DIFFERENCES IN CERTAIN KINANTROPOLOGICAL CHARACTERISTICS OF ELEMENTARY SCHOOL STUDENTS AND THEIR COMPARISON WITH CROFIT NORMS

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Abstract
The main purpose of this work is to identify differences in individual kinantropological characteristics of elementary school students and their comparison with Crofit norms. The research was conducted on a sample of 180 pupils from 5th to 8th grade of elementary school in Osijek. The sample was divided into sub-samples according to gender and age of students: 5th grade students (21 boys and 23 girls), 6th grade students (25 boys and 29 girls), 7th grade students (19 boys and 21 girls) and students of 8th grades (18 boys and 22 girls). The researched kinanthropological characteristics are two anthropometric measures (body height and body mass) from which is the result of body mass index, three motor abilities (coordination, MPN; flexibility, MPR; repetitive power, MPT) and functional ability (running 600, 800 meters; F600 for female pupils and F800 for male pupils). All tests are described in CRO FIT norms in the regular curriculum of physical and health education (Neljak and others, 2011).
Key words: kinantropological characteristics, research, Crofit norms, results

INTRODUCTION

Physical education as an integral and inseparable part of physical education, and thus general education, is a permanent, planned and systematic action on man, especially in his youth, by various means, and especially physical exercises, builds and comprehensively develops a man, influences the transformation of his anthropological characteristics, the formation of motor knowledge, improvement of motor achievements, participates in forming his personality and enables him to live and work (Findak, 1992)

The planning, determination and implementation of teaching content in Physical Education depends on the monitoring and verification of students. Findak (1992) claims that the first condition for monitoring and checking, ie evaluation of anthropological characteristics of students, is to initially check the condition of his anthropological characteristics and based on the obtained results to assess the present condition of the subject, ie to diagnose the acute condition of his anthropological characteristics. The diagnosis should include integral assessment of anthropometric characteristics, motor and functional abilities.

The use of data from the diagnosis of the state of kinanthropological characteristics for monitoring body composition and fitness preparation is possible during all years of students education. This information is sent to students, as well as to their parents (Neljak, Novak, Sporiš, Višković, Markuš 2011).

The transitional status of anthropological characteristics of students should be monitored, checked and controlled by transitional checking, which means throughout the school year; this indicates another condition for the success of this process. In fact, without systematic control of transitional status of anthropological characteristics, we cannot get insight and feedback on their transformation, manage transformation processes, correct the program or, if necessary, intervene in the programming of physical exercise processes. Moreover, we cannot obtain an answer about actual, expected or desired effects of student work or teacher work (Findak, 1992).

Findak (1992) claims that the final checking is the third condition for effective monitoring and verification and evaluation of anthropological characteristics of students and that the final checking, ie the results of the final checking are not necessary and useful only for an objective view of the anthropological characteristics of students at the end of the school year (specifically, for assessment of their improvement in relation to the initial state) but as indicative values for the next school year, and within this area monitoring and verification should include: a) anthropometric characteristics, b) motor abilities and c) functional abilities.

Kinanthropology (Greek kinesis = movement; anthropos = man; logos = science) as a scientific

discipline is the study of variability of human characteristics and characteristics important for the manifestation of abilities related to physical exercise and sports, from biological, psychological, cultural and social aspects (Mišigoj-Duraković, 2008). In the field of physical and health education, the term kinanthropological features is used as a common name for morphological features and motor and functional abilities of students (Neljak, Novak, Sporiš, Višković, Markuš 2011) The research of anthropometric, motor and functional abilities of students of different ages in this area was the subject of research by a large number of kinesiologists (Kurelić, Momirović, Stojanović, Šturm, Radojević, Viskić Štalec (1971, 1975)) (Gredelj, Metikoš, Hošek, Momirović (1975)).
The aim of the research is to determine whether there are differences between elementary school students regarding the age and gender and to compare the results with the standards of the Republic of Croatia.

METHODS

Participants

The appropriate sample of subjects consisted of 180 students from 5th to 8th grade of elementary school in Osijek. The sample was divided into sub-samples according to gender and age of students: 5th grade students (21 boys and 23 girls), 6th grade students (25 boys and 29 girls), 7th grade students (19 boys and 21 girls) and 8th grade students (18 boys and 22 girls).

Variables and procedure

The sample of variables consisted of two anthropometric measures (ATV body height and ATT body mass), from which the BMI body mass index was calculated, three tests to assess motor abilities (coordination, MPN; flexibility, MPR and repetitive strength, MPT) and one test for assessment of functional abilities (running 600 and 800 meters; F600 for female students and F800 for male students). All tests in the regular curriculum of Physical Education are described in Crofit norms (Neljak and associates, 2011).
Data were collected during the initial examination in the regular classes of Physical Education during the school year 2017/2018.

