-intensity training (simulated wrestling), including technical and tactical exercises performed in one wrestling match.

The aim of the research is to make a variant of an effective modeled training (competitive wrestling), which would correspond to the level of preparation of the national wrestlers. Also, to determine the biochemical and physiological characteristics of the training load during it by measuring the heart rate and the concentration of lactate in the peripheral blood.

METHODS
Participants
The survey examined five national team Greco-Roman wrestling competitors aged 24 - 28, with 14 - 18 years of experience (10.8 ± 5.56 years). The anthropological data of the participants is presented in **Table 1**.

Table 1. *Anthropological parameters of the national wrestling team competitors that were studied.*

No	Age years	Haight cm	Weight kg
S1	26	162	55
S2	25	164	60
S3	28	164	63
S4	25	174	67
S5	28	181	87
Average value	26.4	169	66,4
SD	1.51	8.18	12.32
SE	0.80	1.63	2.46
Min.	25	162	55
Max.	28	181	87

All survey participants are national competitors and European and World Championship medalists. They were informed of the goals, objectives and the organization of the study and signed an "Informed Agreement Form".

Design of the study
A modeled training was created comprising 10 technical-tactical tasks performed in a single wrestling match of 2x3 minutes and 30 seconds of intermission, or a total of 390 seconds.

The tasks were performed in a sequence in three sessions of two consecutive wrestling matches with 12 minutes of intermission between them.

The lactate concentration was studied (blood was drawn from the ball of the ear) every morning on both days and after each match.

The heart rate was measured at rest and after each match of the modeled training session.

Record heart rate and determine lactate concentration
We used palpation recording of the pulse (HR) for ten seconds due to the fact that during the wrestling match it is not possible to use equipment. Different variants have been tested,

all sensors are moved by the competitors and there is no effect from them.

The quality of the results and the lactate concentration were determined with an automatic lactataanalyzer from StatStrip Lactate and is possible thanks to the patented Nova Biomedical Multi-Well technology.

Statistical Analysis
Statistical processing of the results was done using Microsoft Office Excel. Mean values are presented in the text with standard deviation ($\pm$ SD) and in the graphs with standard error ($\pm$ SE).

Warm-up Description
Warm-up was performed independently by each competitor and included:
● running exercises on the wrestling area (up to 5 minutes)
● general preparation exercises that warm up all body joints by means of gymnastic exercises (up to 5 minutes)
● special preparation exercises (up to 5 min)
● acrobatic exercises (up to 5 minutes)

Description and characteristics of the technical and tactical tasks included in a single wrestling match included in the modeled training:

In order to make the modeled wrestling match efficient, the wrestler has to perform at least six of the assigned ten tasks in accord with the current situation during the wrestling match.

Task 1. During the first minute of the first part of the wrestling match, a realization is sought of a technical action from standing position that should earn technical points so that after that a bottom (parter) position does not occur.

Task 2. During the first part of the wrestling match, by means of active technical and tactical moves, getting the right to put the opponent in a bottom (parter) position is sought in order to earn technical points first.

Task 3. During the first minute of the first part of the wrestling match, if the competitor is put in a bottom (parter) position due to passive wrestling, the latter needs to perform the correct defense so that he/she does not lose technical points.

Task 4. During the second minute of the first part of the wrestling match, by means of powerful physical action, the opponent needs to be forced to step outside the wrestling area, so a point is earned this way.

Task 5. During the third minute of the first part of the wrestling match, by imposing a grip, gain control of the opponent until the end of the part.

Task 6. During the first minute of the second part of the wrestling match, by correctly positioning the body, make the opponent break the rules and thus earn points for negative wrestling.

Task 7. During the first minute of the second part of the wrestling match, after earning the right and putting the opponent in a bottom (parter) position, realize the technical action of bridging the opponent/.

Task 8. During the second minute of the second part of the wrestling match, in the case of a negative score, a technical action of "throw over the chest" suplex is sought to be realized.

