

DIFFERENCES IN MORPHOLOGICAL STATUS AND RESULT SUCCESS OF SHOT-PUT BETWEEN STUDENTS OF PHYSICAL EDUCATION AND SPORT FROM DIFFERENT BACKGROUNDS

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Abstract

Very common research in physical culture aim to discover some new facts that would be a realistic basis to confirm or reject some of the previous laws. Depending on current problem will depend the direction and action of research. In track and field throwing events are manifested motor skills that are usually dominant in their structure of technical performance, and from which participation depends the result of a particular discipline, and as such are often the subject of scientific research. Sometimes it's influence, relations and often differences within a particular discipline within the same or different populations. The results are all the more interesting for science if we take into account a transverse cross-section of the population in order to examine possible differences of specific motor skills, morphological dimension, specific disciplines, etc. It may be a cross-section by gender, by result, and so on. This research analyzes the space of specific motor abilities and anthropometric parameters of the population of students of the Faculty of Physical Education and Sports. The main objective of this study was to determine possible differences in the result success of ball throwing as one of the four throwing events, as well as differences in some anthropometric characteristics of students. The survey was conducted on a population of 265 students from several universities (East Sarajevo, Sarajevo, Nikšić, Niš, Skopje). In analyzing the data, by the module T-test the results obtained statistically significantly explain the differences the result success of shot put in 90% of cases of the level of significance ($p < 0.001$) and a 40% difference in the morphological status (Body Height, Body Mass, $p < 0.01$, $p < 0.05$).

Key words: differences, throwing disciplines, morphological status, students

Introduction

Management of complex system, such as human, in the training process, is not possible without the knowledge of his anthropological characteristics for which we can assume a high prediction of the formation of competitive athletics results (Tončev et al., 1996). For that reason, and for the application of those methods and forms of work which contribute to increasing the efficiency of training process according to the individual characteristics of training practice, increasingly are present the studies of different age groups or differences in the scope of different generations of the same population. What is important is that the factors of success in athletics specify hierarchically, which means that in the sequence at the beginning, are the most important factors or dimensions and in the end less important (Tončev, 2001). In regard to this, in front of the researchers who work in athletics is set the task that by the scientific methods allocate hypothetical factors (skills and abilities) that determine promising athlete and participation of each factor in achieving high scores in a particular athletic discipline. Athletics as a sport cyclic and acyclic type is a broad field of manifestation of motor skills, which are characterized by motor movements and can be successfully applied in the

course of the educational process or through other forms of exercise, by means of which there is a significant impact on raising the general mental and physical abilities of the individual. Also, if you take into account its utilitarianism in the growth and development of the young organism, when directed through the process and accurately dosed exercise acts on the subject of modification in a positive direction, gives a true picture of the relevance of athletics in the sports hierarchy. Usually it is a carefully selected, planned and programmed process of exercise that can allow any positive transformation, regardless of the age of the respondents. Athletic disciplines through an ongoing process of training and development have a direct impact on the development of basic motor skills exhibiting a reversible process on the relation motor ability-discipline- athlete (Pavlović, 2010).

From another point of view we have a situation where from the participation and influence of motor abilities depend the results of athletic disciplines. For these reasons, are important the researches that seek to identify and examine the impact and relationship of athletic discipline of specific population.

Often they are relations in specific athletic disciplines (Milanović, 1980; Stojiljković et al., 2003; Markota et al. 2009), and there are also some studies which analyze the chronological age of participants and its impact on results performance in athletic events (Mihajlović, 1996; Tončev and Mihajlović, 1999, Maleš et al., 2003; Bresauler et al. 2006; Stanković et al. 2010). Similarly to this also in earlier athletic practices have been significant researchings (Milanović, 1976), and more recently these researches have been intensified examining the relationship of motor skills with the result success in the athletic events (Schneider, 1994; Stojanović and Radić, 2002; Pavlović, 2005; Stojiljković and al. 2006; Mihajlović and Tončev, 2008; Žuvela et al., 2009; Bošnjak and sar. 2009).

