

STRUCTURAL DIFFERENCES IN ANTHROPOMETRIC VARIABLES AND MOTOR ABILITIES AMONG STUDENTS FROM DIFFERENT SECONDARY SCHOOLS

(Original scientific paper)

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Abstract

The aim of this study is to identify whether there are structural differences in the anthropometric variables and the motor abilities of students from different high schools in the secondary education in Veles. For this purpose, 75 students from secondary vocational school and 75 students from gymnasium were involved in the measurement of 12 anthropometric variables and 13 motor tests. The results of the conducted canonically discriminative analysis indicate that there are statistically significant differences in the anthropometric variables and the motor abilities between the two groups. The students from the secondary vocational school had statistically significant better results than the gymnasium students. The most important differences in the anthropometric variables are visible at the skin fold at the back (AKFG), skin fold on the stomach (AKFM), and the skin fold on the upper arm (AKFNL). In terms of motor abilities the most significant differences are apparent in mobility (MDPK, MRLEZ); segment speed (MTRA, MTNO), strength of stomach and back musculature (MKTG, MKTM) and rhythmic coordination (MURANO, MP4KV). Based on the obtained results, we can conclude that students from the secondary vocational school are more dominant in certain anthropometric variables and motor abilities because in addition to the regular classes of sport and sports activities, the classes of the subject titled „practical work“ contributed further toward the development of these abilities, especially with the abilities of the chosen motor variables.

Keywords: *physical education, secondary vocational students, high school students, t-test, discriminative analysis*

INTRODUCTION

The physical education is an adaptive process, through which, with the application of planned programmed systematic activities, intensive changes of the students' body are evoked, which lead to desired condition. The physical education is a highly vocational and complex pedagogically organized educational process which influences the individual or group in the adaptation of certain sport – technical knowledge, skills and habits, developing certain abilities through which the individual and the group are being affirmed. The physical education starts institutionally in pre-school establishments and continues until the academic establishments. In this context, the school as an educational institution is a foundation for conducting the physical and health education and it should ensure continuous development of the students as spiritual, corporal, moral, intellectual and social entities, in accordance with their abilities and preferences. The sport and sports activities at the secondary education schools as a transformation process affect

the changes of the anthropological status of the students depending on the managerial capabilities of the teacher in regard to the establishment and realization of the class – classes of sport and sports activities; but the realization of the classes also depends on the active participation of the students. The primary aim of this study is to assess whether there are statistically important differences in the anthropometric and motor area among the students from gymnasium and vocational education and then to determine which variables contribute the most in determining the differences.

METHODS

The research was conducted on 150 students divided in two groups: 75 regular students from the fourth year of the gymnasium “Jovche Teslichkov” and 75 regular students from the fourth year of the secondary vocational school “Kole Nedelkovski”, both from the city of Veles. The pattern of measuring instruments for determining the anthropometric characteristics is introduced

through 12 anthropometric variables, measured according to the International Biological Program (IBP – Winer and Lourie 1968). The variables for assessment of the morphological characteristics have been chosen to cover the four-dimensional morphological area (according to Kurelić et al., 1975). From each area three variables are taken: body height (AVIS), legs length (ADNO), arms length (ADRA), shoulders width (ASRA), elbow diameter (ADLA), pelvis width (ASKA), body weight (ATEZ), bust size (AOGK), upper arm size (AONL), skin fold on back (AKDG), skin fold on stomach (AKDM), skin fold on upper arm (AKDNL). The pattern of the motor tests consists of 13 tests: twisting with bat (MIPAL), deep bow on bench (MDPK) cross-leg movement from lying back position (MRLPG), body lifting from lying back position (MKTLG), body lifting from lying stomach position (MKLM), holding hands high with twisted hands (MIVIS), Hexagon test (MTHE), Illinois test (MTIL), test 96369 with turning of 180° (MT96369), hand tapping (MTRA), leg tapping (MTNO), hand and leg striking in corner of a room (MURANO) and hopping in four squares (MP4kv). The data gathered from this research are processed with the program package Statistics for Windows Version 8.0. An arithmetic average has been calculated for every morphological feature and motor ability, t-test for independent patterns between the two groups and canonically discriminative analysis for determining the structural differences between the two groups in morphological and motor variables.

RESULTS

With differentiating the arithmetic average in the morphological area among the students from the secondary vocational school and the gymnasium, it can be concluded that the groups are statistically different in the gained results from the t-test (Table 1.). The results are in regard to the students who study at the secondary vocational school with the anthropometric variables which

determine the longitude dimensionality and the fat quantity of the body within the following variables: legs length (ADNO), skin fold on stomach (AKDM), skin fold on back (AKDG) and upper arm skin fold (AKDN). There are no statistically significant differences with the other anthropometric variables between the two groups of students.

