



COMPARISON OF RANKING, PREPARATION AND FUNCTIONAL PARAMETERS OF DEAF AND HEARING WRESTLERS FROM THE BULGARIAN NATIONAL GRECO-ROMAN WRESTLING TEAMS

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ABSTRACT

The successful performance at the competitions of Bulgarian Greco-Roman wrestlers with hearing and deaf is largely due to the adjustment of the training process to the ever-changing rules of Greco-Roman wrestling. Before the London Olympics, because of the rules, the focus was on the speed and strength endurance, but after that only strength endurance as a major factor for sport results. **Purpose:** Our goal is to compare a world championship results, the methodology of preparation and the functional parameters of wrestlers with impaired and normal hearing in the pre-Olympic year so as to win Olympic quotas. **Methods:** The analysis involved three best performing Greco-Roman wrestlers at the respective world championships for deaf and hearing athletes in the same year. **Results:** In addition to sport results and the methodology of preparation, from the functional parameters (physiological and biochemical), we are using the maximum oxygen consumption (VO₂max), the maximum oxygen consumption per kilogram (VO₂max/kg), the heart rate values and the lactate concentration in the peripheral blood from conducting functional tests. **Conclusions:** In conclusion, we can say that the sports achievements are in favor of deaf wrestlers, the training methodology is the same and the functional capabilities are better for hearing wrestlers.

Keywords: Greco-Roman wrestling for deaf and hearing wrestlers, analysis, comparison, functional indicators, strength endurance.

INTRODUCTION

In the sport of Greco-Roman wrestling, both for deaf and hearing athletes, it is required to develop a variety of motoric qualities supported by the respective physiological and biochemical mechanisms (1). Analyzing the changes in the competition rules (2), we redirected our team's preparation from speed-strength endurance to strength endurance, which became the major quality that pre-determined the successful application of technical and tactical ideas during wrestling matches and brought victories (3).

This physical quality, which appears to be essential for victory, gives us the opportunity to form a hypothesis - whether it affects the physiological state of deafness of some

fighters. The goal prompted us to compare the indicators of the deaf and hearing national athletes in classical wrestling in Bulgaria for men.

On the basis of the high results achieved in the past, Bulgaria is considered to be a leader in the sport of wrestling. Therefore, we found it beneficial to compare the sports achievements, the training methodology and the functional indicators of the competitors who did the best during the pre-Olympic year among both the hearing and deaf wrestlers.

1. **Competition results** - Due to the fact that deaf competitors participate in only one championship during per year, we view the World Championships for the two respective groups: the one for hearing wrestlers, which was held in Kazakhstan and the World Championship for deaf competitors, which was held in Russia.

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2. **Sports preparation** – As a member of the coaching group of the national wrestling team for athletes with normal hearing and as a chief coach of the national team for deaf wrestlers, I used identical training methodologies for the sports preparation of both teams during the pre-Olympic year. This included almost the same number of Tactical-Technical Improvement sessions (a few more for the hearing wrestlers), almost the same number of games, cross-running, weight-lifting sessions (a few more for the hearing wrestlers), and identical complex training sessions that load different muscle groups in aerobic and anaerobic conditions by a series of technical - tactical tasks (4). This required the use of highly intensive training sessions of sports preparation that aimed at improving the strength endurance, which in turn developed both the aerobic and anaerobic energy supply mechanisms (5).
3. **Functional indicators** – Owing to the support of the Coordination and Control of Sports Preparation office, we were able to use the physiological, biochemical and functional indicators of both deaf and hearing wrestlers, which included Maximum Oxygen Consumption (VO₂max), Maximum Oxygen Consumption per kilogram (VO₂max/kg), Heart Rate, and Lactate Concentration in peripheral blood. We believe that these are the most important indicators in the sport of wrestling and that these indicators best illustrate the wrestler's condition. For the purpose of precision of the comparative analysis, we used the functional indicators before and after base-camp training prior to the major competition.

