COMPARISONS OF ANTROPOMETRIC CHARACTERISTICS BETWEEN FOUR GROUPS STUDENTS OF PRIMARY SCHOOLS

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ABSTRACT

Nowadays, sports teams they want their athletes to be faster stronger, more efficient and, at the same time, they want to have higher quality anthropometric and physiological capacities. Anthropometric characteristics hold immense significance for success in kinesiology activities, as these endeavors necessitate a specific body structure. For the realization of this research, a cohort of 328 primary school students, aged 14 and 15 years, was utilized and subdivided into four groups. The first group (A) comprised 82 students involved in combat sports; Second group (B) encompassed 82 students participating in individual sports. Third group (C) consisted of 82 students involved in team sports, and fourth group (D) consisted of 82 students who, did not involve in any sports. The primary objective of this research is to ascertain potential differences in anthropometric characteristics between athlete's students and non-athlete's students. Based on the results of the research through the, Univariates ANOVA and multivariate MANOVA methods, to identify potential differences between the groups in the anthropometric space, we can ascertain that intergroup differences exist across the entire analyzed spectrum. The outcomes indicate that: Combat sports athletes (A) achieved the most favorable results in body mass; Individual sports athletes (B) achieved the most favorable results in subcutaneous body folds; The team sports athletes (C) achieved the most favorable results in the longitudinal dimensions of the body; Non-athlete students (D) in this research showed that they did not have better results compared to student athletes in almost all anthropometric variables.

Keywords: Anthropometric characteristic, comparison, primary school's students.

INTRODUCTION

Anthropometric characteristics are important to succeed in a sport. (Malina, Bouchard, & Bar-Or, 2004; Malina, Meleski, & Shoup, 1982), team sports are a strength type of sport, where anthropometrics and fitness characteristics are undoubtedly factors for performances. At the same time, for team sports, adolescents are selected based on their skills, performance level, physique and muscular strength (Benetti, Schneider, & Mezer, 2005). The team sports require that the athletes have pronounced longitudinal dimensions such as body height, arm long, hand long and foot long (Sibila, 1997; Srhoj, Marincovic, & Rogulj, 2002; Skoufas et al., 2003). In team games, several anthropometric elements can influence competitive success, such as height, arm span, leg length and sitting height (Gualdi-Russo, & Yaccagni, 2001). Nowadays, athletes in all branches want to be faster and stronger, more efficient and, at the same time, they want to have higher quality anthropometric and physiological capacities (Ocal, Baydil, & Melekoglu, 2010). In today's context, children enjoy greater opportunities to engage in various forms of sports and organized, structured exercise programs (Ibri L. S., 2012). The popularity of sports games is particularly pronounced among school children and adolescents. Besides mandatory physical education classes, they actively participate in extracurricular sports activities (Babijak, 1984). The pursuit of improved athletic performance has driven significant transformations across all sports domains. The key to success in sports lies in the implementation of well-defined strategies, means, and methods, along with a constant vigilance in training and meticulous management of training elements. Achieving success in sports is contingent on a multitude of external and internal factors. Some authors, (Gabrijelic, 1977; Ilić, 1993; Pokrajač, 1983) have identified as many as 13 factors (including morphological, motoric, functional, conative, cognitive, motivational, sociological, and health factors) that collectively contribute to the specifics of sports results. It has been empirically established that in sports games, taller athletes with longer limbs often enjoy an advantage over shorter athletes with shorter limbs. Additionally, athletes with a higher proportion of adipose tissue tend to perform less effectively than their counterparts with the same weight but without this added burden. A substantial body of research on the transformation of morphological characteristics (Popović-Ilić et al., 2010) underscores their intricate nature, influenced by both genetic and environmental factors. It's noteworthy that the impact of genetic factors doesn't manifest uniformly across all latent morphological dimensions. In most cases, young athletes gravitate towards sports that align with their natural morphology, as it represents a physical advantage to a certain extent. Furthermore, as athletes continue to engage in their chosen sport and adapt to its specific demands, they acquire increasingly distinct characteristics typical of that sport over time. It has been observed that higher sporting achievements are closely associated with the composition and structure of athletes' bodies (Bajić, Ponorač, Rašeta and Bajić, 2010; Ibri L., Shala S., 2013;). Consequently, considerable attention is devoted to observing and studying the anthropological status of active athletes, as well as those who aspire to participate in various sports (Sčhmidt, Pienčikowski, and Vander vest, 2005). Morphological characteristics hold immense significance for success in kinesiology activities, as these endeavors necessitate a specific body structure (Mišigoj-Duraković, 1999). Studies on the anthropometric characteristic of the human body indicate that athletes who are taken in a specific sport differ in somatic characteristics from the general population (Gaurav, Singh, & Singh, 2010). Morphological characteristics are primarily influenced by genetic and environmental factors and one should pay a close attention to a well-known fact that different morphological dimensions incur different genetic influence (Nikitjuk, 1998; Malacko et al., 2015). The aim of our study was to investigate the anthropometrical characteristics of primary school students engaged in combat sports, in individual sports, in team sports and students who, apart from physical education classes, are not actively involved in sports, and to study the differences between them.