Some researchers (Bresauler, Delija and Mesarić, 2006) are by studying the differences in athletic events of the same population and chronological age performed significant findings that support the views about the existence of generational differences among the same population in result performance of athletic events. Very often as a problem of research are defined the differences in morphological and motor dimensions of different populations of the same age. Interests in these studies are based on knowledge of the existence of possible differences if certain groups are engaged in a particular form of physical activity within the same sport, discipline when it comes to the implementation of the training process and the effects of this process on possible modifications of the subject. Also a very important role is played by certain activities which through a training transfer reflect and enable successful perception of some new activities in the training process (Idrizović, Nićin, Pavlović and Raković, 2013). It is the athletic disciplines which represent one field in which can be applied positive transfer of training, and the effects of exercises on results success of a specified discipline. On the basis of this interpretation this investigation has been conducted. Included is the population of the same age of the respondents, to which the physical activity is primary. Namely, it is about the students of physical education and sport, which in the scope of athletics trained and implemented activities of shot put, in order to achieve a result norm. It is important to note that some of the curriculum at the faculty students achieve through the practical teaching of athletics in which are represented the athletic throwing disciplines. Also there have been no similar studies based on which to perform a specific comparison of the results.

Given this fact, the research problem has been defined. The problem of research present the possible differences in the result success score of shot put among students of the Faculty of Physical Education, East Sarajevo, Sarajevo, Nikšić, Niš and Skopje and their morphological status. The study was conducted with the aim of analyzing and determining the possible differences between students.

Methods

The sample

The population from which the sample of the entities was drawn accounted for male students, the third year of the Faculty of Physical Education and Sports. The sample included students from East Sarajevo (n=42), Sarajevo (n=60), Nikšić (n=47), Niš (n=50) and Skopje (n=66), for a total of 265 students. All of them at the faculty had practical examination of athletic throwing in 2010/11. On the basis of the results relevant information have been obtained.

A sample of measuring instruments

A sample of measuring instruments included only one throwing discipline: shot put. Also, as indicators of the morphological status of students were measured: 1) Body Height, 2) Body Weight. At the time of testing, all subjects were healthy without any injury that could adversely affect the final result of the measurement. In order to obtain relevant results based on which we will get answers, basic statistical parameters were applied, and in terms of determining the differences the analysis by using the t-test for large independent samples have been applied.

Results and discussion

Table 1. Descriptive statistics dependent variables Shot Put (cm)

The Sample	Mean	Min	Max	Rang	SD	Skew	Kurt	CV %
E Sarajevo (n=42)	950	780	1320	540	2,34	1,11	1,75	24,63
Sarajevo (n=60)	857	663	1225	562	11,29	,672	1,78	12,98
Nikšić (n=47)	885	720	1180	460	,84	1,01	3,04	9,49
Niš (n=50)	840	700	1020	320	,87	,219	,75	10,39
Skoplje (n=66)	1073	864	1410	546	1,55	,10	-,78	14,44
Total (N=265)	921	745	1231	486	3,38	,62	1,62	14,39

Mean-the arithmetic mean, Min-minimum results; Max-maximum result; Range-range results; Std.Dev-standard deviation, Skew-Skewnes, Kurt-kurtosis; CV%-

Table 1. gives the basic statistical parameters of results in the shot put. Mean values range from a minimum of 840cm to subsample from Nis to the maximum 1073cm for subsample from Skopje. The difference between these two faculties of 233cm is the largest in the analyzed sample of all students. Analyzing the homogeneity of the results of shot put, it can be concluded that students from East Sarajevo were the least homogeneous (CV = 24.63%). The average score is (Mean = 950cm) with minimum 780cm and maximum 1320cm. The highest homogeneity of results was observed in students from Nikšić (CV% = 9.49%), with an average score of 885cm and a range of 460cm. Minimum score subsample of students was 720cm and the maximum 1180cm. Of the total sample, students from Skopje have achieved the highest minimum score (Min = 864cm) and the highest maximum score (Max=1410cm) with a range of 546cm and (CV = 14.44%). In contrast, students from Niš recorded the lowest mean score (Mean = 840cm) and the minimum value of the maximum result (Max = 1020cm).