Task 9. During the third minute of the second part of the wrestling match, in the case of a negative score, the wrestler risks and seeks a flawless victory by pinning the opponent.

Task 10. During the third minute of the second part of the wrestling match, the wrestling match is conducted in the center of the wrestling area with correctly imposing a grip.

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RESULTS

The values of lactate in the morning and after the six contractions on the two days of the modeled training are illustrated in **Table 2**

In the morning, the mean lactate was 1.16 mmol / L. After the first wrestling match of the simulated training, the lactate reached a maximum value of 18.0 mmol / L, and its average values for this fight were 15.8 mmol / L ± 1.82 mmol / L. At the end of the second

wrestling match, the maximum lactate concentration was 15.4 mmol / L, the mean values decreased to 12.81 ± 1.88 mmol / L. In the afternoon session after the end of the third wrestling match, the average value of the lactate concentration was 14.4 mmol / L $\pm$ 2.03 mmol / L, with the maximum values reaching 17.7 mmol / L. In the fourth wrestling match, the mean value of the lactate concentration was 11.45 mmol / L $\pm$ 0.99 mmol / L, the maximum values were 12.2 mmol / L. The minimum values of lactate were also high in all four contractions, they were 13.5

mmol / L, 10.5 mmol / L, 12.4 mmol / L, 10.1 mmol / L. All competitors experienced a slight decrease in lactate concentration in every second wrestling match of the session. The next day before warming up, the average lactate was 1.22 mmol / L. In the fifth wrestling match, the lactate reached a maximum value of 17.4 mmol / L, and its average values for this fight were 15.6 mmol / L $\pm$ 2.24 mmol / L. After the end of the sixth contraction, the maximum lactate concentration was 14.2 mmol / L, the mean values decreased to 11.86 ± 2.11 mmol /.

Table 2. *Values of lactate concentration of wrestlers*

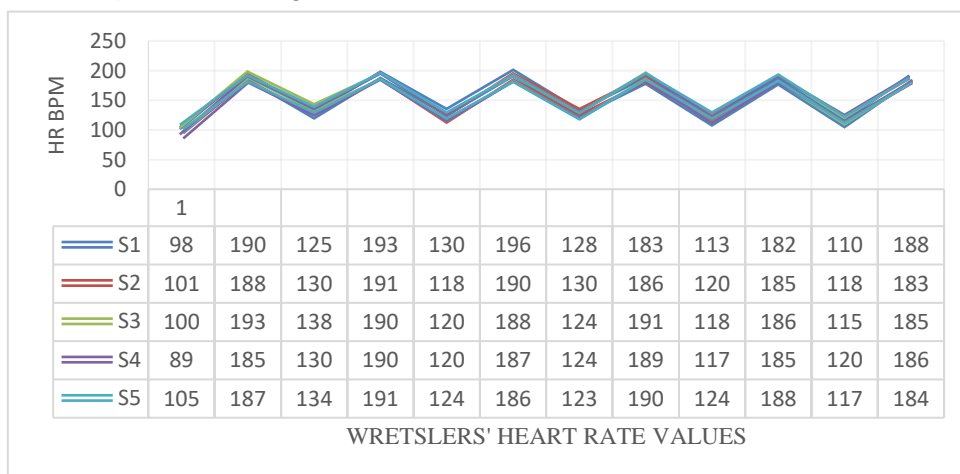| Wrestler	La in the morning	La after first wrestling match	La after first wrestling match	La after first wrestling match	La after first wrestling match	La the next morning	La after first wrestling match	La after first wrestling match
	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L	mmol/L
S1	1,2	17,0	15,4	17,7	12,2	1,3	17,3	10,2
S2	1,0	13,5	12,0	13,1	12,1	1,0	13,3	12,0
S3	0,8	14,5	10,5	12,4	10,7	0,9	12,5	9,3
S4	1,6	18,0	12,3	14,3	10,1	1,2	14,8	14,2
S5	1,2	16,0	13,9	14,5	12,2	1,7	17,4	13,6
Average value	1,16	15,8	12,81	14,4	11,45	1,22	15,6	11,86
SD	0,29	1.82	1,88	2,03	0,99	0,31	2,24	2,11
SE	0,9	3.32	3,53	4,14	0,98	0,9	5,05	4,45
Min.	0.8	13,5	10,5	12,4	10,1	0,9	12,5	9,3
Max.	1,6	18,0	15,4	17,7	12,2	1,7	17,4	14,2

