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BIOLOGICAL MATURITY AS A FACTOR OF HOMOGENIZATION IN THE SUBJECT OF PHYSICAL EDUCATION

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Abstract. At the first meeting with his pupils a teacher of physical education notices that they differ in height, development of hairiness, difference in the breasts which girls no matter they are of the same age. The aim of this study is to point out to possibilities of homogenization of groups by their height and biological maturity so that the psycho-physical traumas would be avoided. The study included the schoolgirls at the age of 11 and 12. The total number of the examinees was 220 schoolgirls. The biological age of the schoolgirls was determined by the Tanner's method. The results of this survey show that according to height and body mass at every of the examined ages can be separated in three homogenous groups of examinees. The differences in body height at one age group between the tallest and the shortest girl is 17,0 and even more cm. There is statistically significant difference in body mass, power of the hand squeeze of the left and right hand. With the taller schoolgirls the percentage of menarchae, developness of the breast, axilar and pubic hairiness are more apparent.

1. INTRODUCTION

Surveys carried out in this country and in the world point out that growth and development with man is different within a calendar age. A certain number of authors points out too, that within one calendar age at human organism during its development, there is a difference in biological maturity. The difference in biological maturity causes the definite differences in growth and development of the psychological and motoric abilities. All this points out that the teacher should take care of these factors during the lessons of physical education, especially in the elementary school.

At the first meeting with the pupils of the elementary school, specially with those of higher grades, the physical education teacher notices that the pupils of the same class are very different in height and body mass, likewise some of them already have the first signs

of moustache, beard and axillary hairiness with the boys. The changes can be noticed with the girls meaning that some already have developed breasts while the others do not have breasts at all. Some girls have menses while the others still don't.

Considering the elements which the PE teacher takes into consideration while giving marks to his pupils of the fifth and the sixth classes we notice the categories: jump, putting the shot, long horse vault in gymnastics, and of sports games handball, and basketball. The same criterion at giving marks was applied for all the pupils.

For the mentioned reasons, the aim of this study is to point out the possibility of homogenization of groups by definite criterion of the biological maturity because of the more objective evaluation on the classes of the physical education in the elementary school. The same holds true for prevention of physical and psycho traumas during the contests in sports games, cross country races and other sports.

2. MATERIALS AND METHODS OF WORK

The examination included the schoolgirls of the elementary schools "Kole Rašić" and "Sveti Sava" from Niš age 11 and 12. The total number of the examinees was 220, 83 of which aged 11 and 137 aged 12. Measuring their height and body mass was done by standard instruments after the method recommended by IBP (Weiner J. Lourie J., 1969.). Biological age was determined by Tanner, so that the axillary hairiness was pointed from 1 - 3 (in which case one meant no hairs and 3 meant hairiness like with a grown up person), pubic hairiness and development of the breasts from 1 - 5 (1 in this case meant no hairiness and development of breasts like with boys, but 5 meant breasts and hairiness like with a grown up mature woman). We also registered the presence of menarche with the examinees.

The power of the flexory fingers of the left and right hand was determined by dynamometer with spring after Collins type "Medicon".

3. RESULTS WITH DISCUSSION

On the following tables the basic statistic parameters are shown and the importance of the differences of arithmetical average of height, body mass and the strength of the squeeze of left and right hand with the examinees of the age of 11. The differences in biological maturity were also shown in percentage marked by Tanner method.

The obtained results shown in the table 1. point out that examinees aged 11 body height 140 - 149,9 cm in relation to the total number of examinees of the same age are of the less average height and body mass, weaker right hand squeezing and biologically younger referring to the same index of the average values with all the examinees of the age of 11.

The results shown on the table 2. point out that the examinees of 150 - 159,9 cm body height statistically are rather taller and of greater body mass relating to the average values of all the examinees of the same age. They are biologically more mature and the percentage of menarche is higher. The strength of left and right hand squeezing is average stronger with the girls of the first group but not statistically significant.

Table 1. Statistical importance of the differences of the arithmetical average of height and body mass, the strength of hand squeezing and biological maturity with the girls of 11, height (140-149,9cm) and all the examinees 11 years old.

Variables	Body height 140-149,9cm (N= 40)		Average height with girls (N= 83)			
	SV	SD	SV	SD	t	p
Body height, cm	146,00	3,16	150,60	7,65	- 4,84	< 0,001
Body mass, kg	36,592	5,05	42,08	9,56	- 4,25	< 0,001

The power of strength squeezing in kg

Left hand	16,22	5,88	17,68	5,69	- 1,35	> 0,05
Right hand	17,37	5,38	19,62	6,07	- 2,12	< 0,05

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	67,50	30,00	2,50	-	-	50,00	43,33	6,66	-	-
Pubic hairs	40,00	40,00	17,50	2,50	-	33,33	16,66	33,33	6,66	1,11
Breasts	27,50	57,50	12,50	2,50	-	22,00	41,11	32,22	6,66	-
Menarcha	No					10,00				

Table 2. Statistical importance of the differences of the arithmetical averages of height and body mass, the power of hand squeezing and biological maturity with the girls of 11 years old, height (150-159,9cm) and all the examinees 11 years old.