Although this is about, to a large extent, the selected sample, that is about the students of physical education and sport from different faculties, different geographical regions, differences in result success of shot put are evident, both within the same and between different subsamples. The range of results for the entire sample, on average, is about 570cm.

Table 2 Differences between students (E.Sarajevo – Sarajevo)

	Mean (cm)		SD	t-value	p-level
Body Height	E.Sarajevo	184	6,22	2,31	0,034*
	Sarajevo	181,18	6,75		
Body Mass	E.Sarajevo	81	9,08	2,78	0,080
	Sarajevo	77,76	9,13		

* Sig. (p <0,05)

Table 3 Differences between students (E. Sarajevo- Nikšić)

	Mean (cm)		SD	t-value	p-level
Body Height	E.Sarajevo	184	6,22	0,12	0,415
	Nikšić	183	5,31		
Body Mass	E.Sarajevo	81	9,08	-0,42	0,584
	Nikšić	82	8,11		

Table 4 Differences between students (E. Sarajevo-Niš)

	Mean (cm)		SD	t-value	p-level
Body Height	E.Sarajevo	184	6,22	1,11	0,923
	Niš	183,87	6,57		
Body Mass	E.Sarajevo	81	9,08	1,96	0,458
	Niš	79,72	7,42		

Table 5 Differences between students (E. Sarajevo – Skoplje)

	Mean (cm)		SD	t-value	p-level
Body Height	E.Sarajevo	184	6,22	2,12	0,010*
	Skoplje	180,58	6,90		
Body Mass	E.Sarajevo	81	9,08	2,91	0,030*
	Skoplje	77	9,33		

* Sig. (p <0,05)

Table 6 Differences between students (Sarajevo- Nikšić)

	Mean (cm)		SD	t-value	p-level
Body Height	Sarajevo	181,18	6,75	-2,39	0,132
	Nikšić	183	5,31		
Body Mass	Sarajevo	77,76	9,13	-3,16	0,013*
	Nikšić	82	8,11		

* Sig. (p <0,05)

Table 7 Differences between students (Sarajevo–Niš)

	Mean (cm)		SD	t-value	p-level
Body Height	Sarajevo	181,18	6,75	-2,24	0,037*
	Niš	183,87	6,57		
Body Mass	Sarajevo	77,76	9,13	-2,12	0,225
	Niš	79,72	7,42		

*Sig. (p<0.05)

In tables 2-11 are analyzed differences in anthropometric parameters (Body Height, Body Weight) among students. T-Test results have shown differences in the anthropometric indices, but they were in most cases not statistically significant. Statistically significant differences in Body Height were recorded between students of East Sarajevo Sarajevo (t=2.31*), East Sarajevo-Skopje (t=2.12*), Sarajevo-Niš (t=-2.24*), Nikšić-Skopje (t=2.38*) and Niš-Skopje (t=3.21).

Table 8 Differences between students (Sarajevo– Skoplje)

	Mean (cm)		SD	t-value	p-level
Body Height	Sarajevo	181,18	6,75	0,35	0,623
	Skoplje	180,58	6,90		
Body Mass	Sarajevo	77,76	9,13	0,18	0,645
	Skoplje	77	9,33		

Table 9 Differences between students (Nikšić– Niš)

	Mean (cm)		SD	t-value	p-level
Body Height	Nikšić	183	5,31	-2,33	0,476
	Niš	183,87	6,57		
Body Mass	Nikšić	82	8,11	2,36	0,151
	Niš	79,72	7,42		

Table 10 Differences between students (Nikšić–Skoplje)

	Mean (cm)		SD	t-value	p-level
Body Height	Nikšić	183	5,31	2,38	0,046*
	Skoplje	180,58	6,90		
Body Mass	Nikšić	82	8,11	3,01	0,003**
	Skoplje	77	9,33		

* Sig. (p <0,05); ** Sig. (p <0,01)

Table 11 Differences between students (Niš–Skoplje)

	Mean (cm)		SD	t-value	p-level
Body Height	Niš	183,87	6,57	3,21	0,010*
	Skoplje	180,58	6,90		
Body Mass	Niš	79,72	7,42	2,91	0,092
	Skoplje	77	9,33		

* Sig. (p <0,05)