* - $p < 0.05$ in comparison with the La concentration after the first wrestling match

**- $p < 0.01$ in comparison with the La concentration after the first wrestling match

In the morning and six contractions, the averaged lactate concentration data showed a statistically significant decrease in values after the second contraction compared to the first ($p < 0.05$), as well as after the fourth versus the third ($p < 0.01$) and after the sixth versus the fifth.

The pulse or heart rate of national athletes is shown in **Figure 1.** Starting values start at 89

bpm for the S4 competitor and reach 138 bpm for the S3 competitor. During the simulated fights, the heart rate increased in all wrestlers and the highest values were registered in competitors S1 (196 bpm) after the third fight and in the same competitor after the second fight, as well as S3 after the first fight. The HR in the breaks between the matches had values from 89 to 138 bpm

	1											
S1	98	190	125	193	130	196	128	183	113	182	110	188
S2	101	188	130	191	118	190	130	186	120	185	118	183
S3	100	193	138	190	120	188	124	191	118	186	115	185
S4	89	185	130	190	120	187	124	189	117	185	120	186
S5	105	187	134	191	124	186	123	190	124	188	117	184

WRETSLERS' HEART RATE VALUES

Figure 1. Athletes' heart rate values before and after each wrestling matches of the modeled training

The average values show a large increase in heart rate during contractions to 188.6 ± 3.04 bpm during the first contraction, 191 ± 1.22 bpm during the second, 189.4 ± 3.97 bpm, during the third, during the fourth 187.8 ± 3.27 bpm, during the fifth 185.2 ± 2.16 bpm, and during the sixth 185.2 ± 2.16 bpm (Figure 2.)

At rest, the heart rate recovered, reaching values of 98.6 ± 5.94 bpm after the first; 131.4 ± 4.87 bpm after the second bout, 122.4 ± 4.77 bpm after the third bout, 125.8 ± 3.03 bpm after the fourth bout, 118.4 ± 4.03 bpm after the fifth bout, 116 ± 3.80 bpm after the sixth bout (**Figure 2).**
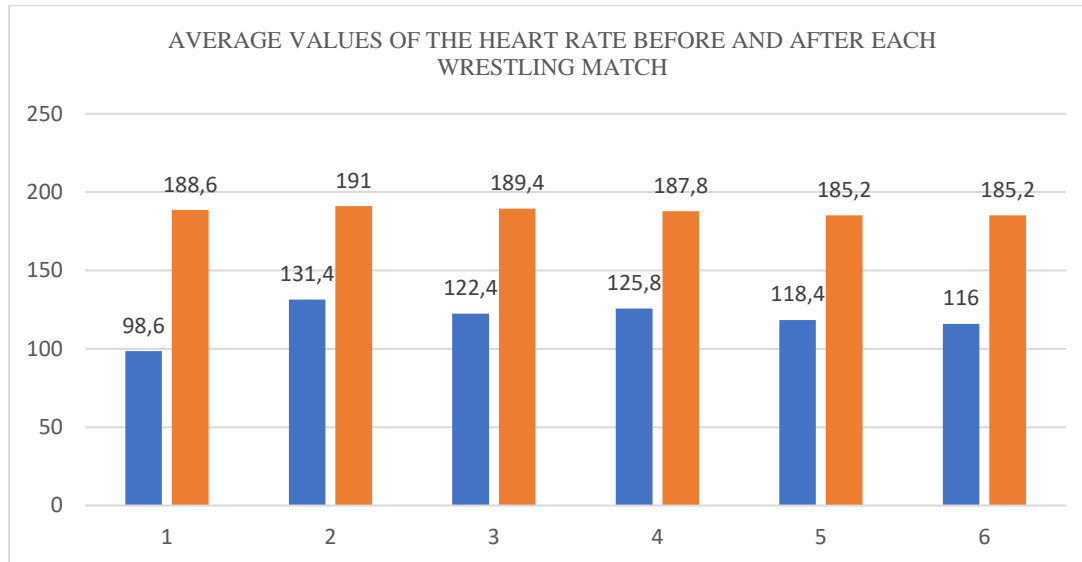
Figure 2. Average values of the heart rate of the five national team competitors at before and after each wrestling matches of the modeled training.

