BALANCE AND SYMMETRY OF LOAD IN LOWER LIMBS AMONG MALE AND FEMALE POPULATION AT 10 -12 YEARS OLD CATEGORY

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- load on lower limb,
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Abstract:
Shaping functional residual domination of one lower limb may be manifested through systematic transfer weight to the other one – not dominated. Among adults, these movements are almost unnoticeable during calm standing position. While motor ataxia characteristic for young age manifests itself in a variable - pressure feet, swinging reverse body in standing position. Obtained results in the course of the study have made it possible to assess balance and load of right and left lower limb, based on stability graphic's measurements with eyes control and out of eyes control in children's aged category: 10-11, 11-12 i 10-12. Most of researched attempts are characterized by minority in asymmetry of loads' distribution in lower limbs, but greater load is adopted by lower limb. The whole tested group of children 10-12 shows no significant differences in control balance without eyes control with the exception of the maximum difference in balance, which is greater in position with eyes closed, while greater load is on lower right limb. Minor differences were found between left and right limb, where the load is larger. The difference applies to most boys 12 and 11 and girls 10 and 11 for the benefit of younger children.

INTRODUCTION

The ability to maintain balance has been evaluating and depends on each child's age (Sobera 2010, Wit 2012, Mazur-Rylska, Czarny 2015). The importance of stabile graph's research is included in problem of partiality test and evaluation of human functional asymmetry. Both phases of gait and state-kinetic micro movements in standing posture are characterized by symmetry. It provides efficient layouts: bone and joint, nervous and muscular one (Dyszkiewicz and co-authors 2004). However, the existing functional asymmetry, next to morphological and dynamic one is associated with dominant role of one limb, which acts leading function in activities requiring precise movements to coordinate. Hence, characteristics of the most dependent are agility, dexterity and accuracy based on equivalent reactions (Stokłosa 1995).

Shaping a functional residual domination of one lower limb may be manifested through systematic transfer weight to the other one – not dominated. Asymmetry of stabilization activity features one of the lower limb probably is the cause of unbalanced load – asymmetry of support (Sobera 2010). A small child can perform the varied movements of left and right lower limb while maintaining body balance in natural standing position (Berger and co-

authors 1995), and the biggest change in balance of control apply to children aged 6-8 (Hay, Redon 1999). Children 4-7 maintain body balance with more pressure on right foot. During calm both food standing position among adults significant differences in difference ratio between right and left lower limb was not noticed, what means that mature movement system requires no special features, what could engage more dominant lower limb rather than not dominant one and it is followed by similar involvement of both lower limbs in standing position (Sikora 2001).

PURPOSE AND SCOPE OF WORK

Analysis of balance and difference in balance concerns 165 children aged 10-12. The purpose of material is to examine the level of asymmetry of stabilization function in lower limbs between girls and boys by analysis of symmetry in loading of lower limbs (body balance) and difference in balance between right and left lower limb in position with eye control and without eye control.

MATERIAL AND METHODS

The analysis covered the 165 children aged 10-12. Counts of the individual age groups, taking into account gender breakdown is presented in the following table.

Tab. 1. Description of the groups participating in the survey

Age [years]	**Sex**		Total
	female	**male**	
10	27	29	56
11	43	19	62
12	25	22	47
Total	95	70	165

Tab. 2. Anthropometric characteristics of children participating in the survey (height, weight)

Age [years]	**Height [centimeter]**											
	Sex											
	female						**male**					
	$\bar{x}$	Me	*s*	min	max	*V*	$\bar{x}$	Me	*s*	min	max	*V*
10	142,6	142,0	7,3	127	155	5,1%	143,2	144,0	5,8	129	155	4,1%
11	147,3	149,0	6,6	134	160	4,5%	149,7	151,0	8,3	135	161	5,6%
12	156,3	157,0	7,3	142	170	4,7%	151,7	149,0	7,3	144	168	4,8%
Age [years]	**Weight [kilograms]**											
	Sex											
	female						**male**					
	$\bar{x}$	Me	*s*	min	max	*V*	$\bar{x}$	Me	*s*	min	max	*V*
10	34,8	33,7	7,6	23,5	53,1	21,9%	33,5	33,2	4,8	26,1	42,9	14,3%
11	38,7	37,2	7,9	27,0	64,9	20,5%	39,7	38,2	8,3	26,7	58,2	21,0%
12	44,9	44,0	8,7	31,1	59,9	19,3%	41,4	40,9	7,1	28,0	52,4	17,2%

In the trial balance stabile metrical Computer Platform CQ Stab. 2 p was used. Measurement of balance consisted of two trials in variety of positions, where there are 30 seconds changes in balance of body to right and left lower limb: the basis for open (heel separately in a relaxed attitude with eyes open (EO) and closed (EC).

