Research article

Identification of asymmetries between longitudinal parameters and anthropometric proportionality ratios in children aged between 7 - 10 years

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Abstract: (The present study pursued the investigation of anthropometric asymmetries regarding the length of the upper and lower limbs and the indices of body proportionality and had the follow-ing ob-jectives: identifying the differences between the female and male groups, in the 4 age catego-ries (7, 8, 9 and 10 years old), regarding anthropometric parameters and proportionality indicators; also tried to identify the differences in anthropometric parameters and proportionality indicators between the 4 age categories (7 - 10 years old) for each gender (female, respectively male). The study included 727 subjects with the age between 7-10 years, of which 383 (52.7%) female and 344 (47.3%) male, the subjects being divided into four groups according to age (7, 8, 9 and 10 years old groups). The measurements aimed at the following longitudinal anthropometric parameters and the calcula-tion of proportionality ratios: height (cm); the length of the right upper limb (cm – LUL Right); the length of the left upper limb (cm – LUL Left); the length of the right lower limb (cm - LLL   Right); the length of the left lower limb (cm - LLL   Left); ratio of LUL Right X 100 / LLL Right; ratio of LUL Left x 100 / LLL   Left;   ratio of LUL Right x 100 / height; ratio of LUL Left x 100 / height;   ratio of LLL Right x 100 / height;   ratio of LLL_Left x 100/ height. Analyzing ccompara-tively the results recorded between the upper and lower right and left segments, we find asym-metry in all samples according to age and gender. The differences between the groups of girls and boys, in all age cate-gories, were statistically significant. The ANOVA analysis reflects statis-tically significant differ-ences between the 4 age groups (7 - 10 years) in all anthropometric evalu-ations. The largest asym-metries between the right and left upper limb were recorded in the age category of 7 years old group; respectively, the largest asymmetries between the lower limbs were recorded in the 10 year old groups depending on gender.

Keywords: longitudinal anthropometric dimensions; segmental laterality; anthropometric asymmetries; limb length; height; gender and age differences

1.   Introduction

The evaluation of the physical anthropometric parameters of children facilitates the understanding of the mechanisms of growth and physical development and the identification of the factors that influence and condition the body development. The inequality of the contralateral upper or lower limbs during the growth period represents

an important concern of the specialists in order to adapt and implement prophylaxis programs and corrective physical exercises [1-3]. The knowledge of how different longitudinal anthropometric dimensions develop and especially the identification of inter-limbs asymmetries are relatively known in relation to age and gender due to the specific phenomena of the secular trend [4-6] Expanding the knowledge of how inter-limbs longitudinal asymmetries are manifested will facilitate the understanding of their effects on the biomechanics of movements, specific physical or sports performance for different age categories [7-9].

Numerous researches have focused on the influence of: age, gender, the level of physical activity, vicious attitudes, physical deficiencies, and the impact of some activities on the development and growth of some anthropometric parameters [10-12]. A number of studies have highlighted non-linear relationships between anthropometric body proportions and age [13-15]. Experts in the medical field and physical exercise believe that anthropometric measurements, weight, height, arm circumference, length of lower and upper limbs represent relevant criteria of their nutritional status, health and socio-economic level in school-aged children [16-19].

The growth process presents an upward and uneven dynamic in relation to age and gender, which determines important differences between the dimensions of some longitudinal anthropometric parameters, as well as the appearance of some asymmetries between the contralateral segments [20-22]. These differences between the longitudinal dimensions of the contralateral body segments also affect the longitudinal proportionality ratios between the segments of the same body part, as well as those related to body height [13,23].

Numerous studies have focused on the evaluation of different anthropometric dimensions, but the identification of asymmetries between the upper and lower contralateral seeds and proportionality ratios in children of 7-10 years old have been less evident. The knowledge of these aspects aims to identify the asymmetries specific to the age and gender in order to better understand the changes in the biomechanics of some movements and how the corrective programs of prophylaxis and motor rehabilitation must be adapted.