Variables	Body height 150-159,9cm (N= 32)		Average height with girls (N= 83)			
	SV	SD	SV	SD	t	p
Body height, cm	154,71	2,77	150,60	7,65	4,37	< 0,001
Body mass, kg	47,48	8,39	42,08	9,56	3,01	< 0,001

The power of strength squeezing in kg

Left hand	19,28	5,59	17,68	5,69	1,39	> 0,05
Right hand	21,53	6,16	19,62	6,07	1,51	> 0,05

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	34,37	56,25	9,37	-	-	50,00	43,33	6,66	-	-
Pubic hairs	12,50	31,25	37,50	18,75	-	33,33	16,66	33,33	6,66	1,11
Breasts	9,37	28,18	53,12	9,37	-	22,00	41,11	32,22	6,66	-
Menarcha	15,62					10,00				

According to this, 32 schoolgirls had advantage with their height and body mass the stronger squeeze with their left and right hand likewise the biological maturity referring to the same average index of all the other schoolgirls of the same age. These schoolgirls were more successful in all the exercises in the subject of physical education, than the schoolgirls who are shorter and with less body mass, with less strength of the definite muscular groups and by their biological maturity younger.

Analysing the results shown in the table 3. we can conclude that the girls of 11 whose height is 160 cm and more, are statistically of a significant greater body height, body mass, power of left and right hand squeeze are biologically older relating to the same values of

all the examinees of 11. The results gained this way point out that 11 schoolgirls of 11 can be in a real advantage referring to the rest of the schoolgirls as for their height and body mass, the power of the definite muscular groups, not only doing the exercises in the subject of PE but also in some competition activities in some sports and games like athletics (crosscountry, high jump) basketball, handball, volleyball and other sports.

Table 3. Statistical importance of the differences of the arithmetical averages of height and body mass, the strength of hand squeezing and biological maturity with the girls of 11 years old, height (160 and more cm) and all the examinees 11 years old.

Variables	Body height 160 and more cm (N=11)		Average height with girls (N= 83)			
	SV	SD	SV	SD	t	p
Body height, cm	163,42	3,33	150,60	7,65	9,94	< 0,001
Body mass, kg	52,27	8,60	42,08	9,56	3,66	< 0,001

The power of strength squeezing in kg

Left hand	20,73	3,98	17,68	5,69	2,28	< 0,05
Right hand	24,64	5,06	19,62	6,07	3,04	< 0,005

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	18,18	63,63	18,18	-	-	50,00	43,33	6,66	-	-
Pubic hairs	9,09	-	18,18	63,63	9,09	33,33	16,66	33,33	6,66	1,11
Breasts	9,09	18,18	54,54	18,18	-	22,00	41,11	32,22	6,66	-
Menarcha	36,36					10,00				

Table 4. Statistical importance of the differences of the arithmetical averages of height and body mass, the strength of hand squeezing and biological maturity with the girls of 12 years old, height (140-149,9 cm) and all the examinees 12 years old.

Variables	Body height 140-149,9cm (N= 20)		Average height with girls (N= 137)			
	SV	SD	SV	SD	t	p
Body height, cm	145,69	1,68	157,19	6,87	-16,67	< 0,001
Body mass, kg	35,70	3,08	48,15	9,98	-11,45	< 0,001

The power of strength squeezing in kg

Left hand	17,20	4,74	21,37	6,99	-3,59	< 0,001
Right hand	18,95	3,92	23,75	7,64	-4,40	< 0,001

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	35,00	60,00	5,00	-	-	18,43	47,52	34,04	-	-
Pubic hairs	-	55,00	40,00	5,00	-	4,25	16,31	29,79	3,33	16,31
Breasts	10,00	45,00	40,00	5,00	-	3,35	22,61	42,55	4,82	6,38
Menarcha	5,00					44,68				

The results on the table 4. point out that the girls of 12 whose height is from 140 - 149,9 cm are statistically of a significant less height and body mass, and less powerful left and right hand squeeze likewise biologically younger relating to the some values of all

examinees of 12 years old. Their greater psycho - physical charge is evident relating to the examinees with greater values of examined parameters.

Table 5. Statistical importance of the differences of the arithmetical averages of height and body mass, the strength of hand squeezing and biological maturity with the girls of 12 years old, height (150 - 159,9 cm) and all the examinees 12 years old.