DISCUSSION

Our task in this work was to make a variant of effective modeled training (modeled wrestling) with technical and tactical tasks, which would develop important for the sport Wrestling qualities and muscle groups needed for it. We understand the effect of this training through the data from the lactate in the blood and the heart rate, which were measured in the morning on both days after the six contractions.

During a modeled training, after each wrestling match, the lactate in the blood reached high values in all athletes. A decrease of this indicator is registered in every second wrestling match of the session. In competitor S4 and S5, an increased lactate concentration was reported in the morning, which gives us information about their incomplete recovery.

This modeled training was created in order to aid the preparation of the national team of classic wrestling for the traditional Bulgarian international wrestling tournament "Nikola Petrov". During the competition we measured an average value of 10.5 ± 2.07 mmol/L after the third wrestling match (this data has not been published yet). This shows that the

simulated wrestling constructed by us has a much higher intensity than the racing load. It is known that in different types of training the concentration of the lactate varies significantly depending on the qualifications of the athletes. If the athletes are less experienced, they show higher concentrations of lactate in the blood compared to the experienced nationals after technical training, conditioning training, as well as after training simulated wrestling (11). In the same study, the highest lactate concentrations were found after a simulated wrestling 18.0 ± 1.82 mmol / L in national athletes and 9.3 ± 2.11 mmol / L in more experienced international athletes. The values after the technical and tactical training are 8.3 ± 0.8 mmol / L for wrestlers competing at international level and 11.3 ± 0.8 mmol / L for wrestlers competing at national level, and after conditioning training - 5.3 ± 0.5 mmol / L and 7.9 ± 0.6 mmol / L, respectively.

The heart rate after the wrestling matches increased in all wrestlers above 182 bpm. The lowest value of competitor S1 shows HR = 182 bpm after the first fight. During breaks, the heart rate decreases and varies from 89 to 138 bpm.

Similar values were reported during the international tournament and in previous studies (12), around and over 182 ± 9 bpm. Therefore, we can say that in wrestling competitions (13, 14) the load on the body of the athletes is very high, which causes almost maximum cardiovascular reactions and high values in the concentration of lactate.

These parameters do not differ much and always remain high after all matches during a competition (15, 16). These results give coaches the confidence to plan their training so that they can reach the maximum competitive conditions and prepare their wrestlers for high loads during responsible matches. Using the modeled training that we created, the competitors who took part in went as far as the medals and achieved the following ranking at the "Nikola Petrov' tournament:

Table 3. *Ranking at international tournament "Nikola Petrov"*

No	Age years	Hight cm	Weight kg	Ranking at "Nikola Petrov" international tournament
S1 Н.П.	26	162	55	3st place
S2 А.С	25	164	60	5rd place
S3 Н.В	28	164	63	3rd place
S4 Д.Д	25	174	67	3st place
S5 Д.А	28	181	87	1th place

CONCLUSIONS
- ✓ The levels of the concentration of lactate in the blood after the end of each fight from the modeled training are higher in comparison with the ones reported in the international tournament "Nikola Petrov".
- ✓ The heart rate of the surveyed competitors reaches its maximum levels and are comparable to those recorded during the competition.
- ✓ The concentration of lactate at such high loads is more indicative of the degree of load on the body compared to HR.
- ✓ During a competition, the load that is received has smaller values compared to the load of the modeled training we have built.
- ✓ From the presented results and analyzes, it can be concluded that the modeled training built by us has led to the necessary results.