The present study aimed to investigate the anthropometric asymmetries regarding the length of the upper and lower limbs and the indices of body proportionality with the following objectives:

— to identify the differences between the female and male groups, in the 4 age categories (7, 8, 9 and 10 years old), regarding the anthropometric parameters and proportionality indicators;

— to identify the differences in anthropometric parameters and proportionality indicators in between the 4 age categories (7 - 10 years old) for each gender (female, respectively male).

2. Materials and Methods

2.1. Study design

Data collection was carried out between May and June 2023, including primary school students (grades I - IV) from Targu Mures and Galati. All anthropometric measurements were performed under standardized conditions regarding the order of the measurements and the equipment used. A tallyometer was used to measure the height of the subjects, and a measuring tape (2 m) was used to measure the longitudinal anthropometric parameters of the upper and lower limbs.

The subjects of the study were trained on the experimental protocol regarding the order of measurements: height, length of upper right limb, length of upper left limb, length of lower right limb, length of lower left limb. All subjects of the study participated voluntarily based on the principles of the Declaration of Helsinki.

2.2.   Participants

The study included 727 subjects with the age in between 7-10 years, from wich 383 (52,7%) were female and 344 (47,3%) weere male, the subjects being arranged in four age groups :

— 7 years old group: in total 202 subjects, from wich 118 (58,4%) were   female and 84 (41,6%) were male;
— 8 years old group: in total 191 subjects, from wich 113 (59,2%) were female and 78 (40,8%) were male;
— 9 years old group: in total 182 subjects, from wich 71 (39%%)   were female and 111 (51%) were male;
— 10 years old group: in total 152 subjects, from wich 81 (53,3%) were female and 71 (46,7%) were male.

The inclusion criteria for subjects in the study were: students, aged between 7 - 10 years, clinically healthy, without physical deficiencies and physically active. Exclusion criteria: complete non-performance of anthropometric measurements.

2.3. Anthropometric measures

The measurements in the study concerned the following longitudinal anthropometric parameters and the calculation of proportionality ratios:

-   height (cm); the length of the right upper limb (cm - LUL Right); the length of the left upper limb (cm - LUL Left); the length of the right lower limb (cm - LLL   Right); the length of the left lower limb (cm - LLL   Left);
-   ratio of LUL Right X 100 / LLL _Right; ratio of LUL_Left x 100 / LLL   Left;   ratio of LUL Right x 100 / height;   ratio of LUL Left x 100 / height;   ratio of LLL_Right x 100 / height;   ratio of LLL Left x 100 / height.

Body height had as anthropometric landmarks the vertex and the support surface. The length of the upper limbs had as anthropometric landmarks the acromion and the tip of the middle finger from each upper segment. The length of the lower limbs had as anthropometric landmarks the anterior-superior iliac spine and the lower edge of the internal malleolus, in orthostatism. Interpretation: ratio of LUL_Right/Left x 100/ height: under 43 (b), under 42,5 (f) short arm; 43 -45,5 (b), 42,5 – 44 (f) – superior limb normal developed; over 45,5 (b), over 44 (f), long arm [24]. Interpretation: ratio of LLL_Right/Left x 100/ height: under 51 (b), under 49,5 (f), short leg; 51 – 52,5 (b), 49,5 – 51,5 (f), inferior limb normal developed; over 52,5 (b), over 51,5 (f), long leg [24].

2.4.   Statistical analysis

The processing of the study data was carried out with IBM-SPSS 24, calculating the following statistical parameters: mean, standard deviation (SD), mean difference, independent t-test, confidence coefficient (95% CI) with lower and upper levels. To identify statistical significance between the 4 age groups depending on gender, analysis of variance (ANOVA) was used, calculating: Mean Square and Fisher test (F). For the present study, the reference value of statistical significance was $p < 0.05$.

