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ORIGINAL RESEARCH

Anthropological profile of long jumpers: Differences between Olympic games finalists

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Abstract. The study included a sample of 48 male and female Olympic finalists (Beijing, 2008; London, 2012; Rio de Janeiro, 2016) in the long jump discipline. The following primary parameters of anthropological status (Body height, Body mass, Body Mass Index, Age) and Result (secondary parameter) were analyzed. The aim of the study was to determine the differences in the defined parameters of anthropological status (body height, body weight, BMI, and age) between male and female long jump finalists. The basic central and dispersion indicators were calculated on the basis of which a descriptive comparison of the analyzed variables was performed. The significance of the difference between subjects was examined by MANOVA and ANOVA ($p<0.05$). The results showed statistically significant differences in mean values of body height in men where the jumpers in Beijing (180,25cm) were lower than the jumpers in London (186.88cm) for level ($p<0.05$). There were significant differences in height among women, the female athletes in Beijing (175.50cm) were more than the female athletes from Rio (Rio, 169cm), for level ($p<0.05$). Numerical differences were also recorded for other parameters, but the expected statistical significance was not achievable. It has been shown that anthropometric parameters are relative and not primary. Preference is given to the motor and functional parameters of jumpers.

Keywords. Anthropological status, differences, long jump, Olympics.

Introduction

Athletic jumps belong to cyclic-acyclic movements, where the distance and height of the body's ascent are conditioned by the initial velocity (Vo) and the angle of ascent(α) body of gravity to be directed at the most favorable angle (Iα) in relation to the horizontal (Jovović et al., 2006; Smajlović et al., 2010; Mihajlović et al., 2010). As biomotor movements, they represent the transition of the body from the position of contact on a solid surface to an unsupported position, through its own muscular forces, whereby the synergistic muscular action of kinetic chains is manifested (Pavlović et al., 2016). In all jumps, an unwritten rule applies, that each subsequent phase in the technique of performance is conditioned by the previously performed phase, where any mistake has a significant impact on the correctness of movement in subsequent phases and the final result of competitors (Toncev et al., 2001; Idrizović et al., 2010). Although it seems simple at first glance, long jump is motor and functionally complex discipline that requires the integration of most of the abilities of anthropological space. It is a discipline that combines speed and jump in technique, that is, the speed-strength properties of competitors. In the long jump, dynamic balance based on the compensatory movement (step technique) is of special importance, when, in relation to the center of gravity of the body, when moving one part of the body upwards, the other part moves downwards. Such movements in the flight phase also determine the jumping technique. In order to achieve top results, it is necessary for jumpers to have basic and special motor abilities (speed, strength, endurance, flexibility) as well as optimal height and body weight (Jovović et al., 2006), which allows tall jumpers to start the flight phase from a much higher level when the center of gravity of the body moves in the air in accordance with the principles of projectile motion (Fukashiro et al., 1983). According to Smajlović (2010), Stanković & Raković (2010), the influence of morphological and