Data analysis

The basic descriptive parameters in each variable were calculated separately by gender and separately for each class. In order to determine the deviation in relation to the orientation values, the results were compared with the values of Crofit norms of the Republic of Croatia (Neljak, 2011). A t-test for independent samples was used to determine gender differences in each class, with a significance level of $p = 0.05$. The normality of the distribution was tested by Kolmogorov-Smirnov test.

RESULTS

Neljak and associates (2011) in Crofit norms divided each motor ability and functional ability into five categories, depending on the achievements of students and by grades. The following categories are listed: markedly below average, moderately below average, average, moderately above average, markedly above average.
The results in Table 1, analysis of descriptive parameters in all variables show that there are differences in nominal values in the 5th grade students, but these differences are not statistically significant.
The results of the analysis in Table 2, descriptive parameters in the variables ATT and MPN, show that there is a difference in the nominal values, but they are not statistically significant. The variables ATT, BMI, MPT, and MPR show that there is a statistically significant difference between 6th grade students. Female students have a higher body mass (ATT) than male students and a higher body mass index (BMI). Female students also perform better in the variables of torso lift from lying down (MPT) and prone bending (MPR).
The results of the analysis in Table 3, descriptive parameters in the variables ATV, ATT, BMI and MPN, show that there are differences in nominal values, but they are not statistically significant. The variables MPT and MPR show that there is a statistically significant difference between 7th grade students. Male students achieve better results in the variables of torso lifting from lying down (MPT), while female students achieve better results from the prone position (MPR).

Table 1. Basic descriptive parameters in all variables and gender differences between male and female students in the 5th grade

	Male students				Female students					
	AS	SD	Minimum	Maximum	AS	SD	Minimum	Maximum	t-value	p
ATV	148,79	7,47	130,50	160,00	151,37	8,31	136,00	168,50	-1,08	0,29
ATT	43,80	13,35	27,20	87,80	48,80	13,61	26,90	82,00	-1,23	0,23
BMI	19,55	4,73	14,97	34,73	21,06	4,46	12,28	32,03	-1,09	0,28
MPN	15,42	5,95	9,58	32,52	16,48	3,85	10,92	22,68	-0,69	0,49
MPT	36,19	9,47	18,00	58,00	38,43	6,65	24,00	57,00	-0,92	0,36
MPR	55,38	8,14	39,00	72,00	58,26	10,04	41,00	87,00	-1,04	0,30
F800(m)/F600(f)	4,58	0,80	3,43	6,30	3,54	0,77	2,48	6,25		

Table 2. Basic descriptive parameters in all variables and gender differences between male and female students in the 6th grade

	Male students				Female students					
	AS	SD	Minimum	Maximum	AS	SD	Minimum	Maximum	t-value	p
ATV	155,42	8,22	139,00	172,50	156,16	6,56	144,00	169,00	0,37	0,72
ATT	43,68	7,87	29,90	63,80	53,09	12,07	32,90	75,20	2,69	0,01*
BMI	18,06	2,58	13,47	24,30	21,49	4,47	15,43	29,38	2,75	0,01*
MPN	12,45	3,12	7,28	19,28	12,83	1,99	7,73	15,78	0,52	0,61
MPT	44,88	6,74	31,00	57,00	38,70	7,90	28,00	59,00	-3,02	0,00*
MPR	51,68	9,24	39,00	73,00	65,59	13,60	38,00	91,00	4,32	0,00*
F800(m)/F600(f)	4,42	0,79	3,50	6,52	3,29	0,49	2,40	4,38		

Table 3. Basic descriptive parameters in all variables and gender differences between male and female students in the 7th grade

	Male students				Female students					
	AS	SD	Minimum	Maximum	AS	SD	Minimum	Maximum	t-value	p
ATV	163,16	7,57	141,00	173,00	161,71	6,22	148,50	179,00	-0,66	0,51
ATT	59,91	14,12	32,80	93,40	58,41	9,69	45,20	78,00	-0,39	0,70
BMI	22,28	3,92	16,50	31,21	22,26	2,85	17,58	28,91	-0,02	0,98
MPN	11,80	3,05	8,13	18,75	13,67	4,62	8,00	24,04	1,43	0,16
MPT	49,33	7,05	39,00	63,00	42,29	7,08	32,00	55,00	-3,11	0,00*
MPR	61,17	13,04	42,00	89,00	72,74	9,04	52,00	86,00	3,26	0,00*
F800(m)/F600(f)	4,27	0,59	3,13	5,33	3,41	0,32	3,01	4,18		

The results of the analysis in Table 4, descriptive parameters in the variables BMI, MPN and MPT, show that there are differences in nominal values, but they are not statistically significant. The variables ATV, ATT, and MPR show that there is a statistically significant difference between 8th grade students. Male students have higher body height (ATV) and body weight (ATT) than female students. In the variable prone variable (MPR), female students perform better than male students.

