SOMATIC DEVELOPMENT AND MOTOR FITNESS OF SECONDARY SCHOOL FEMALE STUDENTS IN PRESOV REGION

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- Body height,
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- Eurofit,
- Female

Abstract:

Thesis presents partial results of research task supported by Slovak Research and Development Agency according to contract APVV-0768-11 named Physical, functional and motor development of secondary school students in the reflection of their physical activity. The aim of thesis was to analyze the level of somatic development and general motor fitness of secondary school female students. Research group consisted of 163 female at the age of 15 to 19 years in three secondary schools in Presov region. Anthropometrical indicators as body height, body weight, BMI and thickness of five skinfolds were measured. For testing general motor fitness tests, Eurofit battery was applied. Gained data were compared with results of 7th national anthropometric survey held in 2011 and with the results of Slovak school population measured in 1993-1994 using control-information system Eurofit [6, 7]. Research group with its average values of basic anthropometric indicators occupies the referential value level of Slovak adolescent population. After a period of 20 years we can state secular trend ending in body height and increase of body weight with simultaneous slight increase of skinfolds sum. Data analysis of motor fitness showed evident differences against secondary school females. Analysis of motor fitness data showed significant differences against present secondary school females especially in aerobic endurance, explosive strength of lower limbs and joint flexibility. Comparable results were found only in Handgrip test, 10x5 meter Shuttle run test and Bent-Arm-Hang test.

INTRODUCTION

The issue of somatic fitness and motor fitness is currently one of the most actual problem involving both gender and all age categories. Society-wide standard shows decrease of habitual movement activity in lifestyle of current population. Youth of today prefer more likely passive spending of free time despite of generally known appropriate movement activity importance for health and life quality of human. The result of that are not only the decrease of somatic fitness and motor fitness but also related thereto adverse changes in body composition and also health complications at this age. Unfortunately, only small group of youth actively do sport and create positive relationship to sport [2].

Monitoring of somatic development and motor fitness of Slovak school population was studied by many authors [1, 2, 5, 9].

School physical education provides educational process with its content and orientation which influences children and youth healthy lifestyle realization. Its main aspect is apart from motor habits and skills acquiring also somatic and motor fitness increasing of children and

adolescent population. Monitoring of children and adolescents basic somatic characteristics is an important way to evaluate their actual health and nutrition status.

The aim of the thesis, within project APVV-0768-11, was to evaluate current level of somatic development and motor fitness of secondary school females in three chosen secondary schools in Presov region. Eurofit test battery [6, 7, 8], with which national measuring of 7 to 18 year old population was carried out in 1993-1994, was used to evaluate tendency in mentioned indicators for last 20 years.

METHODS

The research group consisted of 163 female students from 1st to 4th classes of three secondary schools in Presov region: Medical High School in Presov, Hotel Academy in Presov and Pedagogic High School in Levoca. Compulsory schooling of P.E. was in the range of two P.E. units per week. Research group consisted of 1st year female students – age category 15.00 – 15.99 (n = 48, age x = 15.71 ± 0.31), 2nd year female students – age category 16.00 – 16.99 (n = 31, age x = 16.55 ± 0.32), 3rd year female students – age category 17.00 – 17.99 (n = 58, age x = 17.60 ± 0.27) and 4th year female students – age category 18.00 – 18.99 (n = 26, age x = 18.84 ± 0.70).

Measures were carried out in October 2013/2014 during class within standard conditions in particular school gyms. Students were informed about the process of testing. The level of somatic development was measured by anthropometric testing. Body height was measured by altimeter Seca to an accuracy 0.1 cm and body weight was measured by InBody 230 device to accuracy 0.1 kg. Height-weight index BMI was measured according to pattern TH (kg): TV^2 (m). Thickness of five skinfolds (triceps, biceps and spinal area – subscapularis skinfold, hip area – supraspinalis skinfold and on calf area - calf medialis skinfold) as a part of Eurofit test battery was measured by Best caliper to accuracy of 0.5 mm. Body height, body weight and BMI were evaluated according to national growth graphs for specific age categories.

For diagnosing general motor fitness 9 tests of Eurofit test battery were applied: Flamingo Balance test, Plate tapping, Sit-and-Reach test, Standing Broad Jump, Handgrip test, Sit-Ups, Bent Arm Hang, 10x5 meter Shuttle run and 20m Endurance shuttle run. Basic statistical characteristics were used for processing gained data.