These results allow for developing a variety of training sessions that are adapted to the competition rules, lead to developing a higher strength endurance and include technical and tactical tasks that require the latter (6,7). The need of Bulgarian wrestlers of both aerobic and anaerobic energy supply during their sports preparation requires a mixed regime of preparation which build the adaptivity of all metabolic paths (8).

It is currently believed that during sports preparation the main energy provider is the aerobic system with a share of $77.8 \pm 5.8\%$ of the overall energy supply (9). Our purpose is to

analyses and compare the results from the World Championships, the preparation methodology, and the functional indicators of deaf and hearing wrestlers during the pre-olympic year in the aim of achieving olympic quotas (Tokyo Olympics and Deaflympics). The purpose was to study (10) the changes in sports preparation as a result of the changes in the competition rules, and to determine the biochemical and physiological characteristics of the Greco-Roman wrestling training workload by studying the Maximum Oxygen Consumption (VO₂max), Maximum Oxygen Consumption per kilogram (VO₂max/kg), Heart Rate, and Lactate Concentration in peripheral blood (11) during the training process aimed at strength endurance.

METHODS

The indicators studied can be formally divided into two major groups:

1. Anthropometric – height, mass, active body mass.
2. Functional – Maximum Oxygen Consumption (VO₂max), Maximum Heart Rate (HRmax) and Maximum Oxygen Consumption per kilogram (VO₂max/kg). In order to avoid the impact of body mass in the comparative analysis of functional parameters, we used relative indicators presented by the ratio of their absolute values and body mass of each studied individual. The results were measured at three stages of the wrestlers' preparation - before the base-camp training, after the base-camp training and before the competition.

Registration of Heart Rate, Maximum Oxygen Consumption (VO₂max), Maximum Oxygen Consumption per kilogram (VO₂max/kg) and Lactate.

Heart rate (HR), maximum oxygen consumption (VO₂max absolute value in liters per minute), maximum oxygen consumption per kilogram (VO₂max / kg relative oxygen consumption, and the unit is ml / kg / min), and lactate concentration were recorded ultrasound equipment for Echocardiography, ECG at rest and under load, anthropometry, spiroergometric with equipment (CORTEX, PULSAR / HP COSMOS) of the National Center for Sports Medicine Dianabad Bulgaria.

Statistical Analysis

The data were processed using the statistical package Microsoft Word - Excel and the average values in the text with the standard deviation (\pm SD) were presented.

Test Subjects

The survey examined the three Greco-Roman wrestlers from the national teams for hearing and for deaf athletes who qualified the best in the same year were studied. The anthropological data of the participants is presented in **Table 1 and in Table 2.**

Table 1. Anthropometric parameters of Greco-Roman national team wrestlers with normal hearing.

No	Height cm	Mass kg	Active body mass
S1 (N.P.)	162	62	56.9
S2 (A.M.)	178	77	69.8
S3 (N.V.)	164	66	59.6
average value	168	68.33	62.1
min.	162	62	56,9
max.	178	77	69,8

Table 2. Anthropometric parameters of Greco-Roman national team wrestlers with impaired hearing.

No	Height cm	Mass kg	Active body mass
S1 (P.D.)	160	58	53.5
S2 (I.S.)	169	77	68.2
S3 (D.D.)	167	60.9	54.6
average value	165.33	65.3	58.7
min.	160	58	53,5
max.	169	77	68,2

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

In table format, we presented the World Championship ranking, the basic year-long

indicators of sports preparation utilizing data from training camps during the pre-Olympic year, as well as the individual functional values of the physiological and biochemical indicators of the deaf and normal-hearing wrestlers.

We analyzed and compared the values for the respective year in order to determine whether or not deafness was a factor in wrestlers' preparation.

