

## DETERMINING DIFFERENCES IN FUNCTIONAL ABILITIES IN WRESTLERS FROM THREE DIFFERENT COUNTRIES

DOI: <https://doi.org/10.46733/PESH2514199sh>

(Original scientific paper)

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### Abstract

*Wrestling as a sport, with its specificity after a long training process, has a transformation effect on the human body, primarily in the muscle topography. The presence of strength abilities during training and competition, as well as technical and tactical actions, contribute to the greatest extent to such muscle topography. The research was conducted on over 120 elite junior and senior wrestlers from three countries. For all applied variables, basic descriptive statistical parameters were calculated for each group of respondents. Testing the normality of the distribution of the applied variables was carried out based on the coefficient of asymmetry (Skew) and the coefficient of elongation (Kurt), as well as the Kolmogorov-Smirnov method. The differences between the studied groups of wrestlers, in the functional space, were determined using multivariate analysis of variance - MANOVA and univariate analysis of variance - ANOVA.*

**Key words:** *wrestling, motoric abilities*

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### Introduction

Wrestling is one of the oldest Olympic sports. Wrestling is characterized as a discipline that places high demands on athletes in terms of their physical preparation. The best wrestlers, categorized as elite athletes, are similar in terms of body structure and represent a group that is less differentiated than other wrestlers. They have an exceptionally massive somatic structure, which is characterized by a quality muscle structure and strongly developed epiphyses adapted to withstand greater weights (Charzewski et al., 1991). Body mass positively influences local endurance of the muscles of the arms and trunk. The level of athletes clearly differentiates the indicators related to the muscular endurance of the arms and trunk, whose function is extremely important in wrestling (Sterkowicz and Starosta, 2005). The body composition of a wrestler largely depends on caloric intake and energy expenditure. Calorie consumption depends on the individual, so this difference is also present in wrestlers who are subjected to high physical activity (Clayton & Thomas 1993). Starting from the subject of the research, the main goal of this research would be to determine the differences in functional abilities in elite athletes-wrestlers from three different countries.

### Work methods

#### *Participants sample*

The research was conducted on over 120 elite junior and senior wrestlers from the Republic of Macedonia (60 respondents from wrestling clubs), the Republic of Albania (30 respondents from wrestling clubs) and the Republic of Kosovo (30 respondents from wrestling clubs). All respondents have long-term training experience, are participants in national championships and medalists and high-ranking athletes from national and international competitions.

#### *Variable sample*

The Beep Shuttle run test – 20-meter return run test, has a wide application in sports and will be used to assess the maximum oxygen consumption, i.e. it will be used to measure the aerobic abilities of wrestlers. The frequency load zones will be determined using the heart rate, the use of which allows easier monitoring of the training process. The percentage of the anaerobic threshold will most accurately determine the load

zones for each athlete. 1. Maximum oxygen consumption (VO2 max). 2. Beep Shuttle run test – return run test (BSHR), 3. Beep test (b.test) and 4. Heart Rate (SFRE)

### Data processing

Based on the problem set, as well as the defined goal in this research, appropriate analyses were applied at the univariate and multivariate levels. For all applied variables in each group of respondents, the basic descriptive statistical parameters were calculated: arithmetic mean (X), standard deviation (SD), minimum (Min) and maximum (Max) score. Testing the normality of the distribution of the applied variables was carried out based on the coefficient of asymmetry (Skew) and the coefficient of elongation (Kurt), as well as the Kolmogorov-Smirnov method. The differences between the researched groups of wrestlers (Macedonia, Albania and Kosovo), in the functional space, were determined using multivariate analysis of variance-MANOVA and univariate analysis of variance-ANOVA.

### Results

Most kinesiological information is multivariate in nature. This means that an anthropological characteristic, whether motoric, psychological or sociological, is influenced by multiple factors (Peric, D.2001).

Table 1. Intergroup differences in functional abilities among wrestlers

GROUP	Macedonia		Albania		F	Sig.	$\eta^2$
	Mean	SD	Mean	SD			
VO2 max	41,15	0,75	42,24	0,53	8,09	0,00	0,12
BSHR	8,37	0,22	8,68	0,15	8,04	0,00	0,12
b.test	2,20	0,12	2,40	0,09	8,00	0,00	0,12
SFRE	223,10	12,07	200,68	8,53	1,28	0,28	0,02

In kinesiological research, multidimensional manifest or latent variable spaces are most often analyzed. For this purpose, multivariate analysis of variance (MANOVA) is used, which basically analyzes only one variable, but a vector of variables whose elements are variables in the research space (Bala, G. 1986)

Table 1 presents the results of the squared arithmetic mean (Mean), F approximation and the level of statistical significance (Sig.) between the dependent variables of the treated groups. Significant significance is observed in all examined variables with the exception of the variable Heart Rate (SFRE) which will also be commented on in further analyses.

Table 2. Multivariate differences across the entire examined functional abilities space among wrestler respondents

	Value	F	Hypothesis df	Error df	Sig.	$\eta^2$
Wilks' lambda	0,859	3,032	6	230	0,007	0,073

Analyzing the obtained results (table no. 2), which presents the values of the multivariate analysis of variance in the variables for assessing functional abilities between the wrestlers from the three countries, it can be noted that there is a statistically significant difference in the arithmetic means. The difference was determined based on the values of Wilks' lambda which is .859 and which, in conjunction with the value of the F approximation of 3.032, the degrees of freedom  $df=6$  and the number of degrees of freedom associated with the errors of the model Error  $df=230$ , is significant at the level of Sig.=.007 ( $p<.05$ ).