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motor parameters on the results in jumps is not the same (long jump of 48%), and the remaining percentage falls on other parameters, primarily on technique. The speed of running in the run for men is about 10.6m/s, for women 9.5m/s, and it is achieved with a run between 40 and 45 meters (for women a few meters shorter). When preparing for a bounce, the penultimate step is for a longer one (the center of mass of the body is lowered and placed behind the front leg), and the last step is 20 to 30 centimeters shorter than the previous one with raising the body's center of gravity (Ćuk & Rakić, 2019). The horizontal speed of the body's center of gravity itself depends on the speed of arrival on the board (Lee et al., 1994; Pavlović et al., 2014). Every athlete is characterized by different mental and physical (morphological) characteristics, which distinguish them from other athletes. Their morphology is of a variable type, which means that there are both shorter and taller jumpers who possess extraordinary motor skills (speed, explosive power, coordination). Anthropological characteristics are largely genetically determined, primarily in relation to morphological dimensions. In addition to morphological features, motor abilities also play an important role, and together they form a universal profile of long jumpers. A characteristic of long jumpers is increased longitudinal and transverse skeletal and lighter body weight. An example can be given that in the ten best jumpers in the world the height is about 188 cm, and in women from 172-180 cm (Pavlović, 2010). In general, jumpers are tall with relatively lighter body weight, with long legs, long and thin muscles. The muscle structure is dominated by white muscle fibers. According to the constitution, it is the leading leptosomal type with the participation of athletics, which was confirmed by the Pavlović research (2012, 2013). In appearance and constitution, long jumpers are most similar to sprinters, because like sprinters, they must have high speed, explosive strength, leg and torso muscle strength, and running is one of the preconditions for performing a long jump. As an indicator of the physical condition of the jumper, the potential of speed strength appears, which is manifested in a fast and maximally strong bounce, when the pressure on the ground exceeds the weight of the athlete several times. This is where the synchronized action of the muscle kinetic chains, which extends from the feet to the muscles of the arms and shoulder girdle, comes to the fore. To perform complex actions, both when entering the bounce and during the jump itself, a high level of coordination of movements and a good condition of the vestibular apparatus is required. The need for larger amplitudes during swinging movements in jumping variants requires that jumpers achieve high mobility, especially the mobility of the spine (lumbar and thoracic part). There have also been attempts in the past, and also in the future, to continue to look for answers about the participation of certain anthropological characteristics in success in some jumping disciplines. If we look at the values and correlations with long jump, it can be concluded that explosive power, static power, speed of alternative movements as well as anaerobic potentials are important factors in the result performance. Morphological dimensions are not marked as relevant. According to Ugarković (1996), muscle mass dominates in male and female throwers (50-53%), bones are in second place (16-19%), and fat is the last (5-9%), so it can be concluded that, when it comes to jumpers, both sexes are dominated by mesomorphic with the participation of the ectomorphic component. Over the past century, it has become increasingly difficult to find athletes of the size and shape needed to compete successfully at the highest level. Not every physical characteristic can be expected to play a role in this selection process, but the two that are important and for which there are significant data sets are height and mass. A number of authors analyzed the morphological profile of athletes in the jumping disciplines of participants in the Olympic Games and World Championships in both competitions (Pavlović et al., 2012; Pavlović et al., 2013) by analyzing differences in morphological space segments or kinematic parameters between finalists. (Pavlović et al., 2016; Ljubičić et al., 2017) or result differences (Pavlović et al., 2020). The results were mainly different depending on the sample, discipline, sex, morphological parameters, neuromuscular activities, other exogenous and endogenous factors.

The aim of the study was to determine the differences in the defined parameters of anthropological status (body height, body weight, BMI, and age) between male and female Olympic finalists in long jump.

Methods

The sample of Participants and Variables

The study included a sample of 48 long jump finalists (24 men and 24 women) who competed in the finals of the Olympic Games (Beijing 2008, London 2012, Rio de Janeiro 2016). All data are taken from the official IAAF website (IAAF, 2022).

For the purposes of the research, the following primary parameters were analyzed:

1. Body height (cm) - BH,

2. Body weight (kg) - BW,

3. Body mass index (kg/m^2) – BMI,

4. Age - year

5. Result (m) - is defined as a secondary parameter.

Data Analysis

For all investigated variables, the basic central and dispersion parameters were calculated, on the basis of which a descriptive comparison of the analyzed variables was performed. The normality of the distribution was examined by the Kolmogorov-Smirnov test (K-S test). The significance of the differences between the subsamples of the subjects in anthropological characteristics was examined by MANOVA and ANOVA. Statistical significance of differences was tested at the significance level $p<0.05$. Data processing was performed with the software package Statistica 10.0 for Windows (Stat Soft, Inc., Tulsa).

Results

Table 1 contains the basic statistical parameters of the primary anthropological characteristics and results (secondary parameter) of the female and male finalists.

Table 1
Descriptive statistics of female and male finalists in Olympic games.