Table 3. World Championship ranking for wrestlers with normal hearing, Kazakhstan

No	Age years	Height cm	Mass kg	Ranking
S1 (N.P.)	25	162	85	8th place
S2 (A.M.)	25	178	64	3rd place
S3 (N.V.)	28	164	68	7th place

Table 4. World Championship ranking for deaf wrestlers, Russia

No	Age years	Height cm	Mass kg	Ranking
S1 (P.D.)	22	160	85	3rd place
S2 (I.S.)	23	169	64	2nd place
S3 (D.D.)	23	167	68	3rd place

Table 5. General year-long indicators of sports preparation for deaf and for normal-hearing wrestlers utilizing data from training camps during the pre-Olympic year,

Indicators	Tactical-Technical Improvement sessions (number)	Cross-run(km).	Weight lift (tons)	Trekking (hours)	Games (number).	Wrestling matches
Deaf	110	190	1000	30	26	40
Normal-hearing	130	220	1300	30	26	50

Table 6. Individual functional values of Greco-Roman wrestling competitors with normal hearing

№		VO2max	VO2max/kg	HR max	La 2''	La 6''	La 15''	HR2''	HR6''
S1 (N.P.)	before base-camp	2450	55.02	195	9.4	10.1	5.7	148	98
	after base-camp	3250	56.47	199	6.5	8.5	5.5	145	94
	competition	3500	58.47	192	9.1	8.0	5.0	135	88
S2 (A.M.)	before base-camp	4400	57.14	188	7.0	9.8	8.3	147	103
	after base-camp	4450	57.79	198	8.3	9.1	7.2	142	91
	competition	4500	58.23	193	8.1	6.0	4.4	128	87
S3 (N.V.)	before base-camp	3400	51.65	188	8.2	11.3	8.3	152	110
	after base-camp	3500	52.55	196	7.2	10.5	6.9	149	99
	competition	3600	53.14	191	6.8	7.8	5.8	120	88
average value		3672	55.61	193	7.8	9.01	6.34	140	95
min.		2450	51.65	188	6.5	6.0	4.4	120	87
max.		4500	58.47	199	9.4	11.3	8.3	152	110

Table 7. Individual functional values of deaf Greco-Roman wrestling competitors

№		VO2max	VO2max/kg	HR max	La 2''	La 6''	La 15''	HR2''	HR6''
S1 (P.D.)	before base-camp	2600	46.62	179	3.8	5.9	3.6	145	68
	after base-camp	2700	47.54	177	3.5	5.8	3.5	141	71
	competition	2800	48.25	180	3.5	5.7	3.4	138	65
S2 (I.S.)	before base-camp	3800	49.35	186	10	12	9.7	164	99
	after base-camp	3900	49.90	184	9.2	11.2	9.5	158	90
	competition	3950	51.00	188	8.8	10.1	8.8	145	83
S3 (D.D.)	before base-camp	3200	52.55	202	9.6	12.1	10.3	172	117
	after base-camp	3300	53.25	189	9.4	11.5	8.8	165	111
	competition	3400	53.88	188	8.7	10.8	7.6	140	98
average value		3294	50.26	185	7.4	9.5	7.0	152	89
min.		2700	46.62	177	3.5	5.7	3.4	138	65
max.		3950	53.88	202	10	12.1	10.03	172	117