Quantitatively it is 50% statistically significant differences. Differences of students were recorded also in Body Mass between students of East Sarajevo-Skopje (t=2.91*), Sarajevo-Nikšić (t=-3.16*) and Nikšić-Skopje (t=3.01**) which is quantitatively 30%. Generally speaking, the students of East Sarajevo, on average, are the tallest 184cm with an average body weight of 81kg, and as the lowest were students from Skoplje 180.58 cm with a mass of 77 kg (Figure 1). Distribution of mean values of shot put (Shot Put) showed the dominance of students from Skoplje with the result (1073cm), then East Sarajevo (950cm), Niksic (885cm) and Sarajevo (857cm). As the weakest in this throwing discipline were students from Nis, with an average score of 840cm. (Figure 2). By the analysis of mean differences in the result performance of shot put have been achieved statistically significant differences at the level (p <0.001) in 90% of cases. The results differences in shot put have not been confirmed only among students of Sarajevo and Niksic (Table 12). Shot put is one of the derived forms of movement, a dominant influence on the result performance have certain morphological dimensions, primarily body weight, voluminosity of the body as well as longitudinality of skeleton. Also in shot put certain parameters, ie. motor skills achieve significant influence on the result success in the shot, above all, the strength and speed (Bale, 1980). More authors (Ropret 1969; Schpenke, 1973 by Milanović, 1976, 1979; Čalija, 1977; Milanović 1982; Zagorac et al. 1988; Idrizović 1991; Stojanović and Radić, 2003) have studied the impact of the motor and morphological parameters on the result performance of shot put in different populations.

Table 12 Differences in the shot put between students (T-test)

	Mean	SD	t-value	p-level	
SHOT PUT (cm)	East Sarajevo	950	2,34	3,06	0,000**
	Sarajevo	857	111,29		
	East Sarajevo	950	2,34	2,94	0,000**
	Nikšić	885	0,84		
	East Sarajevo	950	2,34	3,33	0,000**
	Niš	840	,87		
	East Sarajevo	950	2,34	-4,02	0,000**
	Skoplje	1073	1,55		
	Sarajevo	857	11,29	-1,61	0,087
	Nikšić	885	0,84		
	Sarajevo	857	11,29	1,29	0,000**
	Niš	840	,87		
	Sarajevo	857	11,29	-5,23	0,000**
	Skoplje	1073	1,55		
	Nikšić	885	0,84	2,11	0,000**
	Niš	840	,87		
	Nikšić	885	0,84	-4,95	0,000**
	Skoplje	1073	1,55		
	Niš	840	,87	-3,93	0,000**
	Skoplje	1073	1,55		

Mean-arithmetic mean, SD-standard deviation; t-value-test; p-level of significance **Sig. (p<0,001)

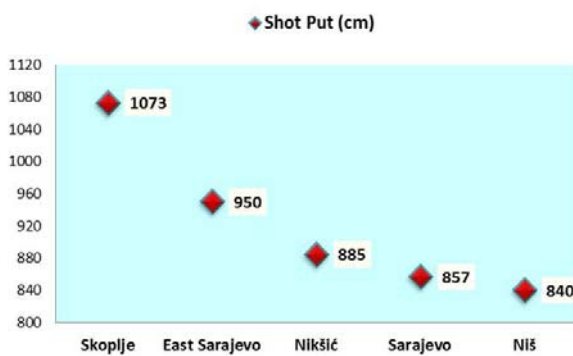


Figure 1. Mean values of anthropometric parameters of students

Some authors have researched the influence of the mentioned dimensions on the student population. They obtained the results in favor of the direct impact of the morphological status (Vrcić, 2010) and primarily strength as motor skill (Pavlović, Branković and Živković, 2012). The structure of other dynamic parameters constitute the size of the muscle forces the pitcher develops and manifests in the course of performing motor activity and the size of the achieved forces that occur during the throw, and they are a result of the inertia of the mass, and reactive action of the base and the momentum (Tončev, 2000; Jovović, 2006).