Data were subjected to statistical analysis with using the statistic package. Descriptive statistics were used with registered variables (Stanisz 2006, Łomnicki 2014). For differences of DB balance, coefficient of variation could not be determined due to the fact the admission by variable negative values. Among different calculations performed by platform, following data were analyzed:
BalanceL%EO- balance on left limb (EO) and (EC),
BalanceP%EO- balance on right limb (EO) and (EC),
DB - differences in balance [%] (EO i EC): MNDB - arithmetic mean of difference in balance,
MinDB- minimum balance difference, MaxDB- maximum balance difference.

Analysis of parameters involved comparison of stabile graph parameters among age categories: 10 and 11, 11 and 12, 10 and 12. In order to determine the normal schedules tests of Shapiro-Wilk and Kołmogorow – Smirnow were used. Because schedules much dissent from normal distributions and it has not been shown for oneness of variance, Wilcoxon not parametric test was used for dependent variable in the analysis of specific groups. For the calculation of the level of severity in different age categories not parametric Mann Whitney test was used for independent variable U. Analysis of the differences in the levels of significance is made on three levels of significance: p<0,1*- result of the statistically significant, p<0,01** - result of the highly statistically significant, p<0,001***- result of very highly statistically significant. An illustration of a graphical chart represent the type of box-whiskers, which shows the value of the arithmetic mean, 95% of confidence interval, and the typical range of individual variation in separate groups.

RESULTS AND DISCUSSION

Comparison of balance parameters and balance variations in age of 10-12 years in position with eyes open (EO) and closed (EC).

Tab.3. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes open (EO) and eyes closed (EC) p - Wilcoxon test

Balance (EO)	$\bar{x}$	Me	***s***	c_{25}	c_{75}	min	max	***V***
Balance L [%]	48,9	49	4,6	46	52	30	60	9,4%
Balance P [%]	51,1	51	4,6	48	54	40	70	9,0%
Balance (variation) [%]	7,3	6	5,9	4	10	0	40	81,2%
MNDB	-2,0	-2	8,6	-6	4	-29	20	×
Min DB	-6,2	-6	9,0	-11	0	-45	16	×
Max DB	2,2	2	8,9	-3	8	-25	26	×
Balance (EC)								
Balance L [%]	49,1	49	4,3	46	52	33	61	8,8%
Balance P [%]	50,9	51	4,3	48	54	39	67	8,5%
Balance (variation) [%]	6,8	6	5,6	2	10	0	34	82,4%
MNDB	-1,6	-1	7,9	-7	3	-24	19	×
Min DB	-6,4	-6	8,2	-12	-1	-35	13	×
Max DB	3,1	3	8,6	-3	9	-22	27	×
Balance (EO vs EC)	$\bar{x}$	Me	**s**	c_{25}	c_{75}	min	max	p
Balance L [%]	0,2	0	4,1	-2	2	-11	18	0,9437
Balance P [%]	-0,2	0	4,1	-2	2	-18	11	0,9437
Balance (variation) [%]	-0,5	0	6,5	-4	4	-36	14	0,7588
MNDB	0,3	0	5,7	-3	3	-16	25	0,5631
MinDB	-0,2	0	6,8	-3	3	-25	38	0,4585
MaxDB	1,0	1	6,9	-2	4	-16	31	0,0577*

Load distribution of right and left lower limb for trials with eyes open (EO) and closed (EC) in a group of 10-12 showed statistically significant difference only in maximum difference in balance (Max DB) with higher load to lower right limb in position without sight control (2,2/3,1) (Tab.3.).