		Parameters	Mean	Min.	Max.	Rang	SD	K-S
Female	Beijing, 2008	BH (cm)	175.50	172.00	185.00	13.00	4.60	0.331
		BW (kg)	62.38	58.00	72.00	14.00	4.31	0.317
		AGE (year)	26.88	19.00	32.00	13.00	5.08	0.218
		BMI (kg/m^2)	20.24	18.52	21.05	2.53	0.89	0.269
		Result (m)	6.81	6.58	7.04	0.46	0.17	0.162
	London, 2012	BH (cm)	172.88	165.00	181.00	16.00	4.70	0.145
		BW (kg)	59.75	53.00	65.00	12.00	4.06	0.120
		AGE (year)	26.63	23.00	32.00	9.00	3.20	0.327
		BMI (kg/m^2)	20.01	18.08	21.67	3.59	1.35	0.201
		Result (m)	6.86	6.67	7.12	0.45	0.16	0.209
	Rio, 2016	BH (cm)	169.00	162.00	176.00	14.00	4.17	0.219
		BW (kg)	58.88	53.00	65.00	12.00	3.80	0.158
		AGE (year)	25.13	20.00	30.00	10.00	3.87	0.216
		BMI (kg/m^2)	20.62	18.78	22.86	4.08	1.28	0.227
		Result (m)	6.92	6.69	7.17	0.48	0.19	0.221
Male	Beijing, 2008	BH (cm)	180.25	169.00	190.00	21.00	7.23	0.161
		BW (kg)	75.88	70.00	85.00	15.00	5.62	0.195
		AGE (year)	24.13	21.00	29.00	8.00	2.53	0.171
		BMI (kg/m^2)	23.39	19.94	25.62	5.68	1.76	0.186
		Result (m)	8.17	8.00	8.34	0.34	0.10	0.197
	London, 2012	BH (cm)	186.88	180.00	197.00	17.00	5.30	0.206
		BW (kg)	77.25	69.00	87.00	18.00	7.05	0.226
		AGE (year)	25.50	21.00	30.00	9.00	2.56	0.172
		BMI (kg/m^2)	22.12	19.94	24.62	4.68	1.76	0.168
		Result (m)	8.10	7.93	8.31	0.38	0.11	0.182
	Rio, 2016	BH (cm)	184.50	177.00	189.00	12.00	4.44	0.284
		BW (kg)	78.75	67.00	87.00	20.00	6.07	0.144
		AGE (year)	26.25	19.00	36.00	17.00	5.01	0.190
		BMI (kg/m^2)	23.13	20.00	24.62	4.62	1.54	0.205
		Result (m)	8.21	8.05	8.38	0.33	0.13	0.167

The average height of the female long jump finalists in Beijing was 175.50cm, with a minimum height of 172cm (Udmurtova) and a maximum of 185cm (Johnson), while the average body weight was 62.38kg (Table 1). Udmurt had the lowest body weight (58kg) and the maximum was recorded in Johnson's (72kg). The average age of the female finalists was 26.88, and the epithet of the youngest was taken by the athlete Okagbare (19 years), and the oldest at the age of 32 were Maggi, Lebedeva and Upshaw. The average recorded BMI is 20.24kg/m^2, with a minimum value of 18.52kg/m^2 (Okagbare) and a maximum of 21.05kg/m^2 (Lebedeva). The average height of female jumpers in London (172.87cm) is slightly lower than in Beijing in the range of a minimum of 165cm (Deloach) to a maximum of 181cm (Lesueur). The average body weight was 59.75kg. The lightest was Mironchyk-Ivanova (53kg), and the heaviest was Frenchwoman Lesueur with 65kg. The average age of female finalists in London (26.63 years) is almost equal to participants from Beijing ranging from 23 years (Mironchyk-Ivanova) to 32 years (Kolchanova), while the average BMI finalists in London (20.01kg/m2), with a minimum BMI of 18.08kg/m2 (Radevica) and a maximum BMI of 21.67kg/m^2 (Deloach). The least tall were the finalists in Rio (169cm), ranging from 162cm (Sawyers) to 176cm (Španović). The average body weight was 58.88 kg, ranging from 53 kg (Balta) to 65kg (Španović) with an average of 25.13 years, while the youngest athlete was Brume (20 years) and the oldest one was Bartoletta (30 years). The average recorded range of BMI was 20.62kg/m^2, from a minimum of 18.78kg/m^2 (Balta) to a maximum of 22.86 kg/m^2 (Sawyers). The average height of all finalists was 172.46 cm with a body weight of 60.33 kg, age 26.21 decimal years and BMI = 20.29 kg/m^2 (Figure 1).