Comparing the results of 5th grade male students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), Table 5 of the variable shows that students in ATV, ATT, ITM, MPN, MPR achieve average results, while the variable MPT they are significantly above average. Comparing the results of 5th grade students with Crofit norms of the Republic of Croatia (Neljak et al., 2011), Table 6 of the variable shows that students in ATV, ATT, ITM, MPN achieve average results, while in MPR they are moderately below average. MPT results are markedly above average.

Table 4. Basic descriptive parameters in all variables and gender differences between male and female students in the 8th grade

	Male students				Female students					
	AS	SD	Minimum	Maximum	AS	SD	Minimum	Maximum	t-value	p
ATV	167,94	7,80	155,00	190,00	163,52	6,73	150,00	174,50	-2,17	0,04*
ATT	59,97	12,47	36,10	89,90	55,36	13,94	38,00	110,00	-2,38	0,02*
BMI	21,06	2,87	14,93	25,22	20,42	4,13	16,89	36,12	-1,85	0,07
MPN	11,55	2,48	7,90	16,83	11,98	3,33	8,50	20,21	0,42	0,68
MPT	49,00	8,46	30,00	62,00	46,67	8,06	31,00	64,00	-0,60	0,55
MPR	63,00	10,04	41,00	88,00	73,18	17,04	35,00	100,00	2,05	0,04*
F800(m)/F600 (f)	4,16	0,49	3,33	5,11	2,97	0,39	2,43	3,42		

Table 5. Orientation values of Crofit norms for 5th grade male students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 5th grade
Body height (ATV)	<142,87	142,88-146,60	146,61-154,08	154,09-157,82	>157,83	148,79
Body mass (ATT)	>55,14	55,13-50,02	50,01-39,77	39,76-34,65	<34,64	43,80
ITM	> 24,63	24,62 – 22,85	22,84 – 19,29	19,28 – 17,52	< 17,51	19,55
Coordination (MPN)	> 18,13	18,12 – 16,47	16,46 – 12,75	12,74 – 10,69	< 10,68	15,42
Flexibility (MPR)	< 29	30 – 35	36 – 47	48 – 53	> 54	36,19
Repetitive power (MPT)	< 29	30 – 33	34 – 43	44 – 47	> 48	55,38
Functional abilities (F (800)	> 322,81	322,80– 289,83	289,82 – 223,87	223,86 – 190,90	< 190,89	4,58

Table 6. Orientation values of Crofit norms for 5th grade female students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 5th grade
Body height (ATV)	< 144,35	144,36 – 148,25	148,26 – 156,06	156,07 – 159,96	>159,97	151,37
Body mass (ATT)	> 56,89	51,47 – 56,88	40,61 – 51,46	40,60 – 35,18	< 35,17	48,80
ITM	> 28,58	28,57 – 24,19	24,18 – 15,39	15,38 – 10,99	< 10,98	21,06
Coordination (MPN)	> 20,85	20,84 – 18,69	18,68 – 14,37	14,36 – 12,22	< 12,21	16,48
Flexibility (MPR)	< 37	38 – 44	45 – 57	58 – 63	> 64	38,43
Repetitive power (MPT)	< 26	27 – 30	31 – 39	40 – 43	> 44	58,26
Functional abilities (F (800)	> 271,78	271,77– 242,37	242,36 – 183,54	183,53 – 154,13	< 154,12	3,54

Comparing the results of 6th grade male students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), Table 7 of the variable shows that students in ATV, MPN, MPR achieve average results, while the variables ATT and ITM results are moderately above average. The MPT variable shows that the results are markedly above average.

Comparing the results of 6th grade female students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), Table 8 of the variable shows that students in ATV, ATT, BMI achieve average results, while in MPN they are moderately above average. The results of the MPR variable show that the results are markedly below average, while the results of MPT are markedly above average.

Comparing the results of 7th grade male students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), Table 9 of the variable shows that students in ATV, ATT, ITM, MPN and MPR achieve average results, while in MPT they are significantly above average.