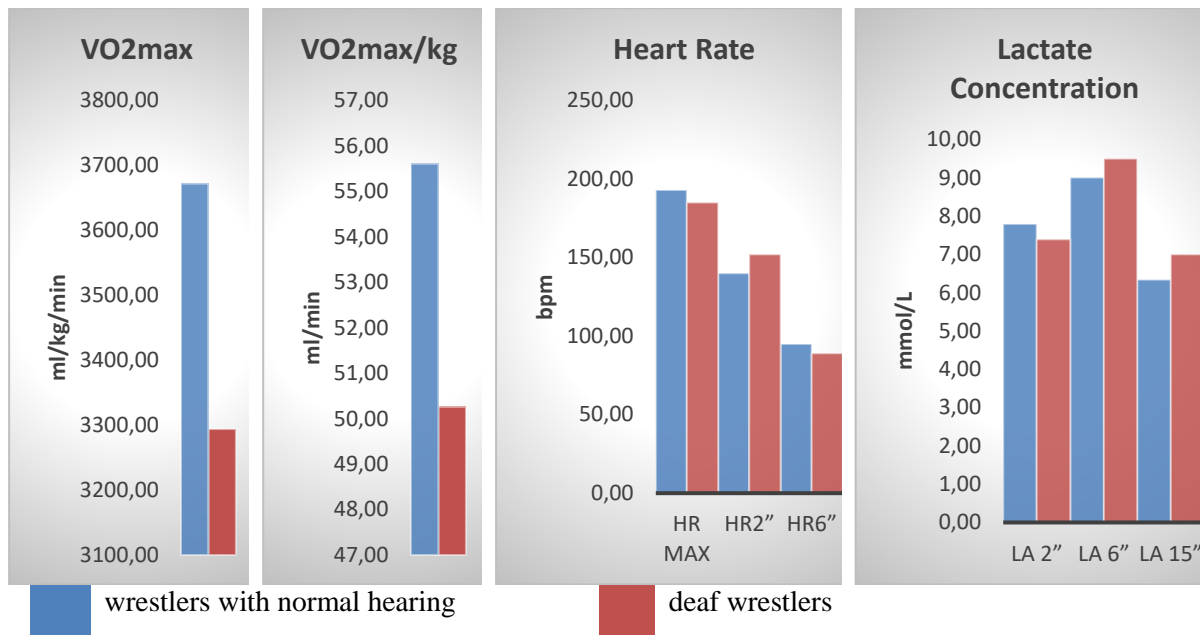


Figure 1. General presentation of data. Values of the functional parameters of hearing and deaf wrestlers.

VO₂max values varied from 2450 ml/kg/min to 4500 ml/kg/min for athletes with normal hearing and showed an average of 3672 ml/kg/min. For deaf athletes, the maximum VO₂max values ranged from 1700 ml/kg/min to 3950 ml/kg/min and had an average value of 2294 ml/kg/min.

VO₂max/kg values ranged from 51.65 ml/min to 5847 ml/min in athletes with normal hearing and showed an average of 55.61 ml/min. For the deaf wrestlers, the maximum values ranged from 53.88 ml/min to 46.62 ml/min and marked an average 50.26 ml/min.

At the second minute of the study, lactate reached a maximum of 9.4 mmol/L for normal-hearing wrestlers and 10 mmol/L for deaf wrestlers, with average values of 7.8 and 7.4 mmol/L, respectively. At the sixth minute of the study, the maximum lactate concentration was 11.3 mmol/L for wrestlers with normal hearing and 12.1 mmol/L for deaf wrestlers, with average values rising to 9.1 mmol/L for the hearing and 9.5 mmol/L for the deaf, respectively. At the 15th minute of the study, the average lactate concentration in wrestlers with normal hearing was 6.34 mmol/L and 7.0 mmol/L for the deaf ones, with maximum values reaching 8.3 and 10.03 mmol/L, respectively. The minimum values of lactate were also high in all three measurement moments: they were 6.5 mmol/L for the hearing and 3.5 mmol/L for the deaf at the second minute, 6.0 mmol/L and 5.7 mmol/L at

the sixth minute and 4.4 mmol/L and 3.4 mmol/L at the fifteenth minute of the study.

At the second minute of the study, the heart rate varied between 120 and 152 bpm for athletes with normal hearing and showed an average of 140 bpm. For deaf athletes, the readings in the second minute of the study ranged between 138 and 172 bpm, with an average of 152 bpm. At the sixth minute of the study, the heart rate of athletes with normal hearing ranged between 87 and 110 bpm and showed an average of 95 bpm. For deaf athletes, at the sixth minute of the study, the readings ranged between 65 and 117 bpm, with an average of 89 bpm. Maximum heart rate values ranged from 188 bpm to 199 bpm for athletes with normal hearing and showed an average of 193 bpm. For deaf athletes, the maximum heart rate values ranged from 177 bpm to 202 bpm with an average of 185 bpm.

RESULTS

The comparison between the two teams, from **Table 1** and **Table 2**, shows that anthropometric data, which is comparable for the respective weight categories of -55 kg, 63 kg, and 72 kg. Regarding the height and the weight, the active body mass, by a minimum percentage, is to the benefit of the wrestlers with normal hearing.