RESULTS AND DISCUSSION

Somatic development

Basic statistical characteristics of female research group anthropometrical indicators are presented in Table 1. Mean values of female body height, body weight and BMI of specific age categories are situated on the level of 50th up to 75th percentile, thus in zone of middle body height and normal weight, according to national growth standards. With increasing age, the increase of body height and body weight values were found between 15 and 16 years old namely by 3.6 cm and 3.4 kg while in other age categories stagnation can be stated.

In the case of BMI, temporary decrease of average value was found in 16-year-old females that at the same also represent the lowest average BMI value namely 20.7 while the highest value 21.6 was found in females that were on the adulthood threshold. Intraindividual analysis of BMI values, according to national growth graphs for specific age categories, showed that 8.6% females are in overweight zone (90. – 97. percentile) and 3.7% females is in obese zone (> 97. percentile). All females have higher values of BMI and higher values of skinfolds sum. We found out that most of 15-year-old females were overweight and 17-year-old females had obesity.

Table 1. Basic statistical characteristics of anthropometric indicators in female group

Group Female		**BH** (cm)	**BW** (kg)	**BMI** (kg . m^{-2})
I. year	**x**	**163.1**	**56.3**	**21.2**
(n = 48)	s	5.2	8.4	2.9
II. year	**x**	**166.7**	**59.7**	**20.7**
(n = 31)	s	4.6	10.6	3.1
III. year	**x**	**166.9**	**59.6**	**21.2**
(n = 58)	s	6.5	9.1	3.0
IV. year	**x**	**166.2**	**60.0**	**21.6**
(n = 26)	s	4.3	7.7	4.0

Legend: BH – body height BW- body weight BMI - Body mass index x - mean s – standard deviation, n – number

The comparison of somatic development of female research group with measures of Slovak population using Eurofit in 1993 - 1994

Based on somatic development results comparison of Slovak adolescent population realized 20 years ago and using Eurofit test battery we can state increase of average body weight values in the range of 2.2 to 4.4 kg simultaneously with lower average body height values in monitored female research group. Except for increase of body weight which was simultaneous with slightly increase of skinfolds sum apart from 17-years-old females. Gained data correspond with results of recent national anthropometric surveys and confirm ending of secular trend in body height case.

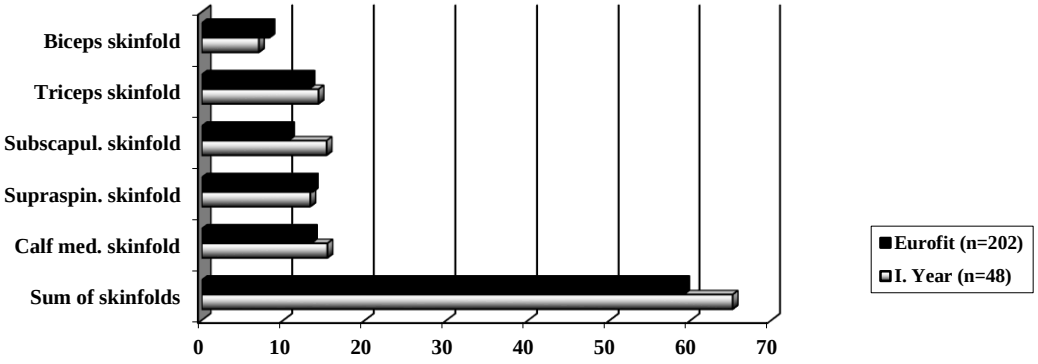
By analysis of skinfold thickness mean values (Figure 1-4) we found out:

–Higher mean values of triceps, subscapularis and calf medialis skinfolds in 15-year-old female students;

–Higher mean values of triceps and subscapularis skinfolds in 16-year-old female students;

–Higher mean values of subscapularis and supraspinalis skinfolds in 17-year-old female students;