METHODOLOGY

The research was carried in a sample 328 male's primary school students divided into four groups: Group (A) consist of the 82 students who taken with combat sports; Group (B) consist of the 82 students who taken with individual sports; Group (C) consist of the 82 students who taken with team sports; and Group (D) consist of the 82 students who not taken with any sports i.e., non-athlete students, of aged from 14 to 15 year. It should be noted that, for our research, advance we received written consent from the principals of the schools where the tests were conducted, as well as from the parents of the students who participated in the research, which is in accordance with the Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects (World Medical Association, 2013). The research problem at hand revolves around discerning the disparities in anthropometric characteristics between primary school students involved in sports and those who are not involved in sports. The successful execution of this research endeavor sought to address the central question arising from the subject and research problem: Will there be statistically significant differences in anthropometric profiles between the four identified groups? After setting the subject and the research problem, it is essential to determine the main purpose of the research. The research aims to investigate the level of anthropometric characteristics of primary school students engaged in sports and those who are not engaged in sports, as well as prove if there are significant differences between them within the anthropometric realm. Sample variables: Body height (ABHE), Body weight (ABWE), Body mass index (ABMI), Circumference of the chest in inspiration (ACCH), Leg length (ALEL), Arm length (AARL), Abdominal skin fold (AASF), Triceps skin fold (ATSF), Biceps skin fold (ABSF), Subscapular skin fold (ASSS), Sub-iliac fold skin (ASIS), Lower leg skin fold (ALLS). The measurements were carried in sport's halls where students regularly participated in physical education classes, they were realized with help of the physical education professors of the primary schools where the tests were carried out. These halls were adequately illuminated, maintaining a normal working temperature. The tests were consistently conducted in the in the morning, at the same designated time (9.00 - 12.00) for all subjects, and in the same prescribed order, taking into account the feasibility and complexity of the tests themselves. Each respondent voluntarily participated in this research. Prior to the research, respondents were informed about the research's procedures, goals, and objectives. To ensure the precise collection of data, the following measurement instruments were utilized: Tanta scale, Anthropometry according to Martin, Caliper, and a 2.0m Meter tape.

RESULTS

The obtained measurement data were processed using software systems for univariate data analysis. The analyses were conducted using Statistic for Windows and SPSS for Windows 25, incorporating suitable subprograms. The applied variables underwent standard descriptive procedures, including the calculation of basic central and dispersion parameters and a certain function of their distribution. Key parameters for the investigated areas were computed, including minimum values (Min), maximum values (Max), arithmetic mean (Mean), and standard deviation (St. Dev). To assess the normality and distribution of the results, coefficients such as skewness (Skew), kurtosis (Kurt), and the Kolmogorov-Smirnov method (max D) were utilized. Univariate ANOVA and multivariate MANOVA methods were employed to identify potential differences between the groups in the observed space.

Table 1. Descriptive statistical anthropometric parameters of group A, respondents.

No.	Variables	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis	Max D	Sig.
1.	ABHE	155.00	190.00	172.2927	8.49472	.581	-.530	,113	p > .01
2.	ABWE	46.90	105.40	63.2341	12.37861	1,493	2,546	.164	p > .00
3.	ABMI	17.60	29.20	21.1451	2.38406	1.127	1.219	.117	p > .00
4.	ACCH	33.00	116.00	92.0488	11.69721	-1.813	8.211	.123	p > .00
5.	ALEL	80.00	114.00	93.6951	5.97255	.507	1,665	.131	p > .00
6.	AARL	65.00	96.00	74.5976	6.30865	.976	.804	.172	p > .00
7.	AASF	.70	5.50	1.5122	.76858	2,424	8,929	.168	p > .00
8.	ATSF	.40	2.30	1.0207	.42477	1.288	1.238	.234	p > .00
9.	ABSF	.30	1.90	.8098	.28571	.921	1.441	148	p > .00
10.	ASSS	.50	5.00	1.4329	.93756	1.856	3,636	.209	p > .00
11.	ASIS	1.00	6.40	1.8098	1.05405	2.208	5,717	.274	p > .00
12.	ALLS	.40	1.80	.8524	.28425	1.063	1.286	.183	p > .00

Table 1 reflects the results of the parameters of the anthropometric characteristics of the group (A), student's engaged in combat sports. Including minimum values (Min), maximum values (Max), arithmetic mean (Mean), and standard deviation (St. Dev). To assess the normality and distribution of the results, coefficients such as skewness (Skew), kurtosis (Kurt), and the Kolmogorov-Smirnov method (max D) were utilized.