REFERENCES
1. Yoon, J., Physiological profiles of elite senior wrestlers. *Sports Med* 32: 225–233, 2002.
2. Makaveev, R., New Regulations in the Wrestling- Changed Requirements in the Preparation Period, PhD Book of abstracts Sakaria 2015, pp.61., 2015
3. Horswill, C.A., Miller, J.E., Scott, J.R., Welk, G., and Van Handel P., Anaerobic and aerobic power in arms and legs of elite senior wrestlers. *International J. Sports Medicine,* 13: 558-561. 1992
4. Meranzov, H., Olympic training system. Sofia: Medicine and Physical Education, 1976
5. Lansky, R.C., Wrestling and Olympic-style lifts: in-season maintenance of power and anaerobic endurance. *Strength Conditioning J.,* 21: 21-27, 1999
6. Volkov, NI, Nesen, E. N., Osipenko, AA., Korsun, SN., "Biochemistry of muscle activity", Kiev, 2000, Olympic literature
7. Makaveev R., Andreeva, L., Alexandrova, A., Nikolov, N., Chamishki, D., Petrov,L., Lactate dynamics training match in wrestling, 7 International scientific congress "Sport, stress, adaptation" 2014, book of abstracts, pp. 97.
8. Makaveev, R. Formation of models of competition and methodology of recovery between meetings during a competition based on the use of the indicator - concentration of lactate in the blood, *Sports and Science,* issue 2 (original number), pp.28-32, 2016
9. Penov R, Alexandrova A., Petrov, L., Zaykova, D., Functional Characteristics of Specialized Circuit Training for Karate Competitors, *Journal of Applied Sports Sciences*, Vol. 2, pp.3-11, 2018
10. Tabata, I., Nishimura, K., Kouzaki, M., Hirai, Y., Ogita, F., Miyachi, M., Yamamoto, K., Effects of moderate-intensity endurance and high-intensity intermittent training on anaerobic capacity and VO2max, *Med Sci Sports Exerc.,* 28(10):1327-30, 1996

11. Kirov, P., Makaveev, O., Sports training of the wrestler. Sofia: NSA PRESS, 2010

12. Zaekov, N., Petrov, L., Rankov. K., Nikolova. M., Makaveev, R., Nikolov, N., Determining Energy Expenditure from Heart Rate Monitoring during Training Sessions at Bulgarian Wrestlers, *Int J Bioautomation,* 23 (3), 251-258., doi: 10.7546/ijba.2019.23.3.000524, 2019

13. Cinar, G., Tamer, K., Lactate profiles ofwrestles who participated in 32nd European free-stylewrestling championship in 1989. *J. Sports Medicineand Physical Fitness,* 34: 156-160, 1994

14. Kraemer, WJ., Fry, AC., Rubin, MR., Triplett-McBride, T.,Gordon, SE., Koziris, LP., Lynch, JM., Volek, JS., Meuffels, DE., Newton, RU., and Fleck, SJ., Physiological and performance responses to tournament wrestling. *Med Sci Sports Exerc* 33:1367–1378, 2001

15. Shiyan,V.V., Bioenergetic factors determining the development of special endurance of wrestlers/*International Journal of Wrestling Science,* Vol. 2 Issue 1, p.17 – 20, 2012

16. Uusitalo, AL., Uusitalo, AJ., and Rusko, HK., Heart rate and blood pressure variability during heavy training and overtraining in the female athlete. *Int J Sports Med* 21: 45–53, 2000