The average height of the male finalists in Beijing (180.25cm) from a minimum of 169cm (Makusa) to a maximum of 190cm (Mokena and Badji). The jumpers weighed an average of 75.88kg ranging from 70kg (Saladino) to 85kg (Badji). The age is 24.13 years, where the youngest is 21 years old (Makusa) to 29 years old (Meliz). When we look at the body mass index, we notice an average value of 23.39kg/m^2, from a minimum of 19.94 kg/m^2 (Mokoena) to a maximum of 25.62 kg/m^2 (Martinez). The finalists in London averaged 186.88cm tall, ranging from 180cm (Clay) to 197 (Tomlinson), average body weight (77.25kg). The average age of the finalists in London was 25.50 years where the epithet of the youngest athlete was taken by Claye at the age of 21, and the oldest was Tomlinson at the age of 30. The average value of BMI jumpers was 22.12kg/m^2. The minimum BMI was recorded in Mokoena (19.94kg/m^2) and the maximum in Rutherford (24.62kg/m^2). The average height of the finalists in Rio 2016 was 184.50cm, from a minimum of 177cm (Wang) to a maximum of 189cm (Manyong). The average body weight was 78.75kg, from a minimum of 67kg (Gomis) to a maximum of 87kg (Rutherford). The average age was 26.25 years, the epithet of the youngest athlete was carried by Wang at the age of 19, and the oldest one was Gomis at the age of 36. The average BMI was 23.13 kg/m^2, the minimum body mass index was recorded in athlete Gomis 20.00 kg/m^2, and the maximum BMI was 24.62kg/m^2 (Rutherford). The average height of all finalists was 183.87cm, with a body weight of 77.29kg, age 25.29 decimal years and BMI=22.88kg/m2 (Figure 1).

Table 2 contains intra-group correlations of female finalists with 17 significant relationships, from low to medium high strengths. It is evident that different intra-group connections are present in the three finals of the Olympic Games. In terms of the analyzed measures and their correlations with the result success, only in London were medium and medium-high correlations of height, weight and age achieved. At the Olympic Games in Beijing and Rio, height proved to be a negative factor in the result success. Intra-group correlations of male finalists (Table 2) record 19 significant relationships, from low to high projections of vector strengths with different intragroup relationships. The positive correlation of mass, BMI with the result success was most extracted at the Olympic Games in London and Rio, while the height was significant only at the Olympic Games in Rio. To determine the differences between the sample of female Olympic finalists, an analysis of variance (ANOVA) was applied, which recorded statistically significant differences at the multivariate level (Wilks=0.231; F=1567; p<0.002) (Table 3). Levene's test showed high homogeneity of variance of the tested variables. At the univariate level, differences are present only in the amount between the female finalists for the value F=4.228; p<0.029. A post-hoc test found that female athletes in Beijing were significantly taller than female athletes in Rio (p=0.023; Figure 3). Among other variables, numerical differences were also recorded, but they did not achieve statistically significant differences in body weight, age and BMI and the achieved result (Table 4). Identical to the female sample, the same procedures were performed for the male sample to check the homogeneity of the variance of the results with the Leven test. Differences between the sample of male finalists were tested by analysis of variance, which confirmed statistically significant differences at the multivariate level (Wilks = 0.133; F = 1613;

Table 2
Within - Group Correlations (p< 0.05) (female and male).