3. Results

In table 1-4 we presented the descriptive analysis of the main statistical parameters for the 4 age groups (7, 8, 9 and 10 years old), differentiated by gender (female, male) in order to highlight the main differences recorded according to gender and level the statistical significance of the anthropometric parameters and the proportionality ratios between the longitudinal body dimensions.

Table 1. Descriptive statistics of anthropometric parameters and proportionality indices of the group of 7 years old subjects

Anthropometrics	Gender	Mean	SD	Mean Difference	t	p	CI95% Lower	CI95% Upper
Height (cm)	F	135,21	6,70	6,80	8,93	,00	8,41	13,18
	M	128,41	4,77					
Length of the right upper limb (cm) (LUL_Right)	F	52,17	2,15	-1,82	-4,17	,000	-2,68	-,96
	M	54,00	3,01					
Length of the left upper limb (cm) (LUL_Left)	F	52,31	2,68	-1,41	-2,77	,006	-2,42	-,41
	M	53,73	2,88					
Length of the right lower limb (cm) (LLL_Right)	F	67,66	5,19	2,72	2,97	,003	,92	4,53
	M	64,94	2,61					
Length of the left lower limb (cm) (LLL_Left)	F	67,86	5,01	2,79	3,16	,002	1,05	4,52
	M	65,06	2,56					
Ratio of LUL_Right X 100 / LLL_Right (%)	F	77,62	7,44	-5,50	-4,24	,000	-8,06	-2,94
	M	83,13	2,89					
Ratio of LUL_Left x 100/ LLL_Left (%)	F	77,60	8,00	-4,96	-3,56	,000	-7,71	-2,22
	M	82,57	2,80					
Ratio of LUL_Right x 100/ height (%)	F	38,6	2,55	-4,69	-10,52	,000	-5,57	-3,81
	M	42,05	1,00					
Ratio of LUL_Left x 100/ height (%)	F	38,80	2,99	-4,36	-8,39	,000	-5,39	-3,34
	M	41,84	,92					
Ratio of LLL_Right x 100/ height (%)	F	50,00	2,30	-2,20	-5,41	,000	-3,00	-1,40
	M	50,57	1,21					
Ratio of LLL_Left x 100/ height (%)	F	50,15	2,01	-2,16	-6,04	,000	-,35	-2,86
	M	50,66	1,18					

F- female, M-male, SD – standard deviation, t- Student test value, p –value of significant level, CI – confidence interval

Analyzing the results from Table 1, we find that the height of the group of females is higher than that of the males by 6.80 cm; the length of the upper limbs of the group of females is greater for both upper segments compared to the group of males, but the length of the lower limbs is greater in males than in females. Comparing the results recorded between the upper and lower right and left segments, we find asymmetry in both samples. The group of females have longer left limbs than right ones, by 0.14 cm for the upper limbs and by 0.20 cm for the lower limbs. In the group of males, the right upper limb is 0.27 cm longer than the left, respectively the left lower limb is 0.10 cm longer than the right. Analyzing the values of the ratio of proportionality between upper limbs and height, we find that both the group of females and the group of males have values that indicate short hands. The values of the ratio of proportionality between the lower limbs and the height indicate that the females recorded values of 50% for the right lower limb and 50.15% for the left, which indicates normally developed legs; the males recorded values between 50.57% for the right leg and 50.66% for the left leg indicating short legs. The differences between the anthropometric parameters and the proportionality ratios between the group of girls and the group of boys were statistically significant for $p < 0.05$. Values of mean difference were situated in between the lower and upper limits of CI 95%.