But with the differentiating the arithmetic average in the area of motor skills (t-test Table 2.), we can note that the students from the secondary vocational school statistically show significantly better results almost in all motor tests, while the students from the gymnasium show better results only in the test 96369 with turning of 180° in regard to the students from the secondary vocational school.

With the aim of determining the structural differences in the anthropometric measures among the students from the gymnasium and the students from the secondary vocational school, the canonically discriminative analysis has been applied. In the anthropometric area (Table 3.) we can notice that the Wiliks' Lambda is 0.55 high, which indicates that the differences between the examinees are on significant Sig=0.00 level. A discriminative function has been drawn which statistically discriminates significantly the examinees in the examined area of the variables. The quotient of the canonic correlation shows that the gained discriminative function covers 67% of the explained inter-group variable. The anthropometric measures from the subcutaneous fat weaving ("skin fold on back", "skin fold on stomach" and "skin fold on upper arm") have the greatest contribution to the discriminative function – they discriminate the subsamples of the first discriminative function the most. The explained quotient with correlation to the whole set anthropometric variables has the highest value (Chi - sqr = 83.54). Statistically important projection with negative sign on the first discriminative function has the

Table 1. T-test, differences between students from secondary vocational education and gymnasium students in certain anthropometric variables

Variables	Mean		t-test	df	p
	S. Vocational	Gymnasium			
AVIS	177,93	175,51	1,61	148,00	0,11
ADNO	93,83	88,54	3,35	148,00	0,00
ADRA	175,97	173,41	-0,16	148,00	0,87
ASRA	38,63	37,34	1,69	148,00	0,09
ADLA	67,94	67,66	0,02	148,00	0,98
ASKAR	29,45	28,97	0,92	148,00	0,36
ATEZ	70,43	73,31	-0,90	148,00	0,37
AOGK	91,50	91,08	0,31	148,00	0,76
AONL	28,93	29,96	-0,28	148,00	0,78
AKDG	9,47	14,92	-2,31	148,00	0,02
AKDM	9,89	15,74	-7,15	148,00	0,00
AKDN	7,46	11,51	-3,70	148,00	0,00

Table 2. T-test, differences between gymnasium students and secondary vocational education students in some motor variables

Variables	Mean		t-test	df	p
	S. Vocational	Gymnasium			
MIPAL	92,75	109,44	-5,57	148,00	0,00
MDPK	40,36	24,91	12,12	148,00	0,00
MRLEZ	94,27	77,04	6,42	148,00	0,00
MKTG	25,29	18,44	9,93	148,00	0,00
MKTV	23,67	15,51	11,97	148,00	0,00
MIVIS	37,47	17,15	5,86	148,00	0,00
MTHE	10,93	13,14	-6,29	148,00	0,00
MTIL	16,73	17,36	-1,74	148,00	0,08
MT96369	10,70	26,89	-1,07	148,00	0,29
MTRA	41,80	27,99	10,97	148,00	0,00
MTNO	38,60	27,55	10,99	148,00	0,00
MURNA	7,85	4,51	7,96	148,00	0,00
MP4KV	7,24	5,28	7,44	148,00	0,00
MIPAL	92,75	109,44	-5,57	148,00	0,00

Table 3. Discriminative analysis of anthropometric measures among students in secondary vocational school and gymnasium

Eigenvalue	% of Variance	Canonical Correlation	Wilks' Lambda	Chi-square	df	Sig.
,808	100,00	0,67	0,55	83,54	12,00	0,00

Variables	1
AKDM	0,71
AKDG	0,66
AKDN	0,61
ADNO	-0,30
AVIS	-0,21
ASRA	-0,20
ADRA	-0,15
AONL	0,15
ATEZ	0,14
ASKAR	-0,08
ADLA	-0,04
AOGK	-0,02

School	Centroids
Sec. Vocational school	-0,89
Gymnasium	0,90

Table 4. Discriminative analysis of motor abilities among students in secondary vocational school and gymnasium

Eigenvalue	% of Variance	Canonical Correlation	Wilks' Lambda	Chi-square	df	Sig.
3,426	100,00	0,88	0,23	210,48	13,00	0,00

Variables	1
MDPK	0,54
MKTM	0,53
MTNO	0,49
MTRA	0,49
MKTG	0,44
MRLEZ	0,37
MURNO	0,37
MP4KV	0,33
MTHE	-0,28
MIPAL	-0,27
MIVIS	0,26
MT96369	-0,18
MTIL	-0,08

School	Centroids
Secondary vocational	1,84
Gymnasium	-1,84

anthropometric measure legs length as well. The other anthropometric measures have smaller projection on the first discriminative function.