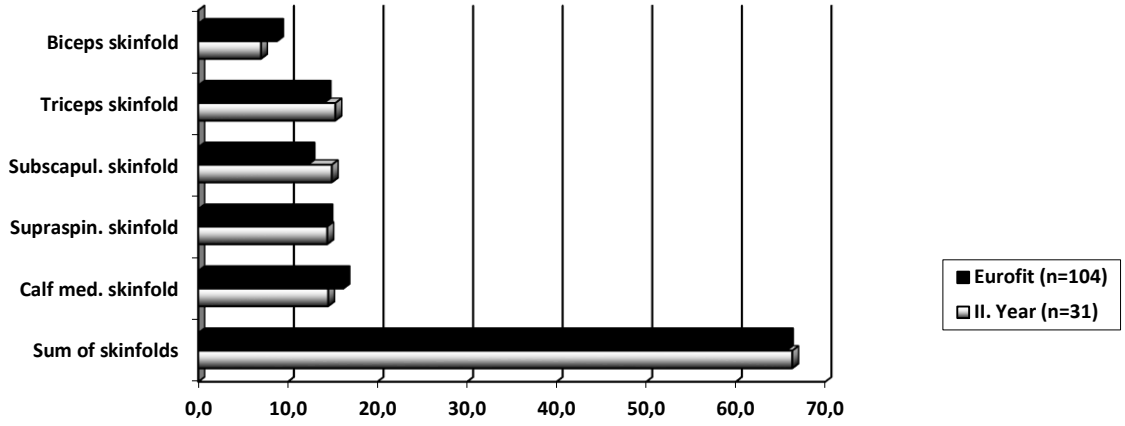
–Higher mean values of biceps, triceps, subscapularis and calf medialis skinfolds in 18-year-old female students;



	Sum of skinfolds	Calf med. skinfold	Supraspin. skinfold	Subscapul. skinfold	Triceps skinfold	Biceps skinfold
Eurofit (n=202)	59,2	13,5	13,6	10,7	13,2	8,3
I. Year (n=48)	65,2	15,4	13,3	15,3	14,3	7,0

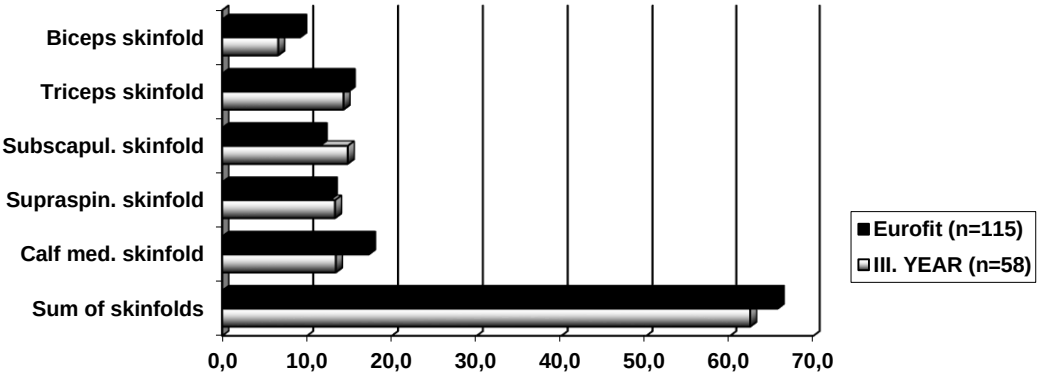
Figure 1. Thickness comparison of mean skinfold values (mm) between female in I. year (n = 48, age x = 15.7) and research group measured by Eurofit in 1993-94 (n = 202, age x = 15.5)

On the basis of above mentioned we can formulate that in all age categories were observed higher average values of subscapularis skinfold (od 2.0 do 4.6 mm) and the smallest difference were found in supraspinalis skinfold thickness (od 0.1 do 0.4 mm).