Table 2. Descriptive statistics of anthropometric parameters and proportionality indices of the group of 8 years old subjects

Anthropometrics	Gender	Mean	SD	Mean Difference	t	p	CI95% Lower	CI95% Upper
Height (cm)	F	138,22	11,47	1,82	1,116	,266	-1,35	4,97
	M	136,40	10,11					
Length of the right upper limb (cm) (LUL_Right)	F	55,97	5,38	,33	-2,368	,019	-3,05	-,27
	M	55,64	3,74					
Length of the left upper limb (cm) (LUL_Left)	F	54,98	5,39	-1,04	-2,715	,007	-3,38	-,53
	M	55,94	4,10					
Length of the right lower limb (cm) (LLL_Right)	F	70,64	7,20	1,76	2,098	,037	,10	3,41
	M	68,88	2,07					
Length of the left lower limb (cm) (LLL_Left)	F	69,83	7,17	1,63	2,919	,004	,85	4,40
	M	68,20	4,12					
Ratio of LUL_Right X 100 / LLL_Right (%)	F	79,23	10,21	-1,55	-2,934	,004	-6,49	-1,27
	M	80,78	6,63					
Ratio of LUL_Left x 100/ LLL_Left (%)	F	79,88	10,05	-2,14	-4,024	,000	-8,46	-2,89
	M	82,02	8,86					
Ratio of LUL_Right x 100/ height (%)	F	40,49	2,62	-,30	-5,076	,000	-2,46	-1,08
	M	40,79	1,96					

Ratio of LUL_Left x 100/ height (%)	F	39,78	2,73	1,23	-5,184	,000	-2,74	-1,23
	M	41,01	2,41					
Ratio of LLL_Right x 100/ height (%)	F	51,11	4,55	,61	,724	,470	-,80	1,73
	M	50,50	4,07					
Ratio of LLL_Left x 100/ height (%)	F	49,44	4,57	-,66	1,761	,080	-,13	2,46
	M	50,00	4,33					

F- female, M-male, SD – standard deviation, t- Student test value, p –value of significant level, CI – confidence interval

According to the results in Table 2, the differences between all the anthropometric parameters and the proportionality ratios between the group of females and the group of males were statistically significant for p < 0.05, also the values of mean difference were situated in within the 95% CI limits. The height of the female group is higher than that of the male group by 1.82 cm. Comparing the results between the female group and the male group, we find that the length of the upper limbs of the female group is higher for both upper segments compared to the male group, but at the level of the lower limbs, we can see that for the right leg the female group recorded higher values than the male group, but for the left leg, the male group have longer legs than the female group. For the female group, the asymmetry between the upper limbs was in favor of those on the right side, 0.99 cm for the upper segment and 0.81 cm for the lower one. For the male group, the asymmetry between the upper limbs was in favor of the left side by 0.30 cm, and for the lower limb by 0.99 cm for the right side. Analyzing the proportionality ratio values between limbs and height, we find that both the group of females and the group of males recorded values that indicate short upper limbs, respectively normally developed lower limbs.

Table 3. Descriptive statistics of anthropometric parameters and proportionality indices of the group of 9 years old subjects

Anthropometrics	Gender	Mean	SD	Mean Difference	t	p	CI95% Lower	CI95% Upper
Height (cm);	F	142,54	11,90	1,08	5,21	,000	5,02	11,13
	M	141,46	8,94					
Length of the right upper limb (cm) (LUL_Right)	F	56,11	10,58	-,87	3,46	,001	2,20	8,06
	M	56,98	9,20					
Length of the left upper limb (cm) (LUL_Left)	F	55,95	10,42	-,97	3,41	,001	2,12	7,932
	M	56,92	9,19					
Length of the right lower limb (cm) (LLL _Right)	F	72,09	4,58	,99	-2,14	,033	-3,85	-,158
	M	71,10	6,99					
Length of the left lower limb (cm) (LLL _Left)	F	72	4,34	,95	-2,09	,037	-3,75	-,1151
	M	71,05	6,95					
	F	77,83	14,91	-2,31	5,59	,000	6,44	13,45