According to the extent of the signs of the centroids, it can be determined that the students studying at the secondary vocational school have the lesser percentage of fat weaving and greater legs length from the students studying at the gymnasium.

In order to determine the structural differences in the motor area among the students studying at the secondary vocational school and the gymnasium, the canonically discriminative analysis has been applied as well. In the area of the motor variables (Table 4.) we can notice that the Wilks' Lambda is 0.23, which indicates that the differences among the examinees are on level Sig=0.00. A discriminative function has been derived that substantially discriminates statistically the examinees in the examined area of the motor variables. The quotient of the canonical correlation is 0.88 with which the meaning of the canonic function is explained, i.e. the discrimination of the function. The explained quotient of correlation of the motor tests has the value 210.48, which indicates the existence of statistically important discriminative differences with the examined variables. The centroids values point to the fact that there is a 3.68 reciprocal distance between the students that study at the secondary vocational school and at the gymnasium in the discriminative area, which on the other hand points

to the statistically important differences in the motor skills between the two groups of examinees.

The motor test in which the examinees of the first discriminative function differ most is the test "deep bow on bench" (.54), after which follows the tests "body lifting from lying stomach position" (.53), "hand tapping", "leg tapping" (.49), "body lifting from lying back position" (.44), "cross-leg movement from lying back position" and "hand and leg striking" (.37) and "hopping in four squares" (.33). The other motor tests have smaller projection on the first discriminative function.

Depending on the fact how big are the pre-signs of the centroids, we can conclude that the students studying at the secondary vocational school show better flexibility of the lower limbs, have better speed of the frequency of the upper and lower limbs, better developed strength of the abdominal and back musculature and have better developed ability for rhythmical structure (coordination in rhythm).

DISCUSSION

The secondary education in the Republic of Macedonia is being realized through plans and programs for gymnasium education, vocational education and secondary education for students with special educational requirements. The study program for the subject sport and sport activities in the secondary schools is being realized

in very specific conditions with the help from optimally planned and programmed educational work, with the application of exactly determined operators from kinesiology, methodically organized forms of work, resources, educational procedures, all these led by educated teachers for teaching the specific educational process. Because of this, the development of the motor, morphological and functional abilities in the subject sport and sport activities in the secondary education school can be achieved through the process of physical exercise, which in fact should be systematically and rationally organized and very well controlled (Findak, 1995).

In this research certain anthropometric and motor variables were being applied, for which it was thought that they will show differences with the examined students from the gymnasium and secondary vocational schools, which is exactly what happened, but the differences have become apparent in relation to the students from the secondary vocational school, especially in the area of motor skills, contrary to the research of Segregur (2010); Kova (2007).

The gained differences in the motor efficiency can be explained with the interpersonal factors, i.e. with the biological and psychological background of the results of the tests (Sallis & Owen, 1999), according to Kova (2007). On the basis of the results from the research we can determine the level of the anthropological distinction with the two groups of examinees. The fact that the students from the secondary vocational school showed better results in almost all motor tests is the result of the supplementary "practical classes" which abound with different movement forms, which on the other hand is supported with the fact that certain motor activity in one type of body morphology can directly obstruct the realization of certain kinetic program, while in some other motor activity it can be quite favorable, which can be seen from the research work of Kurelić et al., 1975; Matvejev & Ulaga, 2000; Malacko et al., 2004 (according to Bompa, 2006). These results can be the basis for creation of school curriculum for the subject sport and sport activities in the secondary schools.

CONCLUSION

On the sample of 150 students aged fourth year from the secondary schools in Veles, divided in two sub-sample groups (75 students from the secondary vocational school and 75 from the gymnasium) 12 anthropometric measures and 13 motor tests were applied. The aim of this research was to determine the differences in the anthropometric variables and the motor skills between the two examined groups. The differences between the two groups have been determined with T-test for big independent samples and canonical discriminative analysis. From the results, with the application of the above specified statistical procedures, we can conclude that in the anthropometric area and in the motor area only one discriminative function has been isolated. The differences in the chosen anthropometric variables and mo-

tor tests are in relation to the students from the secondary vocational education. The differences are result not only from the classes in sport and sport activities, but also from the supplementary practice classes (practical work), which is obligatory for the students from the secondary vocational school, and which abounds with different movement forms which have extra influence on the transformation of the anthropological status and which can be noticed especially in the area of the motor skills of the examined samples.

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