Table 2. Descriptive statistical anthropometric parameters of group G2, respondents.

No.	Variables	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis	Max D	Sig.
1.	ABHE	158.00	192.00	174.0122	9.21686	.230	-.945	,097	p > .05
2.	ABWE	41.70	93.10	65.1866	10.07187	.279	.871	,088	p > .20
3.	ABMI	15.30	26.10	21.3110	2.09320	-.199	.093	.059	p > .20
4.	ACCH	45.00	115.00	91.0976	11.28378	-1.055	3,796	.127	p > .00
5.	ALEL	82.00	112.00	95.0366	7.17066	.265	-.189	.096	p > .00
6.	AARL	62.00	91.00	75.8415	7.64888	.159	-1.035	.107	p < .05
7.	AASF	.80	4.20	1.4707	.71379	2.103	4,619	.257	p < .00
8.	ATSF	.40	2.50	1.0902	.37634	2.242	5,639	.282	p < .00
9.	ABSF	.40	1.60	.8768	.19200	1.723	4,829	.245	p < .00
10.	ASSS	.70	5.10	1.2402	.79952	3.171	12.115	.277	p < .00
11.	ASIS	.90	5.70	1.6293	.89945	2,711	9,258	.245	p < .00
12.	ALLS	.50	1.30	.8134	.20474	.381	-.483	.141	p < .00

Table 2 reflects the results of the parameters of the anthropometric characteristics of the group (B), student's engaged in individual sports. Including minimum values (Min), maximum values (Max), arithmetic mean (Mean), and standard deviation (St. Dev). To assess the normality and distribution of the results, coefficients such as skewness (Skew), kurtosis (Kurt), and the Kolmogorov-Smirnov method (max D) were utilized.

Table 3. Descriptive statistical anthropometric parameters of group G3, respondents.

No.	Variables	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis	Max D	Sig.
1.	ABHE	154.00	192.00	175.2561	7.85330	-.503	.208	,088	p > .20
2.	ABWE	48.50	89.50	67.9427	9.90077	.250	-.726	,094	p > .20
3.	ABMI	16.90	26.90	22.0573	2.36831	-.064	-.855	.073	p > .20
4.	ACCH	54.00	114.00	90.2805	10.30315	-.534	1,697	.111	p > .20
5.	ALEL	78.00	112.00	96.4878	5.87155	-.773	1,423	.150	p < .00
6.	AARL	62.00	98.00	77.6341	6.39157	-.125	.724	.094	p > .20
7.	AASF	.80	9.00	2.0488	1.13868	3,686	18,475	.198	p < .00
8.	ATSF	.40	2.50	1.3366	.38826	.550	.773	.196	p < .00
9.	ABSF	.40	2.80	1.0805	.35951	1,794	6.173	.211	p < .00
10.	ASSS	.90	6.10	1.7744	.89702	2,869	11,640	.170	p < .00
11.	ASIS	1.10	6.40	2.2366	.98976	1.902	5,873	.125	p < .00
12.	ALLS	.40	1.80	.9963	.29205	.007	.331	.126	p < .00

Table 3 reflects the results of the parameters of the anthropometric characteristics of the group (C), student's engaged in team sports. Including minimum values (Min), maximum values (Max), arithmetic mean (Mean), and standard deviation (St. Dev). To assess the normality and distribution of the results, coefficients such as skewness (Skew), kurtosis (Kurt), and the Kolmogorov-Smirnov method (max D) were utilized.

Table 4. Descriptive statistical anthropometric parameters of group G4, respondents.