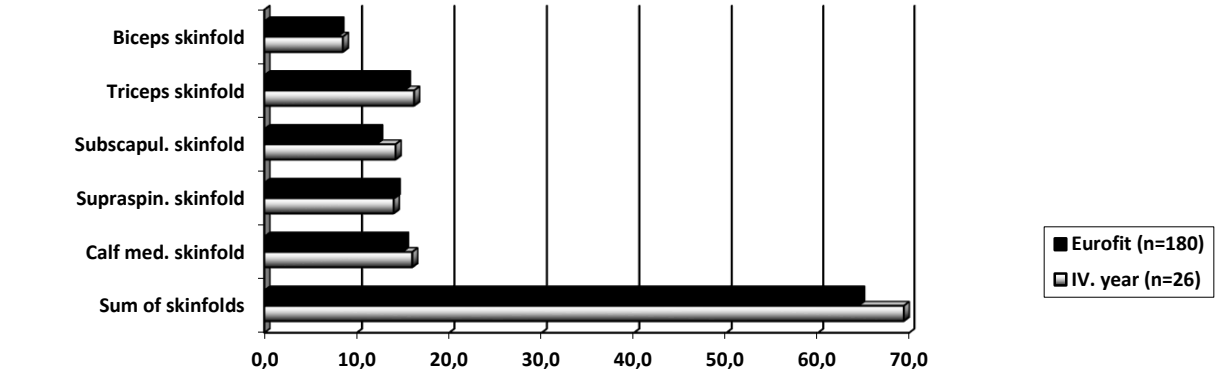
	Sum of skinfolds	Calf med. skinfold	Supraspin. skinfold	Subscapul. skinfold	Triceps skinfold	Biceps skinfold
Eurofit (n=104)	65,7	16,2	14,3	12,3	14,1	8,8
II. Year (n=31)	66,3	14,5	14,4	14,9	15,3	7,0

Figure 2. Thickness comparison of mean skinfold values (mm) between female in II. year (n = 31, age x = 16.6) and research group measured by Eurofit in 1993-94 (n = 104, age x = 16.5)



	Sum of skinfolds	Calf med. skinfold	Supraspin. skinfold	Subscapul. skinfold	Triceps skinfold	Biceps skinfold
Eurofit (n=115)	65,7	17,3	12,8	11,6	14,9	9,2
III. YEAR (n=58)	62,4	13,4	13,3	14,8	14,3	6,6

Figure 3. Thickness comparison of mean skinfold values (mm) between female in 3th year (n = 58, age x = 17.6) and research group measured by Eurofit in 1993-94 (n = 115, age x = 17.6)



	Sum of skinfolds	Calf med. skinfold	Supraspin. skinfold	Subscapul. skinfold	Triceps skinfold	Biceps skinfold
Eurofit (n=180)	64,5	15,0	14,1	12,2	15,2	8,0
IV. year (n=26)	69,4	16,0	14,0	14,2	16,2	8,5

Figure 4. Thickness comparison of mean skinfold values between female in 4th year (n = 26, age x = 18.8) and research group measured by Eurofit in 1993-94 (n = 180, age x = 19.2)

Comparison of motor fitness outcomes between female research group and Slovak school population measured by Eurofit in 1993 – 1994.

In Table 2 and 5 are presented basic statistical characteristics of research female group in specific age categories and Slovak research group tested by Eurofit in 1993-94. In 6 out of 9 tested indicators were found worse results between compared groups in following tests: Sit-and-Reach – factor of joint flexibility and muscle elasticity; Standing Broad Jump – explosive power of lower limb`s factor; Sit-Ups – factor of dynamic strength of lumbosacral spinal part, 20m Endurance shuttle run – aerobic endurance factor and two coordination tests which are part of Eurofit test battery – Plate tapping with limited frequency speed of dominant hand and Flamingo Balance test that focuses on static balance. Similar results were found in Shuttle run test, Handgrip test and Bent Arm Hang – isometric strength factor of arms and shoulders where only 1st year females that achieved better results while in other categories were comparable results.

Table 2. Basic statistical characteristics of motor fitness in female group in 1st year (age x = 15.7) and Eurofit group (age x = 15.5)

Test	**I. Year** (n = 48)		**Eurofit group** (n = 202)	
	x	**s**	**x**	**s**
Flamingo Balance test (number of falls)	**5.8**	3.7	**9.3**	6.4
Plate tapping (sec.)	**13.2**	1.3	**10.8**	1.5
Sit-and-Reach (cm)	**1.4**	11.4	**28.9**	6.4
Standing Broad Jump (cm)	**162.5**	24.5	**174.4**	18.1
Handgrip test (kg)	**32.9**	5.7	**32.9**	4.7
Sit-Ups (number/30sec.)	**21.1**	3.7	**24.6**	4.2
Bent Arm Hang (sec.)	**21.7**	17.5	**15.2**	13.7
10x5 meter Shuttle run (sec.)	**21.1**	1.9	**20.8**	1.6
20m Endurance shuttle run (shuttles)	**21.5**	21.2	**37.6**	13.0