Table 7. Orientation values of Crofit norms for 6th grade male students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 6th grade
Body height (ATV)	< 147,97	147,98 – 152,00	152,01 – 160,07	160,08 – 164,10	> 164,11	155,42
Body mass (ATT)	> 61,69	61,68 – 55,71	55,70 – 43,73	43,72 – 37,74	< 37,73	43,68
ITM	> 25,12	25,11 – 23,30	23,29 – 19,64	19,63 – 17,81	< 17,80	18,06
Coordination (MPN)	> 17,47	17,46 – 15,67	15,66 – 12,06	12,05 – 10,26	< 10,25	12,45
Flexibility (MPR)	< 32	33 – 38	39 – 51	52 – 57	> 58	44,88
Repetitive power (MPT)	< 31	32 – 36	37 – 45	46 – 50	> 51	51,68
Functional abilities (F (800)	> 319,77	319,76 – 284,34	284,33 – 213,67	213,66 – 178,34	< 178,33	4,42

Table 8. Orientation values of Crofit norms for 6th grade female students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 6th grade
Body height (ATV)	< 150,51	150,52 – 154,14	154,15 – 161,41	161,42 – 165,04	> 165,05	156,16
Body mass (ATT)	> 61,56	61,55 – 55,82	55,81 – 44,33	44,32 – 38,59	< 38,58	53,09
ITM	> 23,90	23,89 – 22,03	22,02 – 18,27	18,26 – 16,39	< 16,38	21,49
Coordination (MPN)	> 19,10	19,09 – 17,14	17,13 – 13,20	13,19 – 11,23	< 11,22	12,83
Flexibility (MPR)	< 41	42 – 48	49 – 61	62 – 67	> 68	38,70
Repetitive power (MPT)	< 29	30 – 33	34 – 42	43 – 46	> 47	65,59
Functional abilities (F (800)	> 256,19	256,18 – 229,35	229,34 – 175,65	175,64 – 148,80	< 148,79	3,29

Table 9. Orientation values of Crofit norms for 7th grade male students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 7th grade
Body height (ATV)	< 154,77	154,78 – 159,31	159,32 – 168,40	168,41 – 172,94	> 172,95	163,16
Body mass (ATT)	> 68,53	68,52 – 62,11	62,10 – 49,25	49,24 – 42,82	< 42,81	59,91
ITM	> 25,28	25,27 – 23,34	23,33 – 19,45	19,44 – 17,51	< 17,50	22,28
Coordination (MPN)	> 16,85	16,84 – 15,02	15,01 – 11,34	11,33 – 9,50	< 9,49	11,80
Flexibility (MPR)	< 34	35 – 40	41 – 53	54 – 59	> 60	49,33
Repetitive power (MPT)	< 35	36 – 39	40 – 48	49 – 53	> 54	61,17
Functional abilities (F (800)	> 308,30	308,29 – 269,24	269,23 – 191,10	191,09 – 152,03	< 152,02	4,27

Comparing the results of 7th grade female students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), from Table 10 the variables show that students in ATV, ATT, ITM and MPN achieve average results, while in MPR they are markedly below average, and in MPTs they are markedly above average.

Comparing the results of 8th grade male students with Crofit norms of the Republic of Croatia (Neljak et al., 2011), Table 11 of the variable shows that students in ATV, ATT, ITM, MPN and MPR achieve average results, while in MPT they are significantly above average.

Comparing the results of 8th grade female students with Crofit norms of the Republic of Croatia (Neljak and associates, 2011), Table 12 of the variable shows that students in ATV, ATT and BMI achieve average results, while in MPN they are moderately above average, MPR extremely below average and MPT distinctly above average

Table 10. Orientation values of Crofit norms for 7th grade female students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 7th grade
Body height (ATV)	< 155,82	155,83 – 159,13	159,14 – 165,76	165,77 – 169,07	>169,08	161,71
Body mass (ATT)	> 65,22	65,21 – 59,97	59,86 – 49,16	49,15 – 43,81	< 43,80	58,41
ITM	> 24,13	24,12 – 22,41	22,40 – 18,95	18,94 – 17,22	< 17,21	22,26
Coordination (MPN)	> 18,19	18,18 – 16,35	16,34 – 12,66	12,65 – 10,82	< 10,81	13,67
Flexibility (MPR)	< 45	46 – 51	52 – 63	64 – 69	> 70	42,29
Repetitive power (MPT)	< 30	31 – 35	36 – 43	44 – 47	> 48	72,74
Functional abilities (F (800)	> 258,74	258,73 – 229,40	229,39 – 170,70	170,69 – 141,35	< 141,34	3,41