Based on the presented results of this study can be confirmed that the actual difference in the shot put among students which are an indication of the heterogeneity of the student population of physical education and sport. By analyzing the indicators, body height and body mass it can be seen less heterogeneity of the results of students. The range of body height is about 4cm, from the minimum 180.68 cm for subsample of students of Sarajevo and the 184cm for subsample of East Sarajevo.

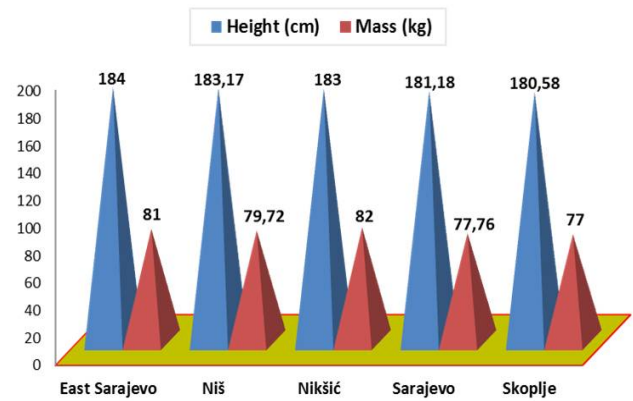


Figure 2. Mean values of the results in shot put

Also a range in body mass on average is about 5kg, 77kg for the subsample of Skoplje and the 82kg for subsample of students from Niksic. In general it can be concluded that the average height of the population of students of Physical Education and Sport is 182,19 cm, Body Mass 79.44 kg. Comparing these values of the morphological status with predispositions of top throwers, it can be concluded that the students are not so destined for throwing disciplines. This can be seen if we analyze the top shot throwers, their relationship of height and body mass. They are of great body height and correspondingly of large amount of body weight. They possess absolute power that manifests itself during ejection of device when the greater mass of thrower acts on less weigh of the ball (Idrizović, 2011; Pavlovic, 2010). By the eight and body weight lead shot put throwers , while for the hammer throwers can be said that they are of less body height, and larger body mass.

It was observed that body weight is greater in those throwers in which the throwing device is of larger weight and it is positively correlated with the result success (Stefanović, 1992). Limbs are in most pitchers long and with strong muscles. Athletic throwing belong to the group of ballistic motion in which in the space are catapulted throwing athletic equipment in order to achieve the as much as possible long-range shots. Throws are initiated by explosive activation of muscle agonists (Stojanović and Radić, 2003), followed by their relaxation period and end with the period of deceleration due to the action of the antagonist muscles or passive stretching of the connective tissue. Most researchers (Zagorac, 1988; Tončev 1988; Idrizović, 1991) engaged in research in the area of morphological characteristics agree that pitchers have over other athletes a greater amount of muscle mass, and that by the Sheldon classification they are closest to mesomorphic type. Weight ranges from 110-120 kg for men, and 85-95 kg for females. The average height is between 187-194 cm in males and in females 178-183 cm. In the javelin throw discipline in addition to quantities of subcutaneous adipose tissue, which limits the success, as significant predictors are not occurring variables in morphological space (Milanović 1982, Pavlović, 2010).

Significant impact on the variability of athletics throws have some indicators of factors of balance, which is determined by the characteristic onesupportive positions in which is important absolute equilibrium composition of the pitcher-device. In the shot put is about complex rotational movement around the vertical axis and overtaking of device in the horizontal plane and much more is important body weight with which shot putter acts on the lower weight of the ball and height of ejection from which the ball is ejected as opposed to, for example, in hammer throw. In hammer, the hammer height ejection is not as crucial (altitude ejections Y.Sedykha was 166cm), as much as speed of turn that seeks to convey the greater effect of centrifugal force which will manifest itself in hammer ejection. Also on result success in the shot put in addition to morphological characteristics (Kyriazis, Terzis, Karampatsos, et al. 2010) takes strength, with all its forms of manifestation as well as speed of performing technique (Bale, 1980; Kyriazis et al., 2009). In some studies as an important factor of success in the shot put is the level of activation of certain muscle groups, primarily m.quadriceps vastus lateralis, m.gastrocnemius internus, m.pectoralis major and triceps brachii (Tesch and Karlsson, 1985; Terzis, Karampatsos, & Georgiadis, 2007), also a casting speed, angular displacement and momentum during ejection (Harasin, Milanović and Čoh, 2010).