Variables	Body height 150-159,9cm (N= 71)		Average height with girls (N=137)			
	SV	SD	SV	SD	t	p
Body height, cm	155,45	2,81	157,19	6,87	-2,59	< 0,01
Body mass, kg	47,06	8,31	48,15	9,98	-0,84	> 0,05

The power of strength squeezing in kg

Left hand	21,14	6,67	21,37	6,99	-0,23	> 0,05
Right hand	23,65	6,67	23,75	7,64	-0,09	> 0,05

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	1,13	49,29	29,58	-	-	18,43	47,52	34,04	-	-
Pubic hairs	5,63	16,90	36,92	25,35	5,49	4,25	16,31	29,79	3,33	16,31
Breasts	1,41	28,17	45,07	15,49	9,86	3,35	22,61	42,55	4,82	6,38
Menarcha	2,25					44,68				

Analising the results shown in the table 5. we can conclude that the examinees at the age of 12 whose body height is from 150 - 159,9 cm are significantly statistically of less body height and biologically younger relating to the average values of the some index of all examinees of this age. The power of their left and right hand squeeze are of almost identical values.

Table 6. Statistical importance of the differences of the arithmetical averages of height and body mass, the strength of hand squeezing and biological maturity with the girls of 12 years old, height (160 and more cm) and all the examinees 12 years old.

Variables	Body height 160 and more cm (N=46)		Average height with girls (N=137)			
	SV	SD	SV	SD	t	p
Body height, cm	164,68	3,06	157,19	6,87	10,26	< 0,001
Body mass, kg	54,85	8,73	48,15	9,98	4,35	< 0,001

The power of strength squeezing in kg

Left hand	23,35	7,58	21,37	6,99	1,57	> 0,05
Right hand	24,54	10,54	23,75	7,64	0,67	> 0,05

Biological maturity after Tanner in percentage

Mark - Tanner	1.00	2.00	3.00	4.00	5.00	1.00	2.00	3.00	4.00	5.00
Hairness in axilla	6,52	39,13	54,25	-	-	18,43	47,52	34,04	-	-
Pubic hairs	-	2,17	15,22	56,52	26,09	4,25	16,31	29,79	3,33	16,31
Breasts	-	8,69	39,13	47,83	4,35	3,35	22,61	42,55	4,82	6,38
Menarcha	63,04					44,68				

The examinees of the age of 12 whose height is above 160,0 cm in average are statistically of a significant greater height and body mass and they are biologically more mature relating to the average values of those indexes with all the examinees of this age. The examinees of the height above 160,0 cm have average numerical values of their left and right hand squeeze but greater to these values with all the examinees, but not statistically significant. These results are shown in table 6.

Analysing such obtained results we can notice a great difference within the calendar age in height and body mass likewise in biological maturity. There also exists some difference in the power of their left and right hand squeeze.

This leads to conclusion that we must be very careful while applying the criterion when evaluating the pupils capabilities in physical education. This refers not only to athletic disciplines, exercises on gymnastic devices but also to some elements of sports games. We must pay attention while making teams for competition in sports games, in order to prevent injuries. Namely, the girls of the stronger body shape must be opposed by the team similar by body height and mass. This difference must be specially emphasized if the groups or teams of the same age are matched at school competitions (cross countries, competitions in athletic disciplines, sports games) which is a usual practice in some towns. Only if we take care of making homogenous groups in the subject of physical education, in sports school clubs and during the competitions we can make sports and physical education become a very important factor in raising health and physical - functional capabilities.

Considering the elements of the syllabus of physical education in the elementary school like evaluation and verification and organisation of competitions at school and among school we must conclude the following:

1. In order to prevent psychical and physical traumas in the lessons of physical education, it is necessary to homogenize the groups of pupils not only by their height and body mass, but also by their biological maturity.

2. Evaluation in the subject of PE must be adapted besides to physical, motoric and psychical capabilities also to biological maturity of the pupils

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BIOLOŠKA ZRELOST KAO FAKTOR HOMOGENIZACIJE GRUPA U NASTAVI FIZIČKOG VASPITANJA

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Pri prvom susretu sa učenicima profesor fizičke kulture zapaža da se oni razlikuju po telesnoj visini, razvoju maljavosti, nejednakim razvojem grudi kod žena i pored toga što pripadaju istoj kalendarskoj starosti. Cilj ovog rada je da ukaže na mogućnosti homogenizacije grupa po visini i biološkoj zrelosti, kako bi se pri izvođenju nastave fizičkog vaspitanja izbegle psiho i fizičke traume učenika. Ispitivanjem su obuhvaćene učenice kalendarske starosti 11 i 12 godina. Ukupan broj ispitanica iznosio je 220 učenica. Biološka starost učenica utvrđivana je metodom po Tanner - u. Rezultati ovog istraživanja ukazuju da se po visini i masi tela u svakom od ispitivanih godišta mogu izdvojiti po tri homogene grupe ispitanica. Razlike u visini tela u jednom godištu između učenice najveće i najmanje visine tela iznosi 17,0 i više cm. Statistički značajne razlike postoje i u telesnoj masi, snazi stiska šake leve i desne ruke. Kod učenica veće visine tela veći je i procenat pojave menarhe, razvijenosti grudi, aksilarne i pubične maljavosti.