No.	Variables	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis	Max D	Sig.
1.	ABHE	160.00	187.00	173.1098	5.80550	.228	-.291	,011	p > .20
2.	ABWE	53.60	82.70	64.6817	5.99455	.857	.731	,091	p > .20
3.	ABMI	17.10	28.60	21.5860	1.72872	.672	2,387	.063	p > .20
4.	ACCH	46.00	114.00	87.0732	13.10996	-.703	1,410	113	p > .20
5.	ALEL	88.00	112.00	98.4024	4.79676	.613	-.089	.155	p < .00
6.	AARL	65.00	88.00	74.3659	5.69278	.811	-.180	.160	p < .00
7.	AASF	.50	4.20	1.3317	.69226	1.751	3,621	.168	p < .00
8.	ATSF	.50	2.40	.9829	.40637	1,375	2,060	.166	p < .00
9.	ABSF	.40	1.70	.8122	.27415	.967	.626	.195	p < .00
10.	ASSS	.50	4.30	1.2085	.59695	2.197	7,956	.201	p < .00
11.	ASIS	.60	4.40	1.6305	.75844	1.052	1.333	.120	p < .00
12.	ALLS	.50	1.20	.7146	.19946	.702	-.644	.242	p < .00

Table 1 reflects the results of the parameters of the anthropometric characteristics of the group (D), student's that apart from the regular hours of physical education, they are not engaged in any sport. Including minimum values (Min), maximum values (Max), arithmetic mean (Mean), and standard deviation (St. Dev). To assess the normality and distribution of the results, coefficients such as skewness (Skew), kurtosis (Kurt), and the Kolmogorov-Smirnov method (max D) were utilized.

Table 5-6, ANOVA analysis of variance and MANOVA multivariate analysis of variance in four groups of subjects.

	Wilks' Lambda	Rao's R	F	df 1	df 2	p-level
1	.000	3174.816	82809.797	3	324	0.00

ANOVA							
			Sum of Squares	df1- df2	Mean square	F	Sig.
1	Body height	ABHE	397.180	3-324	176,977	2,844	.038
2	Body weight	ABWE	954.535	3-324	532.904	5,813	.001
3	Body mass index	ABMI	39,130	3-324	20.858	4,566	.004
4	Chest girth in insertion	ACCH	1146.741	3-324	373.374	3,371	.019
5	Leg length	ALEL	1001.595	3-324	333,865	9,237	.000
6	Arm length	AARL	551.341	3-324	183,780	4,285	.006
7	Abdominal skin fold	AASF	24,393	3-324	8.131	11.308	.000
8	Triceps skinfold	ATSF	6.218	3-324	2,073	12,995	.000
9	Biceps skin fold	ABSF	4.006	3-324	1.335	16,544	.000
10	Sub scapular skin fold	ASSS	16,617	3-324	5,539	8,269	.000
11	Sub iliac skin fold	ASIS	20,153	3-324	6,718	7,733	.000
12	Skin crease at the knee	ALLS	3,358	3-324	1.119	18,068	.000

Tables 5-6 reflect the results of the comparison of anthropometric characteristics to among four groups of respondents were analyzed using multivariate analysis of variance (MANOVA). Utilizing univariate analysis of variance (ANOVA), statistically significant differences are observed among the four groups of subjects in all variables of anthropometric characteristics.

