THE FUNCTIONAL ABILITIES AND THEIR DIFFERENCES BETWEEN THE VOLLEYBALL TEAMS FROM THE REPUBLIC OF MACEDONIA AND THE REPUBLIC OF KOSOVO IN PRE-COMPETETION PERIOD

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Original scientific paper

Abstract
The study was conducted on a stratified sample of two subsamples of subjects to determine the level and differences in heart rate, blood lactate, anaerobic threshold, VO2max. in volleyball players in the pre-competition period. The sample of respondents was taken from the population of volleyball players, a total of 43, members of the representative teams of the volleyball league of the Republic of Macedonia and the Republic of Kosovo. The study used a total of 6 variables to assess the functional abilities of female volleyball players. Using multivariate analysis of variance (MANOVA), statistically significant differences between groups were found at the level of p = 0.00. Testing differences between arithmetic means for each variable with univariate analysis of variance (ANOVA), where no statistically significant differences were found between the two teams.
Keywords*: pulse, oxygen consumption, lactates*

INTRODUCTION

The main characteristic of the volleyball game is a conflict between two teams that are separated by volleyball net. Volleyball is a typical sport of semi-structural movements. It abounds in rapid and versatile body movements, such as jumps, ropes, rolling, and rapid reaction throws in a variety of situations that are crucial throughout the game, especially during matches (Mroczek, D., et. all. 2016). Players are required to have instant ingenuity, composure and quick reaction with equal speed of decision making. Athletes, coaches and scientists in sports have a great interest in monitoring and measuring the body adaptations produced as a result of training. For this reason, methods are used that provide reliable information about the athlete's performance during a competition or training, intensive training is applied to achieve the desired metabolic, cardiovascular and neuromuscular adaptations, in order to increase their physical capacity (Hughson and Shoemaker, 2015; Stanley, Peake and Buchheit, 2013). Many psycho-physiological models consider heart rate (HRV) as a source of non-invasive information about the balance between sympathetic and parasympathetic effects on resting heart rate (VR) or during physical activity (Applehans, B.M., Luecken, L.J. 2006). Assessing the physiological load by monitoring the level of lactic acid concentration in the blood, allows establishing the participation of different metabolic systems in the production of energy necessary for the required type of load. Blood lactates also offer the possibility of establishing a link between blood lactate levels and load intensity. Relationship determined by the athlete's performance capacity in relation to aerobic and anaerobic energy (Navarro, F. 1998). Lactic acid (La) levels increases during short-term maximal strength training, during which time oxygen deficiency occurs. High blood lactate levels are known to be a limiting factor during exercise.

METHODS

From the previous research and experiences in the volleyball game, as one of the important factors for success in the game are the functional abilities. Starting from these findings as a subject of this research in this paper are the functional abilities of the volleyball teams from Republic of Macedonia and the Republic of Kosovo. The research was conducted with the main goal to determine the levels and differences in functional abilities of volleyball players during training in pre-competition period, through: maximum oxygen consumption (VO2max), calculated using the Beep test (Beep t) until giving up. Heart rate before training (HRP) and during peak workout (HRK), and blood lactate levels, before training (KLPO) and after peak load (KLKO) in volleyball players in the pre-competition period. The research was conducted on a stratified sample of two sub-samples of female respondents, drawn from the population of volleyball players a total of 43, members of the representative volleyball

teams of the Republic of Macedonia and the Republic of Kosovo.

The research used a total of 6 variables to assess the functional abilities of volleyball players: 2 variable for assessing oxygen consumption (VO2max) and Beep test (Beep T), 2 variables for assessing heart rate, at the beginning of the load (HRP), at the ending of the load (HRK), and 2 variables for assessment of lactate concentration. Blood lactate concentration, before exercise (KLPO), Blood lactate concentration after exercise (KLKO). Polar Team, Polar Electro 2020 was used to measure heart rate, while Lactate Scout 4 Lactate Analyzer for Athletes, EKF diagnostics, was used to measure blood lactate levels. Having in mind the set goals and hypotheses of the research, the obtained data for all applied measurements and tests will be processed with adequate mathematical-statistical procedures in each group of respondents separately. The basic descriptive statistical parameters will be calculated separately for each variable; Arithmetic mean (Mean), Standard deviation (SD), Lower and upper limit of results (Min-Max). To determine the intergroup differences, multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) were used to test the differences between the arithmetic means for each variable.

RESULTS AND DISCUSSION

In order to determine the basic purpose of the research, the basic statistical parameters for each subpopulation of respondents were determined. The following parameters are calculated: arithmetic mean (Mean), standard deviation (Std.Dev.) - as indicators for absolute deviation of the results from the arithmetic mean, minimum (Min) and maximum (Max) result.