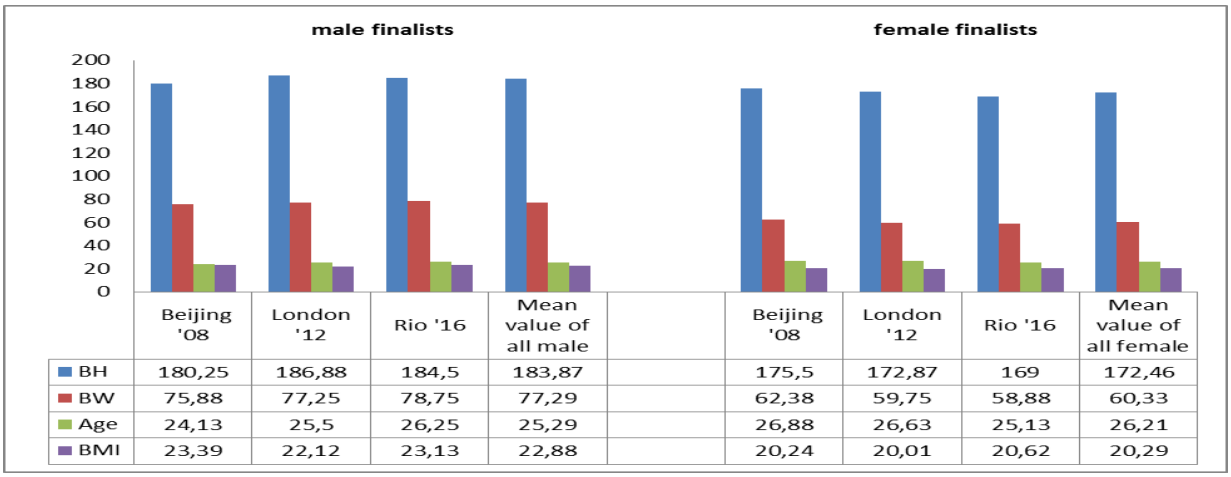
		GROUP 1: PEKING					GROUP 2: LONDON					GROUP 3: RIO				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
FEMALE	BH (cm)	1.00					1.00					1.00				
	BW (kg)	0.42	1.00				0.46	1.00				0.75	1.00			
	AGE (year)	0.17	0.16	1.00			0.39	0.15	1.00			-0.27	0.12	1.00		
	BMI (kg/m²)	-0.40	0.66	0.03	1.00		-0.36	0.66	-0.18	1.00		-0.04	0.62	0.49	1.00	
	Result (m)	-0.40	0.09	0.01	0.43	1,00	0.71	0.52	0.64	-0.05	1.00	-0.22	0.11	0.09	0.13	1.00
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
MALE	BH (cm)	1.00					1.00					1.00				
	BW (kg)	0.49	1.00				0.51	1.00				0.53	1.00			
	AGE (year)	0.15	0.20	1.00			0.91	0.24	1.00			0.18	-0.37	1.00		
	BMI (kg/m²)	-0.57	0.43	0.02	1.00		-0.12	0.79	-0.38	1.00		-0.12	0.78	-0.59	1.00	
	Result (m)	-0.13	-0.26	-0.05	-0.11	1.00	-0.14	0.67	-0.31	0.87	1.00	0.34	0.58	-0.26	0.43	1.00

Table 3
Multivariate Tests of Significance (p<0.05).

	FEMALE						MALE					
	Test	Value	F	Effect df	Error df	p	Test	Value	F	Effect df	Error df	p
Intercept	Wilks	0.000	1567	5	17	0.000	Wilks	0.000	1613	5	17	0.000
GROUP	Wilks	0.231	4	10	34	0.002*	Wilks	0.133	6	10	34	0.000*

Table 4
Analysis of Variance (p<0.05).

FEMALE										
	SS Effect	MS Effect	F	P	Levene test p < 0.05		OG	Post-hoc test (Tukey HSD Test)		
								{1} M=175.50	{2} M=172.88	{3} M=169.00
					F	p				
BH (cm)	171.08	85.54	4.228	0.029*	0.069	0.933	Peking		0.485	
BW (kg)	53.08	26.54	1.610	0.224	0.092	0.913				
AGE (year)	14.33	7.17	0.421	0.662	1.450	0.257	London	0.485		0.220
BMI (kg/m²)	1.54	0.77	0.544	0.588	0.590	0.563				
Result (m)	638.08	319.04	19.837	0.067	0.345	0.223	Rio	0.023*	0.220	
MALE										
	SS Effect	MS Effect	F	P	Levene test p<0.05		OG	Post-hoc test (Tukey HSD Test)		
								{1} M=180.25	{2} M=186.88	{3} M=184.50
					F	P				
BH (cm)	180.25	90.12	2.702	0.048*	0.495	0.617	Peking		0.041	0.324
BW (kg)	33.08	16.54	0.421	0.662	0.892	0.425				
AGE (year)	18.58	9.29	0.733	0.493	0.995	0.386	London	0.041*		0.694
BMI (kg/m²)	7.27	3.64	1.277	0.300	0.190	0.828				
Result (m)	604.33	302.17	44.374	0.088	0.962	0.398	Rio	0.324	0.694	



	Beijing '08	London '12	Rio '16	Mean value of all male	Beijing '08	London '12	Rio '16	Mean value of all female
BH	180,25	186,88	184,5	183,87	175,5	172,87	169	172,46
BW	75,88	77,25	78,75	77,29	62,38	59,75	58,88	60,33
Age	24,13	25,5	26,25	25,29	26,88	26,63	25,13	26,21
BMI	23,39	22,12	23,13	22,88	20,24	20,01	20,62	20,29

Figure 1. Average values of Olympic finalists.