The World Championship ranking from **Table 3** and **Table 4** is to the benefit of the deaf competitors, since all three of them are medalists while only one from the wrestlers

with normal hearing won a medal. It is important to note that the chance to win a medal among the deaf competitors is higher due to the lower number of participants in each category; however, this chance was used and realized. The comparison between the two teams from **Table 3 and Table 4** shows some differences in the age of the teams. The average age of the deaf wrestlers' team is 22.6 years, and the age of the wrestler's team with normal hearing is 26 years.

The general year-long indicators of sports preparation from **Table 5** are the same and are to the benefit of the normal-hearing wrestlers due to the fact that they attended a greater number of camp days.

The individual and average values from **Table 6 and Table 7** regarding Lactate concentration, the Heart Rate (HR), Maximum Oxygen Consumption (VO₂max) and Maximum Oxygen Consumption per kilogram (VO₂max/kg) of national team wrestlers with normal hearing and deaf ones are slightly to the benefit of the ones with normal hearing.

It is important to note that the differences registered are of no statistical importance and can be seen, more likely, as trends. They can be explained on the one hand with the initial characteristics: the deaf competitors studied were younger, and on the other hand the level of fatigue in one of the groups is greater.

Figure 1 compares and visualizes the differences in the functional capabilities of both teams' members that are the most important for the sport of wrestling.

DISCUSSION

The purpose of this study was to analyze and compare the results from the World Championships, the preparation methodology, and the functional indicators of deaf and hearing wrestlers during the pre-Olympic year in the aim of achieving Olympic quotas (Tokyo Olympics and Deaflympics). We aimed to understand whether through the methodology planned we would be able to realize technical and tactical tasks, which would build up wrestling qualities that are important for the team and can lead to earning competition quotas. By studying the Heart Rate and the Lactate Concentration in the blood (12), we determined the efficiency of the training.

In the flow of the sports preparation, regarding the special tools of wrestling, the sessions of Technical and Tactical Learning (TTL) and those of Technical and Tactical Improvement (TTI) are instrumental. During the preparation period, sessions are longer and of lower intensity and aim mostly at TTL. As training shifts to the special-preparation stage, the work-out becomes more intensive, as specialized work is closer to competition workload, and the percentage ratio of TTI rises and the TTL goes down. During the competition period workload is the closest, by nature, to the competition strain, i.e., the intensity of the exercise (both general and specific) is close to the maximum (95-100%).

The results achieved during the World Championships for deaf wrestlers and ones with normal hearing result from the uniform sports preparation as well as from other factors. Therefore, it is correct to say that in the case of wrestling competitions, the intensity of the workload is extremely important, which leads to close-to-maximum cardiovascular reactions and high values of lactate. Besides, the variables in question can vary and remain different for individual competitors (13, 14). This creates the precondition for coaches to organize their training sessions in ways that make them as close as possible to competition in order to prepare the competitors for the high strain during important tournaments (15, 16). On the basis of the uniform sports preparation that we conducted, four of the competitors who participated were able to reach the podium at the World Championships.

CONCLUSIONS

Due to the constant changes of competition rules, we felt that it was necessary to focus on the changing demands regarding the physical and functional preparation of the competitors. The focus is no longer on the explosive power, but it is on strength endurance.

Physical quality - strength endurance, which is the main victory in the current sports rules does not affect the physiological state of deafness of some fighters.

The values of lactate concentration in the blood after conducting the functional measurements indicate higher values for deaf wrestlers in comparison to the ones with normal hearing.

Lactate concentration after such high workloads is a lot more indicative of the strain of the organism than the heart rate indications, and this provides information about the wrestlers' preparation and to what extent they are ready to withstand extreme competition strains.

The heart rate values of the studied individuals reach their maximum values and are comparable to one another.

From the results and analysis presented, it can be concluded that the uniform and identical sports preparation of both hearing and deaf wrestlers has brought about the needed results.

In conclusion, we can say that it is stated that sports achievements are in favor of deaf wrestlers, the training methodology is the same and the functional capabilities are better for hearing wrestlers.

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