Conclusion

The study analyzed the space of specific motor abilities and anthropometric parameters of the population of students of the Faculty of Physical Education and Sports. The main objective of this study was to determine possible differences in

result success in shot put as one of the four throwing events, as well as differences in height and body mass of students. The survey was conducted on a population of 265 students from five universities (East Sarajevo, Sarajevo, Niksic, Niš, Skopje). In analyzing the data, using the T-test, results are obtained that significantly explain differences in the result success of shot put in 90% of cases on the level of significance ($p < 0.001$) and 40% of the differences in anthropometric parameters ($p < 0.01$; $p < 0,05$). The results confirmed significant heterogeneity when it comes to performance results in the shot put. Statistically significant differences were not achieved only among a sample of students of Sarajevo and Niksic ($p < 0.087$). In the space of anthropometric characteristics (AVIS) differences were observed between students of East Sarajevo Sarajevo ($p < 0.034^*$), East Sarajevo-Skopje ($p < 0.010^*$), Sarajevo-Niš ($p < 0.037^*$), Niksic-Skopje ($p < 0,046^*$), Niš-Skopje ($p < 0.010^*$), which amounts to 50% of statistically significant differences. In the space of body mass (AMAS) differences were confirmed in 30% of cases between students Sarajevo-Niksic ($p < 0.013^*$), East Sarajevo-Skopje ($p < 0.030^*$), Niksic-Skopje ($p < 0.003^{**}$). Although it is the case of students of different regions (Bosnia and Herzegovina, Serbia, Macedonia), based on the results of the morphological space it can be concluded that the student population of the four faculties is still somewhat homogeneous. This homogeneity is probably a consequence of similar morphological and motor requirements placed on students during their studies, and also certain selection that takes place in the entrance exam. Also the process of conducting practical classes in faculty enables, significantly, some positive transformation of subjects.

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RAZLIKE U MORFOLOŠKOM STATUSU I REZULTATU USPJEHA BACANJA KUGLE MEĐU STUDENTIMA TJELESNOG ODGOJA I SPORTA IZ RAZLIČITIH SREDINA

Sažetak

Vrlo često istraživanja u fizičkoj kulturi ciljaju otkrivanje nekih novih činjenica koje bi bile realne osnove da se potvrdi ili odbaci neke od prijašnjih zakona. Ovisno o trenutnom problemu ovisit će smjer i djelovanje istraživanja. U atletskim bacanjima događaje manifestiraju motoričke sposobnosti koje su obično dominantne u strukturi tehničke izvedbe, a o čijem sudjelovanju ovisi ishod određene discipline, te kao takve su često predmet znanstvenog istraživanja. Ponekad je to utjecaj, odnosi i često razlike unutar određene discipline unutar iste ili različitih populacija. Rezultati su zanimljiviji za znanost, ako uzmemo u obzir poprečni presjek stanovništva kako bi se ispitalo moguće razlike pojedinih motoričkih sposobnosti, morfoloških dimenzija, posebnih disciplina, itd, pa to može biti presjek po spolu po rezultatu, i td. Ovo istraživanje analizira prostor specifičnih motoričkih sposobnosti i morfoloških parametara populacije studenata Fakulteta za fizičku kulturu i šport. Glavni cilj ovog istraživanja bio je utvrditi postoje li razlike u uspješnosti rezultata bacanja kugle, kao jednog od četiri atletska bacačka događaja, kao i razlike u nekim antropometrijskim karakteristikama studenata. Istraživanje je provedeno na populaciji od 265 učenika iz više sveučilišta (Istočno Sarajevo, Sarajevo, Nikšić, Niš, Skopje). U analizi podataka, od modula T-testa dobiveni rezultati statistički značajno objašnjavaju razlike uspjeha rezultata bacanju kugle u 90% slučajeva na razini značajnosti ($p < 0,001$) i 40% razlika u morfološkom statusu (tjelesna visina, Body Mass, $p < 0,01$, $p < 0,05$).

Ključne riječi: razlike, bacanje discipline, morfološki status, studenti

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