The results of this study regarding the maximum oxygen consumption (VO2 max) and Beep test (Beep T) in volleyball players are shown in Table 1. From them it can be concluded that the volleyball players from the national team have identical values of the arithmetic means of VO2 max (Mean = 34.24 ± 3.97 female volleyball players from Kosovo and Mean = 34.26 ± 3.56 female volleyball players from Macedonia). Analogous to this result, the values of Beep t (Mean = 1.50 ± 1.15 and Mean=1.78 ±, 67) have very similar values. The difference between the two teams in the values of the beep test is evident, which speaks of the greater homogeneity of the volleyball players from the Republic of Macedonia. Namely, the lower value of the standard deviation (BeepT SD=,67) indicates that all volleyball players are relatively equally physically fit, i.e. their achieved results are very close around the arithmetic mean. The obtained results range within the available research from the literature.

Table 2 presents the results related to the heart rate frequency before the maximum load (HRP), and after the maximum load (HRK) in the volleyball players of both teams. The volleyball players from the national team of the Republic of Kosovo have slightly higher values of the arithmetic means of HRP (Mean = 125.90 ± 10.07) compared to the volleyball players from the national team of the Republic of Macedonia HRP (Mean = 121.56 ± 21.66), which can be interpreted that the volleyball players of the Republic of Kosovo in the warm-up before the maximum load devoted more time in adapting the organism. Also from the values of the standard deviation it can be seen that as a team they are more homogeneous in this phase of the training.

The achieved values of the arithmetic means at the maximum heart rate HRK (Mean = 193.85 ± 23.91 and Mean = 195.35. 9.90), indicate the fact that the volleyball players from both teams achieved similar values of maximum heart rate. From the values of the standard deviation it can be said that the volleyball team from the Republic of Macedonia has more homogeneous values in achieving the maximum heart rate frequency and analogously in the part of their physical fitness.

Table 1. Descriptive statistical indicators of the maximum oxygen consumption (VO2 max) in the respondents from both volleyball teams

	Varia	Mean	Min	Max	SD
First team n=20	VO2 max	34,24	27,20	41,90	3,97
	BeepT	1,50	,00	4,00	1,15
Second team n=23	VO2 max	34,26	28,00	41,50	3,56
	BeepT	1,78	1,00	3,00	,67

Table 2. Descriptive statistics indicators of heart rate frequency before maximum load (HRP), and after maximum load (HRK)

	Varia	Mean	Min	Max	SD
First team n=20	HRP	125,90	98,00	140,00	10,07
	HRK	193,85	97,00	210,00	23,91
Second team n=23	HRP	121,56	98,00	167,00	21,66
	HRK	195,35	180,00	210,00	9,90

From the analysis of the results in Table 3, which refer to the level of blood lactates before the maximum load (KLTO), and after the maximum load (KLKO) in the volleyball players of both teams, the following can be concluded: the values of the arithmetic mean of the blood lactates before the maximum load registered in the volleyball players from the Republic of Kosovo (KLTO = 3.75 ± 2.43) are lower than the values of the volleyball players from the Republic of Macedonia (KLTO = 4.06 ± 3.84). After the maximum load, the volleyball players from the Republic of Kosovo have lower values of the arithmetic means of the lactates in the blood (KLKO = 11.26 ± 2.97) than the volleyball players from the Republic of Macedonia (KLKO = 13.53 ± 4.46). The results obtained are within the results of the available research in literature.

From the values shown in table no. 4, and referring to the statistically significant differences between the two groups of volleyball respondents, it can be concluded that: based on Wilks' Lambda (0.672) and Rao's F approximation (2,368), there is a statistically significant difference between the two groups in the functional abilities at the level of p = 0.044.

Table 3. Descriptive statistical indicators of the level of blood lactate before the maximum load (KLTO), and after the maximum load (KLKO)

	Varia	Mean	Min	Max	SD
First team n=20	KLTO	3,75	1,40	9,90	2,43
	KLKO	11,26	6,80	19,40	2,97
Secon team n=23	KLTO	4,06	,80	18,20	3,84
	KLKO	13,53	6,80	24,70	4,46

Based on these results, the null hypothesis can be completely rejected, which reads: H0 - No statistically significant differences in functional abilities will be found between the two sub-samples of respondents.

Table no. 5 represents the values of each variable at the Univariate level in which the statistically significant difference within the groups would be determined, ie the contribution of each variable in the creation of the intergroup difference. From this it can be seen that no variable in particular contributes to the creation of the intergroup difference at the Multivariate level. Hence, the other hypotheses can be completely rejected that move in the following direction: Statistically significant differences will be determined in oxygen consumption, lactate values and heart rate frequency between the respondents from the two sub-samples of respondents. This phenomenon could be explained as a result of the period in which the testing was performed, the pre-competition period. It is obvious that both national teams started in approximately the same period of preparation and with a relatively similar training program.