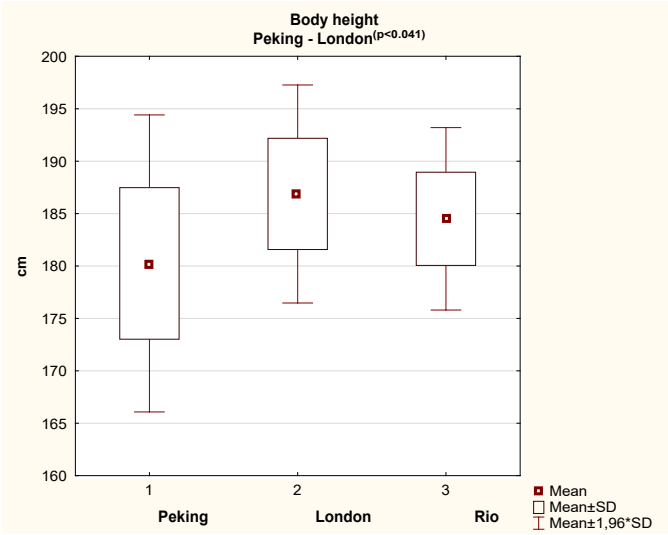


Figure 2. Differences in height of male finalists.

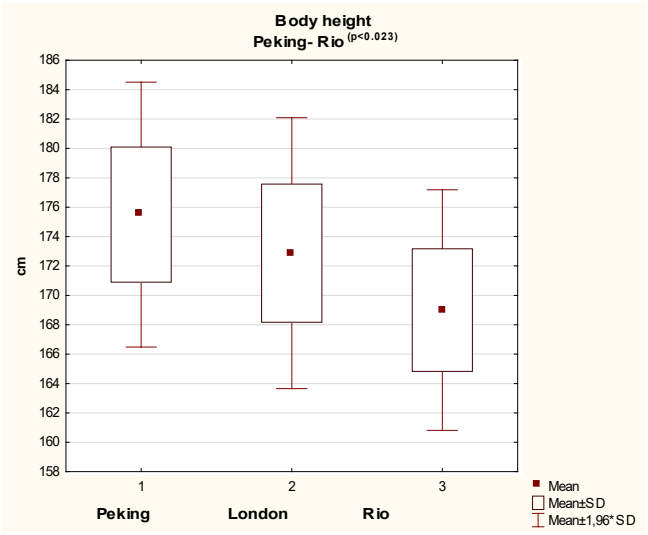


Figure 3. Differences in height of female finalists.

p<0.000; Table 3). At the univariate level, differences were recorded in the height between male finalists (Table 4, Figure 2) with a lower value (F=2.702; p<0.048). A post-hoc test found that the male finalists in London were significantly taller than the finalists in Beijing (p=0.041). Among other variables of the finalists, numerical differences were also recorded, but they did not achieve statistical significance. Identical to the female sample, no statistically significant difference was obtained in body weight, age, BMI, and achieved score.

Discussion

The aim of the study was to analyze the structure of morphological profile and mutual differences in defined status parameters (height, weight, BMI, age) between male and female long jumpers, Olympic finalists (Beijing 2008, London 2012, Rio 2016). Significant differences were recorded in all measured parameters of Olympic finalists in both sexes, but statistically significant were achieved only in body height between male (Beijing-London) and female finalists (Beijing-Rio). The athletic discipline of long jump is a very complex activity that requires full integration of morphological, motor and functional parameters and each of these subsegments has a significant role in the overall jumping structure. This is especially evident when it comes to top athletes, where these segments are treated almost equally in the scoring success of male and female jumpers. However, in terms of structure (profile), it is the morphological space that often records significant differences within the same sexes of competitors in relation to motor and functional abilities. Physical resources that increase the speed of arrival on the board (about 11m/s) and the strength of the reflection at takeoff (more than 3.5m/s) are important determinants of the total distance and jumping technique. In other words, speed or strength is an expression of structural physical resources or a

set of physical characteristics, ie. height, weight, BMI and body composition (Azuma & Matsui, 2021).

Body height is an important parameter in the result success of the long jump due to the greater amplitude of movement, which with good technique and motor skills (speed, explosive power) is a prerequisite for a good jump. Therefore, this morphological parameter is also taken into account during the selection. Based on the obtained results, the epithet of the highest jumpers was achieved by the jumpers at the Olympic Games in London in 2012 with an average height (Mean=186.88 cm), while speaking of women, this epithet was acquired by athletes at the Olympic Games in Beijing in 2008 with an average height (Mean=175.50cm). In terms of height, the second place was taken by the male finalists of the Games in Rio 2016 (Mean=184.50cm), while the athletes in London took second place with an average height (Mean=172.87cm). The shortest jumpers were the finalists of the games in Beijing in 2008 (Mean=180.25cm), and the female jumpers were athletes in Rio 2016 (Mean=169cm).