Table 11. Orientation values of Crofit norms for 8th grade male students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 8th grade
Body height (ATV)	< 161,71	161,72 – 165,98	165,99-174,53	174,54 – 178,80	> 178,81	167,94
Body mass (ATT)	> 72,08	72,07 – 66,20	66,19 – 54,42	54,41 – 48,53	< 48,52	59,97
ITM	> 25,00	24,99 – 23,26	23,25 – 19,77	19,76 – 18,03	< 18,02	21,06
Coordination (MPN)	> 14,65	14,64 – 13,20	13,19 – 10,29	10,28 – 8,84	< 8,83	11,55
Flexibility (MPR)	< 35	36 – 42	43 – 56	57 – 63	> 64	49,00
Repetitive power (MPT)	< 37	38 – 42	43 – 51	52 – 56	> 57	63,00
Functional abilities (F (800)	> 257,25	257,24 – 246,51	246,50 – 189,02	189,01 – 160,28	< 160,27	4,16

Table 12. Orientation values of Crofit norms for 8th grade female students in the Republic of Croatia

	markedly below average	moderately below average	average	moderately above average	markedly above average	AS students 8th grade
Body height (ATV)	< 158,19	158,20 – 161,42	161,43 – 167,89	167,90 – 171,12	< 171,13	163,52
Body mass (ATT)	> 66,81	66,80 – 61,83	61,82 – 51,88	51,87 – 46,86	< 46,85	55,36
ITM	> 24,21	24,20 – 22,61	22,60 – 19,39	19,38 – 17,78	< 17,77	20,42
Coordination (MPN)	> 17,06	17,05 – 15,29	15,38 – 12,03	12,02 – 10,35	<10,34	11,98
Flexibility (MPR)	< 47	48 – 53	54 – 66	67 – 72	> 73	46,67
Repetitive power (MPT)	< 30	31 – 35	36 – 45	46-50	> 51	73,18
Functional abilities (F (800)	> 52,17	52,16 – 47,94	47,93 – 39,47	39,46 – 35,24	< 35,23	2,97

DISCUSSION

The main objective of this paper was to determine whether there are differences between elementary school students with regard to age and gender and to compare the values of the results with the norms of the Republic of Croatia. The research conducted on a sample of 180 male and female students from 5th to 8th grade of elementary school in Osijek pointed out that there are statistically significant differences in certain kinanthropological characteristics of elementary school students.

In the 5th grade of elementary school, the results showed that there are no statistically significant differences between the 5th grade male and female students, but they appear already in the 6th grade, where there are statistically significant differences in the variables ATT, BMI, MPT and MPR, where female students achieve better results. In the 7th grade of elementary school, statistically significant differences were expressed in the variables MPT (male students achieve better results) and MPR (female students achieve better results). Statistically significant differences in the 8th grade of primary school are shown in the variables ATV and ATT, where male students achieve better results, while female students achieve better results in the variable MPR.

Comparing the results with Crofit norms, students in the 5th grade of elementary school achieve average results in the variables ATV, ATT, ITM, MPN and MPR, while in the variable MPT they are markedly above average. The 5th grade female students achieve average results in the variables ATV, ATT, ITM and MPN, but in MPR moderately below-average results, and in the variable MPT markedly above-average results.

In 6th grade, male students achieved average results from the variables ATV, MPN and MPR, while in the variables ATT and ITM they achieved moderately above-average results, but in the variable MPT the results were markedly above average. The 6th grade elementary school female students achieve average results in the variables ATV, ATT and ITM, while those with the variable MPN are moderately above average. The results of the MPR variable show that the results are markedly below average, while the results of MPT are markedly above average. The 7th grade male students achieve average results in the variables ATV, ATT, ITM, MPN and MPR, while the results in the variable MPT are markedly above average. The 7th grade female students achieve average results in the variables ATV, ATT, ITM and MPN, while in MPR the results are extremely below average, and in the variable MPT they are extremely above average. The 8th grade male students achieve average results from the variables ATV, ATT, ITM, MPN and MPR, while the results with MPT are markedly above average. The 8th grade female students show average results in the variables ATV, ATT and ITM, while in the variable MPN they are moderately above average, in the variable MPR they are extremely below average and in the variable MPT they are extremely above average.

Comparing the obtained results with previous research conducted by Badrić (2011) and Prskalo, Nedić, Sporiš, Badrić and Milanović (2011), it is obvious that there are statistically significant differences in the kinanthropological characteristics of 5th to 8th grade students. The results also showed that the differences become more apparent with students getting older and do not depend on the location of the research.

After analysing all the results, it can be said that students from 5th to 8th grade of elementary school in Osijek achieve average results with regard to gender and age. Variables that have markedly below-average results and moderately below-average results should be systematically improved as part of Physical Education.

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