Table 3. Basic statistical characteristics of motor fitness in female group in 2nd year (age x = 16.6) and Eurofit group (age x = 16.5)

Test	**II. Year** (n = 31)		**Eurofit group** (n = 104)	
	x	**s**	**x**	**s**
Flamingo Balance test (number of falls)	**5.6**	2.2	**10.9**	5.5
Plate tapping (sec.)	**12.9**	1.9	**10.9**	2.2
Sit-and-Reach (cm)	**9.9**	4.5	**27.5**	6.3
Standing Broad Jump (cm)	**158.5**	19.6	**174.1**	18.9
Handgrip test (kg)	**30.9**	4.2	**33.8**	5.0
Sit-Ups (number/30sec.)	**19.2**	3.3	**23.7**	4.0
Bent Arm Hang (sec.)	**21.9**	13.9	**21.1**	17.5
10x5 meter Shuttle run (sec.)	**22.6**	1.9	**21.3**	1.8
20m Endurance shuttle run (shuttles)	**29.2**	9.2	**39.2**	13.7

Table 4. Basic statistical characteristics of motor fitness in female group in 3rd year (age x = 17.6) and Eurofit group (age x = 17.6)

Test	**III. Year** (n = 58)		**Eurofit group** (n = 115)	
	x	**S**	**x**	**s**
Flamingo Balance test (number of falls)	**4.3**	2.7	**12.6**	5.8
Plate tapping (sec.)	**12.9**	2	**10.6**	1.2
Sit-and-Reach (cm)	**-1.0**	0	**27.2**	5.7
Standing Broad Jump (cm)	**162.0**	24.6	**173.6**	19.8
Handgrip test (kg)	**31.0**	3.7	**31.8**	5.8
Sit-Ups (number/30sec.)	**21.4**	2.8	**23.5**	4
Bent Arm Hang (sec.)	**24.1**	15.9	**22.7**	18.7
10x5 meter Shuttle run (sec.)	**21.7**	2.1	**21.1**	1.4
20m Endurance shuttle run (shuttles)	**20.2**	15.5	**37.7**	14.1

Table 5. Basic statistical characteristics of motor fitness in female group in 4th year (age x = 18.8) and Eurofit group (age x = 19.2)

Test	**IV. Year** (n = 26)		**Eurofit Group** (n = 180)	
	x	**S**	**x**	**s**
Flamingo Balance test (number of falls)	**3.9**	2.5	**11.6**	6
Plate tapping (sec.)	**12.5**	1.9	**9.7**	1.5
Sit-and-Reach (cm)	**-0.6**	11.6	**26.9**	6.9
Standing Broad Jump (cm)	**160.3**	25.6	**173.8**	19.7
Handgrip test (kg)	**35.5**	8.4	**33.1**	5.1
Sit-Ups (number/30sec.)	**21.3**	4	**25.1**	5.6
Bent Arm Hang (sec.)	**22.8**	14.4	**22.1**	18.2
10x5 meter Shuttle run (sec.)	**20.6**	1.8	**21.8**	1.7
20m Endurance shuttle run (shuttles)	**19.1**	16	**35.7**	12.6

CONCLUSION

Negative tendency of school population motor fitness development in Slovakia was also confirmed in our research group. On the level of somatic development we found 8.6% occurrence of overweight and 3.7% of obesity in female adolescent. After a period of 20 years we found out growth of body weight simultaneously with the growth of skinfolds sum and stagnation of body height. Motor fitness data analysis showed lower level in 6 out of 9 Eurofit tests. The most significant difference against present secondary school females were found in

aerobic endurance, explosive strength of lower limbs and joint flexibility. Analyzed data correspond with preferred passively spend free time which results on inadequate level of motor skills and undesired changes in body composition. Physical education is the only school subject that develops motor functions of children and youth, provides movement education and contributes to formation of relationship to lifetime movement activity as one of the most effective device for preventing healthy disorders and increasing life quality. It is important to find appropriate motivational factors to increase the amount of movement activity in adolescent population because each movement is more effective than no movement.

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