Ratio of LUL_Right X 100 / LLL _Right (%)	M		9,06					
		80,14						
Ratio of LUL_Left x 100/ LLL _Left (%)	F	80,96	14,02	,85	5,64	,000	6,24	12,97
	M		8,97					
		80,11						
Ratio of LUL_Right x 100/ height (%)	F	39,36	4,74	-,92	1,46	,144	-,42	2,87
	M		5,93					
		40,28						
Ratio of LUL_Left x 100/ height (%)	F	39,25	4,61	-,99	1,40	,163	-,47	2,80
	M	40,24	5,94					
Ratio of LLL_Right x 100/ height (%)	F	50,58	4,40	,32	-6,82	,000	-5,33	-2,93
	M	50,26	3,69					
Ratio of LLL_Left x 100/ height (%)	F	48,48	4,04	-1,75	-7,13	,000	-5,23	-2,96
	M	50,23	3,59					

F- female, M-male, SD – standard deviation, t- Student test value, p –value of significant level, CI – confidence interval

In Table 3, based on the comparative analysis of the two groups (females and males), we find that the height of the female group is higher than that of the males by 1.08 cm; the length of the upper limbs of the group of females is greater for both upper segments compared to the group of males, but the length of the lower limbs is greater in males than in female. Analyzing the results recorded between the right and left segments, we find asymmetry in both samples. The group of females have the right upper limb longer than the left one by 0.16 cm; respective 0.09 cm longer right lower limb compared to the left one. In the group of males, the right upper limb is 0.06 cm longer than the left, respectively, the right lower limb is 0.10 cm longer compared to the left. Analyzing the proportionality ratio values between the upper limbs, respectively the lower limbs and width, we find that both the group of females and the group of males have values that indicate short hands and legs. The differences between the anthropometric parameters and the proportionality ratios between the group of females and the group of males were statistically significant for $p < 0.05$. Values of mean difference were situated in between the lower and upper limits of CI 95%.

Table 4. Descriptive statistics of anthropometric parameters and proportionality indices of the group of 10 years old subjects

Anthropometrics	Gender	Mean	SD	Mean Difference	t	p	CI95%	
							Lower	Upper
Height (cm);	F	144,70	10,90	-2,82	-4,42	,000	-11,30	-4,32
	M	147,52	10,72					
Length of the right upper limb (cm) (LUL_Right)	F	57,75	11,14	,36	-2,08	,039	-7,09	-,19
	M	57,39	10,25					
Length of the left upper limb (cm) (LUL_Left)	F	56,67	11,00	-,052	-1,99	,048	-7,01	-,02
	M	57,19	10,61					

Parameter	Sex	Mean	SD		t	p	CI low	CI high
Length of the right lower limb (cm) (LLL _Right)	F	76,41	7,77	1,11	8,06	,000	6,11	10,08
	M	75,30	3,58					
Length of the left lower limb (cm) (LLL _Left)	F	76,58	7,94	1,37	8,27	,000	6,37	10,36
	M	75,21	3,29					
Ratio of LUL_Right X 100 / LLL _Right (%)	F	75,58	10,76	-,63	-6,68	,000	-18,45	-10,03
	M	76,21	15,35					
Ratio of LUL_Left x 100/ LLL _Left (%)	F	74,00	10,81	- 2,,04	-6,58	,000	-18,51	-9,96
	M	76,04	15,67					
Ratio of LUL_Right x 100/ height (%)	F	39,91	6,64	-1,01	-,32	,744	-2,22	1,59
	M	38,90	5,03					
Ratio of LUL_Left x 100/ height (%)	F	39,16	6,66	,39	-,22	,826	-2,16	1,73
	M	38,77	5,32					
Ratio of LLL_Right x 100/ height (%)	F	52,81	2,19	1,77	15,47	,000	7,06	9,13
	M	51,04	4,08					
Ratio of LLL_Left x 100/ height (%)	F	52,92	2,28	1,94	15,88	,000	7,24	9,30
	M	50,98	4,00					

F- female, M-male, SD – standard deviation, t- Student test value, p –value of significant level, CI – confidence interval