Table 4 Multivariate differences in the functional abilities in volleyball respondents

	Valu	F	Hyp df	Error df	Sig
Pilla,s trace	,328	2,368	7,00	34,00	,044
Willks, Lambda	,672	2,368	7,00	34,00	,044

Table 5 Univariate differences of the entire examined area of functional abilities in volleyball respondents

	Dependent Var	Sum of Squar		Mean Square	F	Sig
Group	Vo2	,00	1	,00		
	BeepT	1,78	1	1,78	2,52	,12
	HRP	224,52	1	224,52	,73	,39
	HRK	21,96	1	21,96	,06	,79
	KLTO	,42	1	,42	,04	,84
	KLKO	55,95	1	55,95	3,70	,06

In indoor sports (gyms), the performance of athletes is generally determined by the time of play and the pace of play. In response to this, training programs aim to slow down the formation of fatigue and improve endurance against fatigue (Ismail KAYA et al. 2013). Volleyball is a sport that is characterized by a wide range of movements and the amount of energy consumed, which are exchanged during the match, and the energy is drawn from both aerobic and anaerobic metabolism. Heart rate is an indicator of the intensity of a player's activity in any sport. It is considered the best indicator because it is directly related to the amount of oxygen the player consumes. According to the linear relationship between V02 and heart rate frequency, oxygen consumption increases as heart rate increases (McArdle et al, 1986). This relationship was also used in this study to determine oxygen consumption and blood lactate values, as a result of maximum load. The values for the maximum oxygen consumption published in the literature, for elite male volleyball players, range from 43.2 ± 5.2 to 65.2 ± 6.1 ml.kg-1.min-1 (Kasabalis, 2005). The results of our study showed that the real values for the maximum oxygen consumption in volleyball range from 34.26 26 3.56 ml.kg-1.min-1 to 27.20 ± 3.97ml.kg-1.min-1. If we take into account that our study was related to female volleyball players, and that volleyball in Kosovo is not at the European level, it can be said that the results of some of the volleyball players from the first two teams are satisfactory in terms of the results of the literature. Based on the displayed results, the volleyball players from the two first placed teams have a satisfactory level of aerobic ability, and they use less oxygen during the match compared to measuring the maximum load. During the match, the volleyball players do not reach the maximum load level, one set lasts more than 20 minutes and volleyball requires energy resources for at least three sets. The heart rate values measured in this study are consistent with the values in the literature (Kasabalis, 2005). In our study, the differences that occur in heart rate frequency (HRP) and blood lactate levels (KLTO) before maximal load, are relatively small, can be explained by the individual commitment of each volleyball player to warm-up before testing. Blood lactate concentration is an important tool for determining endurance capacity and maintaining exercise control (Foster C, et. all. 1993). The level of lactates in the venous blood [La ±] significantly increases with high intensity of exercise in a short time interval. This result can be explained by the activation of milk anaerobic metabolism, which participates in energy production and / or re-synthesis of phosphor-caretine used in such a short exercise interval (K. Chamari et. al. 2001).

In our research, the values of the concentration of lactates in the blood after the maximum load range from 11.26 ± 2.97 to 13.53 ± 4.46, which are results similar to the results obtained from the literature.

CONCLUSION

The functional abilities of athletes can play a crucial role in achieving top form, and thus achieving the end result - sports success. That was more of a reason to conduct a survey with 43 female volleyball players from the Republic of Macedonia and the Republic of Kosovo. Laboratory studies to assess blood lactate accumulation often use a fixed time protocol to define the onset of blood lactate accumulation or other blood lactate concentration indices. For practical reasons, field studies with athletes often use a fixed distance protocol to achieve the same goal (Foster C, et al. 1993).

Measuring heart rate frequency (HRV) at different times during the training process can be very useful in assessing the effectiveness of volleyball training, due to the fact that changes in HRV can be of prognostic value, and potentially reduce the risk of overtraining. There is strong evidence that heart rate frequency (HRV) measures what it should measure. Analysis of the variables used in the study largely provides a clear picture of tracking the sports form of the athlete. This is an attempt that should give positive views in the programming and creation of the sports form. The main limitation of our study is the relatively small number of respondents which reduces the power of statistics. However, it should be borne in mind that this is mainly due to the specificity of the discipline, as the number of volleyball players who make up the core of the volleyball team and who train under the supervision of a same coach and under the same conditions is always limited and rarely which team exceeds 8 volleyball players. Therefore, it is advisable to conduct other research that will include volleyball players from other volleyball teams, and which will be conducted according to our research methodology. This type of research is desirable to do, by expanding the segments of the research, in other macro cycles of the training process.

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