DISCUSSION

From Table 1, we can observe the anthropometric descriptive statistical parameters of the respondents of group (A). Analyzing the results presented in Table No. 1, the following conclusions can be drawn: In the case of respondents engaged in combat sports (A), statistically significant deviations in the value of skewness (Skew) are noticeable in the following variables: body weight (ABWE=1.493), body mass index (ABMI=1.127), chest girth (ACCH=-1.813), abdominal skinfold (AASF=2.424), triceps skinfold (ATSF=1.288), subscapular skinfold (ASSS=1.856), sub-iliac skinfold (ASIS=2.208), and lower leg skinfold (ALLS=1.063). Regarding the degree of kurtosis (Kurt), statistically significant deviations are observed in the variables: chest circumference (AASF=8.211), abdominal skinfold (AASF=8.929), subscapular skinfold (ASSS=3.636), and sub-iliac skinfold (ASIS=5.717). When analyzing the results obtained from the coefficient of normality of the distribution of results (max D), it can be concluded that only one variable exhibits a statistically significant deviation at the p<.01 level, which is body weight (ABWE). Analyzing the results of respondents engaged in individual sports (B), as shown in Table 2, the following observations can be made: Statistically significant deviations in the value of skewness (Skew) are observed in the variables: chest girth (ACCH=-1.055), abdominal skinfold (AASF=2.103), triceps skinfold (ATSF=2.242), biceps skinfold (ABSF=1.723), subscapular skinfold (ASSS=3.171), and sup-iliac skinfold (ASIS=2.171). In terms of kurtosis (Kurt), statistically significant deviations are noted in the variables: chest circumference (ACCH=3.796), abdominal skinfold (AASF=4.619), triceps skinfold (ATSF=5.639), biceps skinfold (ABSF=4.829), subscapular skinfold (ASSS=12.115), and sub-iliac skinfold (ASIS=9.258). Analyzing the results obtained from the coefficient of normality of the distribution of results (max D), it can be inferred that there is a statistically significant deviation at the p<.05 level for two variables, namely body height (ATVI) and arm length (ADRU). No deviations at the level of p<.01 were observed. According to the results of respondents who play team sports (C), shown in table 3, we can state; that statistically significant deviations in the value of asymmetry results (Skew) can be observed in the variables: abdominal skin fold (AASF=3.686); biceps skin fold (ABSF=1,794), subscapular skin fold (ASSS=2,869) and sub-iliac skin fold (ASIS=1,902). The degree of curvature (Kurt), statistically significantly deviates in the variables: abdominal skin fold (AASF=18,475), biceps skin fold (ABSF=6,173), subscapular skin fold (ASSS=11,640) and sub-iliac skin fold (ASIS=5,873). By analyzing the results obtained from the coefficient of normality of the distribution of results (max D), it can be concluded that the deviation at the level of p <. 05 and level p <. 01 are not observed. According to the results of student's respondents who do not participate in sports (D), as shown in Table 4, the following observations can be made: Statistically significant deviations in the value of skewness (Skew) are observed in the variables: Abdominal skinfold (AASF=1.751), triceps skinfold (ATSF=1.375), subscapular skinfold (ASSS=2.197), and sub-iliac skinfold (ASIS=1.052). In terms of kurtosis (Kurt), statistically significant deviations are noted in the variables: Abdominal skinfold (AASF=3.621) and subscapular skinfold (ASSS=7.956). Upon analyzing the results obtained from the coefficient of normality of the distribution (max D), it can be concluded that deviations at the levels of p<.05 and p<.01 were not observed in the applied variables. The results presented in tables 5-6 pertain to four groups of respondents and were analysed using multivariate analysis of variance (MANOVA) concerning anthropometric characteristics. Based on the analysis of the results, it can be deduced that there are significant intergroup differences within the anthropometric analysed domain. In light of the results obtained for Wilk's Lambda, a noteworthy difference is observed at the p=0.00 level across the entire analysed spectrum. Utilizing univariate analysis of variance (ANOVA), statistically significant differences are observed among the four groups of subjects in all variables of anthropometric characteristics.

CONCLUSIONS

Starting from the subject and aim of research in this paper, the primary objective was to determine possible differences between four groups of primary school students who actively engage in sports (athletes) and those who do not participate in any sports (non-athletes) within the anthropometric domain. The research sample comprised 328 male primary school students aged 14 and 15 years, categorized into four distinct groups. The first group (A) included of 82 primary school students engaged in combat sports (karate 20, boxing 20, wrestling 15, judo 15, and taekwondo 12); Second group (B) consisted of 82 primary school students participating in individual sports (athletics 22, cycling 20, table tennis 20, and tennis 20); Third group (C) comprised of 82 primary school students involved in team sports (football 42, handball 20, and basketball 20); and forth group (D) encompassed of 82 primary school students who, apart from regular physical education classes, did not partake in any sports. From the analysis of the research results pertaining to the four groups of respondents, assessed via multivariate analysis of variance (MANOVA) of anthropometric tests, it is evident that intergroup differences exist across the entire analysed spectrum. Further, employing univariate analysis of variance (ANOVA), the were also substantiated, statistically significant differences among subjects from the four groups in all anthropometric variables.

The outcomes of this research indicate that: Combat sports athletes (A) achieved the most favourable results in variables pertaining to body mass, this is of course as a consequence of as their sport often necessitates control over body mass due to weight categories in which competitions take place. Individual sports athletes (B) achieved the most favourable results in variables pertaining subcutaneous body folds, which can be attributed to their long-term engagement in activities involving explosive elements such as running, jumping, and powerful serves or shots. Team sports athletes (C) achieved the most favourable results in in variables associated with the longitudinal dimensions of the body, which is likely attributed to the appropriate selection of athletes in line with the requirements of team sports, where team sports aim for their athletes, in addition to good physical skills, they should also stand out in anthropometric characteristics. Non-athlete students (D) in this research showed that they did not have better results compared to student athletes in almost all anthropometric variables. This result was expected, since the students were non-athlete were not involved in any sport and were not involved in the selection process.

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