The obtained results presented in Table No. 3, give the values of the comparisons of the pairs of dependent variables between the examined groups, where the difference in the arithmetic means (Mean Difference), the standard errors of the arithmetic means (Std. Error), the significant level (Sig.) and the lower and upper limits of the confidence interval for the differences are presented. It has been determined that for 3 out of a total of 4 applied variables, there are statistically significant differences at the level of  $p<.05$ .

Statistically significant differences were found between the wrestlers from Macedonia and Albania in the variable, Maximum oxygen consumption (VO2 max) at the level of Sig=.000. In the same variable, a difference was observed between the second and third groups, i.e. between Kosovo and Albania at the level

of Sig=.002. In the variable, Beep test (b.test), a statistically significant difference was found only between the wrestlers from Macedonia and Albania at the level of Sig=.000.

In the same variable, a difference is observed between the second and third groups, i.e. between Kosovo and Albania at the level of Sig=.002. In the variable Beep Shuttle run test – test with return runs (BSHR), a statistically significant difference is determined between wrestlers from Macedonia and Albania at the level of Sig=.000 and Kosovo and Albania at the level of Sig=.002.

Table 3. Multivariate comparisons of functional ability variables among wrestler respondents

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.b	95% Confidence Interval for Differenceb	
						Lower Bound	Upper Bound
VO2 max	1	2	-1,092	0,912	0,234	-2,898	0,714
		3	-4,030*	1,053	0,000	-6,115	-1,945
	2	1	1,092	0,912	0,234	-0,714	2,898
		3	-2,938*	0,912	0,002	-4,744	-1,132
	3	1	4,030*	1,053	0,000	1,945	6,115
		2	2,938*	0,912	0,002	1,132	4,744
b.test	1	2	-0,200	0,150	0,185	-0,497	0,097
		3	-,667*	0,173	0,000	-1,010	-0,324
	2	1	0,200	0,150	0,185	-0,097	0,497
		3	-,467*	0,150	0,002	-0,764	-0,170
	3	1	,667*	0,173	0,000	0,324	1,010
		2	,467*	0,150	0,002	0,170	0,764
SFRE	1	2	22,417	14,781	0,132	-6,856	51,689
		3	22,067	17,067	0,199	-11,734	55,867
	2	1	-22,417	14,781	0,132	-51,689	6,856
		3	-0,350	14,781	0,981	-29,622	28,922
	3	1	-22,067	17,067	0,199	-55,867	11,734
		2	0,350	14,781	0,981	-28,922	29,622
BSHR	1	2	-0,316	0,264	0,233	-0,839	0,206
		3	-1,163*	0,305	0,000	-1,766	-0,559
	2	1	0,316	0,264	0,233	-0,206	0,839
		3	-,847*	0,264	0,002	-1,369	-0,324
	3	1	1,163*	0,305	0,000	0,559	1,766
		2	,847*	0,264	0,002	0,324	1,369

Dependent Variable: 1 Macedonia, 2 Kosovo, 3 Albania

## Discussion

The variables used in this study were defined through standard descriptive procedures, where the basic central and dispersion parameters were calculated in order to determine the function of their distribution, and it was determined that none of the applied variables deviated statistically significantly from the normal distribution.

The reason for this phenomenon should most likely be sought in the fact that we are talking about a deliberate sample of respondents in whom specific training led to a harmonious balance in functional abilities. The results of Šalja E, et al. (2017) are similar. At the multivariate level (using MANOVA), statistically significant differences were observed between the three groups of respondents. This phenomenon should be viewed from the perspective that, although we are talking about the same sport and the same movements in performing the techniques themselves, the specifics that each martial arts school in its country applies most likely contribute to such a difference.

The contribution of each technique in creating intergroup differences was determined through the application of analysis of variance (ANOVA), where they were determined in four tests from the applied battery. In this study, the morphological characteristics of the wrestlers were not analyzed, where the justification of the differences in the variables should also be sought Šalja E, et al. (2017), ĩrem D, et al. (2016) Wrestling as a sports activity is performed in weight categories and it is certain that athletes from heavier categories will perform certain techniques more slowly and vice versa. These arguments leave room for further research that would cover the entire anthropological space, in order to come to a larger spectrum of information and thus to more complete conclusions about the training process in wrestling.

## Conclusion

Analyzing the obtained results, which present the values of the multivariate analysis of variance in the variables for assessing the functional abilities of the wrestlers from the three countries, it can be noted that there is a statistically significant difference in the arithmetic means. It was determined that for 3 out of 4 variables examined, there are statistically significant differences at the  $p < .05$  level. In general, the morphological characteristics of wrestlers are one of the factors that significantly influence the choice of reference techniques and the formation of a specific wrestling style (Kasum & Radovic, 2009), as well as achieving specific success in the largest competitions. The influence of morphological characteristics is very significant in sports where there are weight categories.

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