The results presented in Table 4, reflect statistically significant differences for $p < 0.05$ for all anthropometric parameters and proportionality ratios between the group of females and the group of males; values of mean difference fell within the 95% CI limits. The height of the female group is lower than that of the male group by 2.82 cm. Comparing the results between the female group and the male group, we find that the length of the upper limbs of the female group is greater only for straight segments compared to the male group, but at the level of the lower limbs, we note that for both legs females group recorded higher values than males group. The asymmetry between the upper limbs was in favor of those on the right side, 1.07 cm for the group of females and 0.20 cm for the group of males. The asymmetry between the lower limbs reflects that the left leg is longer than the left one by 0.17 cm for the group of females; the right leg is longer than the left by 0.09 cm for the group of males. Analyzing the values of the ratio of proportionality between the lower limbs and the width, we find that both the group of females and the group of males recorded values that indicate short upper limbs, respectively normally developed lower limbs.

Table 5. Statistical analysis of the differences of ANOVA between the age groups of the study (7 - 10 years) regarding anthropometric parameters and proportionality indices

Anthropometrics	Gender	Means differences of age groups			Anova		
		Age 8-7	Age 9-8	Age 10-9	Mean Square	F	p
Height (cm)	F	3,01	4,32	2,16	1815,84	19,84	,000
	M	7,99	5,06	6,06	5415,50	64,71	,000
Length of the right upper limb (cm) (LUL_Right)	F	3,8	0,14	1,64	528,22	11,74	,000
	M	1,64	1,34	0,41	1358,59	26,01	,000
Length of the left upper limb (cm) (LUL_Left)	F	2,67	0,97	0,72	476,91	10,53	,000
	M	2,21	0,98	0,27	1397,09	25,87	,000
Length of the right lower limb (cm) (LLL _Right)	F	2,98	1,45	4,32	1759,84	46,13	,000
	M	3,94	2,22	4,2	360,90	11,61	,000
Length of the left lower limb (cm) (LLL _Left)	F	0,97	3,17	4,58	1760,91	47,15	,000
	M	3,14	2,85	4,16	372,68	10,98	,000
Ratio of LUL_Right X 100 / LLL _Right (%)	F	1,61	-1,4	-2,25	1192,48	11,70	,000
	M	-2,35	-0,64	3,89	3954,74	49,55	,000
Ratio of LUL_Left x 100/ LLL _Left (%)	F	2,28	1,08	-6,96	1160,76	11,60	,000
	M	-0,55	-1,91	-4,07	4318,11	48,30	,000
Ratio of LUL_Right x 100/ height (%)	F	1,89	-1,13	0,55	83,74	6,06	,000
	M	-1,26	-0,51	-1,38	437,64	24,51	,000
Ratio of LUL_Left x 100/ height (%)	F	0,98	-0,53	-0,09	80,23	5,43	,001
	M	-0,83	-0,77	-1,47	456,59	24,24	,000
Ratio of LLL_Right x 100/ height (%)	F	1,11	-0,53	2,23	368,54	27,33	,000
	M	-0,07	-0,24	-3,96	440,98	27,33	,000
Ratio of LLL_Left x 100/ height (%)	F	-0,35	-1,32	4,44	386,19	28,41	,000
	M	-0,66	0,23	-1,84	453,23	28,23	,000

F - female, M - male, F - Fisher test value, p –value of significant level

The ANOVA analysis reflects statistically significant differences between the 4 age groups (7 - 10 years old) of the study in all anthropometric evaluations. The biggest differences recorded between the anthropometric parameters were: for height of 4.32 cm between the groups of 8-9 years old females and of 7.99 cm between the groups of 7-8 years old for males; for the length of the right upper limb of 3.8 cm for females, respectively 1.64 cm for males in the age groups 7-8 years; for the length of the left upper limb of 2.67 cm for

females, respectively of 2.21 cm for males in the 7-8 age groups; for the length of the right lower limb of 4.32 cm for females, respectively of 4.20 cm for males between the age groups 9-10 years old; for the length of the left lower limb of 4.58 cm for females, respectively of 4.16 cm for males between the age groups 9-10 years, as shown in Table 5.