Age is also an important parameter in the long jump, because some abilities weaken with age, but with age, the personal experience of competitors increases, which can often be an advantage, along with other cognitive and conative factors. The oldest jumpers in the men's competition are the finalists of the Olympic Games in Rio 2016 with an average age (Mean = 26.25 years) and for women they are athletes in Beijing in 2008 (Mean = 26.88 years). In second place are the male finalists at the Olympic Games in London 2012 with an average age (Mean = 25.50 years), while the second place in terms of height was taken by athletes in London 2012 with an average age (Mean = 26.63 years). The youngest in the men's competition are the jumpers from Beijing (Mean = 24.13 years), and speaking of the female athletes, finalists from Rio (Mean = 25.13 years).

Body weight as a factor influencing the result success in the long jump proved to be a negative factor. However, if it is an active mass (muscle, bone) and not ballast body mass (amount of adipose tissue) then this assumption is rejected. Less body mass is associated with muscle mass, and fat mass, which implies an inert substance, acts similarly to weight. Thus, physical characteristics, such as physique, refer not only to simple dimensional parameters but also to structural physical resources (Azuma et al., 2000; Miyatake et al., 2007). Differences were noted between finalists in both competitions, but without statistical significance. The athletes' finalists from Rio have the heaviest body weight (Mean=78.75kg), and speaking of the female athletes, the heaviest are finalists from Beijing (Mean=62.38kg). Second place went to athletes (Mean=77.25kg) and athletes at the London Games with an average body weight (Mean=59.75kg). The finalists from Beijing have the lightest body weight (Mean = 75.88 kg), and the female athletes in Rio 2016 (Mean=58.88 kg).

When it comes to the ratio of height and body weight, it can be concluded that jumpers belong to the meso-ectomorphic or ecto-mesomorphic somatotype, where the height-weight ratio (BMI) plays a significant role. The highest BMI was achieved by the finalist athletes at the 2008 Beijing Olympics (Mean=23.39kg/m^2), and by the female athletes at the 2016 Rio Games (Mean=20.62kg/m^2). In second place are the finalists in Rio 2016 (Mean=23.13kg/m^2), and among the female athletes, finalists at the Beijing Olympics (Mean=20.24kg/m^2). The lowest BMI was achieved by the athletes at the Olympic Games in London 2012 (Mean=22.12kg/m), and speaking of female athletes, the lowest BMI was achieved by the finalists from the Olympic Games in London (Mean=20.01kg/m^2).

Conclusion

By researching the anthropological characteristics of the finalists in the long jump at the Olympic Games (Beijing, London, Rio), some similarities but also differences in certain parameters were noticed. Based on the average values of the obtained results of male and female finalists participating in the Olympic Games, and based on the results of previous research, it can be concluded that the morphological profile of the finalists, both sexes, does not deviate from the standard meso-ectomorphic model. Statistically significant differences were observed in the average height values in men, leading to the conclusion that the jumpers in Beijing were significantly shorter than the jumpers in London (Beijing, 180.25cm <London, 186.88cm, $p < 0.05$). Significant differences in height were also observed in women, the athletes who competed at the Olympic Games in Beijing were significantly taller than the athletes from Rio (Beijing, 175.50cm> Rio, 169cm, $p < 0.05$). Numerical differences were also recorded for other parameters, but they did not achieve the expected statistical significance. Future research of this kind could be realized on a much larger sample of participants in the Olympic Games or World Championships so that the obtained information could define the anthropological profile and possibly more significant differences between jumpers with greater reliability. Although the differences in the anthropometric characteristics of the finalists are evident, they are

not decisive in the final success. The motor and functional abilities of the jumper are preferred.

Authors' Contribution

Study Design: DG, RP; Data Collection: DG, RP; Statistical Analysis: DG; Manuscript Preparation: DG, RP.

Ethical Approval

Ethical approval was not sought for the study because of involving information freely available in the public domain.

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Conflict of Interest

The authors declare no conflicts of interests.

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