4. Discussion

The present study tried as the first aim to identify the asymmetries between the longitudinal body dimensions (height, length of the upper and lower limbs) and the proportionality ratios between these longitudinal dimensions for 4 age categories: 7, 8, 9 and 10 years old. The results of our study highlighted that in all age categories, statistically significant differences were recorded between the longitudinal dimensions and the proportional ratios of the lower and upper limbs, respectively asymmetries between the collateral segments. The second aim of the present study was to identify the differences in anthropometric parameters and proportionality indicators between the 4 age categories (7 - 10 years old) for each gender (female and male). In all age categories, statistically significant differences were recorded between longitudinal body dimensions and proportionality ratios between groups depending on gender. The results of this study facilitate the expansion of the level of knowledge regarding the dynamics of the development of longitudinal anthropometric parameters for children aged between 7 and 10 years old and the identification of specific asymmetries that appear in the process of physical growth. Based on this information, physical therapy specialists and those in the field of physical and sports activities can better understand the particularities of physical development and growth in relation to age and gender, and can adapt prophylaxis and exercise programs to improve contralateral upper and lower limb asymmetries [24-28].

The present study is in line with previous studies that highlighted asymmetries between the contralateral segments in different age categorie, depending on: gender [29]; the health and nutritional status [29-34]; the type of physical activity [25,35]; and depending on the existing physical deficiencies etc. [36-39]. The results of our study also align with previous studies that identified significant differences between the length of the upper and lower segments between female and male children [13,40]. Other studies have highlighted the way in which the practice of physical exercises can influence the processes of growth and physical development, focusing on the identification of symmetries and asymmetries of different body dimensions [41,42]. A series of studies have highlighted the way in which the environment, nutritional indicators, the condition of health, carrying out some physical, professional or recreational activities can influence the dynamics of the development of body dimensions [43-46].

We consider that the phenomenon of growth and physical development must be approached interdisciplinary and in an integrative context in order to highlight the favorable and unfavorable factors that can facilitate the harmonious development or the appearance of asymmetries between different anthropometric parameters differentiated by age and gender [47-51]. Future research directions will be able to focus on expanding the age of the subjects and the number of anthropometric dimensions by including transversal and circular measurements and specific indices of body mass; on the way in which the different activities specific to the age of 7-10 years old can influence the process of physical growth and the improvement of the asymmetries between the sizes of the body segments.

The strong points of the study consist in the large number of children involved in the study, structuring the samples according to gender: female and male groups, dividing the subjects into 4 groups according to age: 7 years old, 8 years old, 9 years old and 10 years old group; evaluation of the longitudinal dimensions of the upper and lower limbs from the point of view of body laterality (right and left side), calculation of proportional ratios between the length of the segments, respectively between the length of the segments related to body height. The limits of the study: the length of the component

parts of the upper (arm, forearm, palm) and lower (thigh, leg) segments was not measured; the transversal and circular anthropometric dimensions were not taken into account, the inclusion in the study only of children aged 7 - 10 years old without the extension to older ages.

5. Conclusions

The comparison of longitudinal anthropometric parameters and proportionality ratios of 7 – 10 years old children highlighted for all age categories, for both genders, asymmetry between the right and left upper limb, respectively between the right and left lower limb. The biggest asymmetries between the right and left upper limb were recorded in the age category of 7 years old, both for the group of females and males; and the greatest asymmetries between the lower limbs, in both groups of girls and boys, were recorded in the 10 years old group.

Based on the results of the study, it was found that girls are taller than boys in the 7, 8, and 9 years old groups, and only in the 10 years old group the height of the males exceeds the height of the females. The height increased upward and unevenly from one age category to another, for all age categories and gender. The results of the present study indicate that in most age categories, the male groups have longer upper limbs than the female groups, and at the level of the lower limbs, the female groups have longer legs than the male groups.

The practical implications of the present study aim at the orientation and adaptation of physical exercise and kinetoprophylactic programs according to the anthropometric characteristics in relation to the age and gender of the different categories of subjects.

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