The results were illustrated through series of charts' dispersion, which presented two-dimensional distribution of measurements made in both research situations. Subsidiary simple for the equation y = x allows to assess the direction of the difference between the results obtained in both research situations. Over the simple there are tags, which correspond to the result with eyes closed and under a simple - reverse situation is presented (Fig.1)

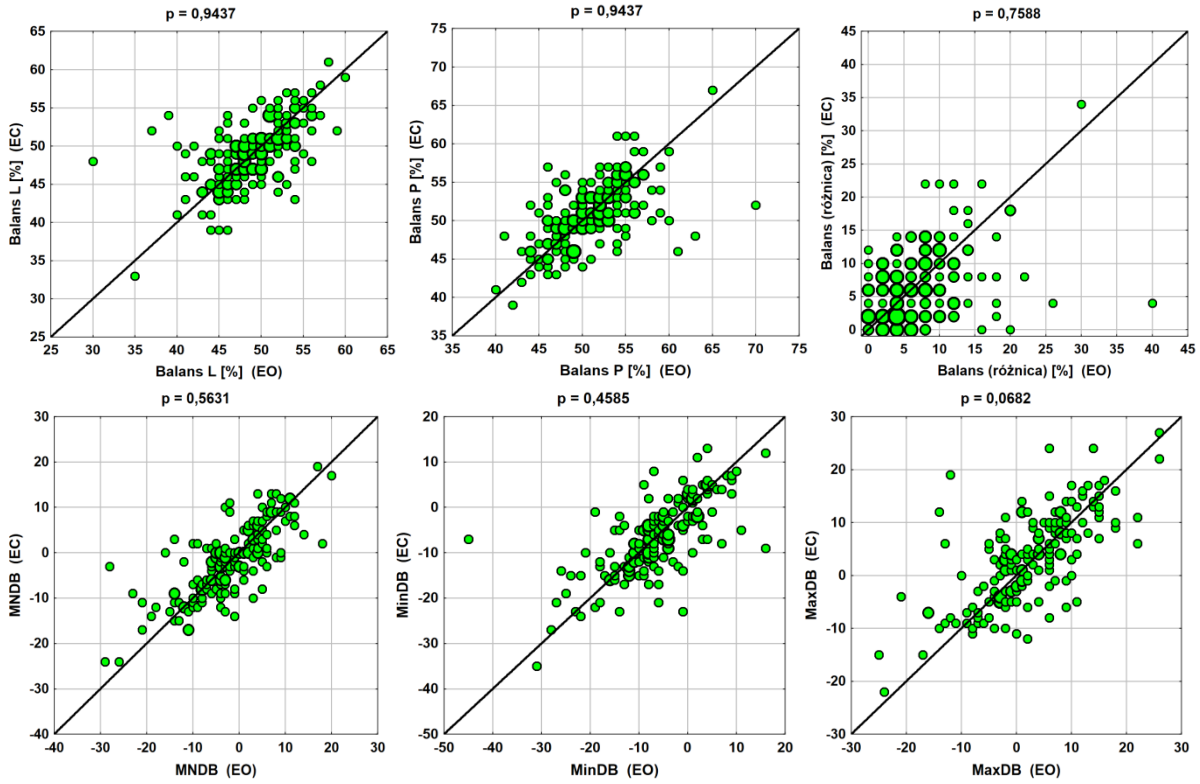


Fig.1. Charts' dispersion and statistic significance p (Wilcoxon test) balance differences' values (average, minimum and maximum) on left and right leg in a group of children 10-12 in the position with eyes open (EO) and closed (EC).

Figure 1 - translation:Balans – balance, Balans (różnica) –balance (variation)

Comparison of balance parameters and balance differences among children age 10 and 11, 10 and 12, 11 and 12 in position with eyes open (EO).

In age group 10 and 11 statistical difference in balance difference parameters was noticed. It deals with the entire group in the researched age category (6,1%/9,0%) and girls (5,8%/9,2%) with higher values at the age of 11 compared to 10. Age group 10 and 11 has slight tendency to load right lower limb, but statistical significance is low. The smallest balance volatility in category of 10 and 11 show boys compared to girls, and the entire group (Tab.4, Fig.2,3).

Tab.4. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes open (EO) , p - Mann-Whitney test

Balance (eyes open)	**Age- complete group**										***p***
	10 years old (*N* = 56)					**11 years old (*N* = 62)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,3	3,7	41	57	8%	48,7	5,6	30	59	12%	0,9550
Balance P [%]	50,7	3,7	43	59	7%	51,3	5,6	41	70	11%	0,9550
Balance (variety) [%]	6,1	4,3	0	18	70%	9,0	7,2	0	40	81%	0,0255*
MNDB	-1,0	6,6	-16	14	×	-2,3	10,4	-29	18	×	0,9380
Min DB	-4,9	6,5	-21	11	×	-6,7	11,3	-45	16	×	0,7090
Max DB	3,0	7,0	-12	22	×	2,0	10,5	-25	22	×	0,9936
Balance (eyes open)	**Age - female**										***p***
	10 years old (*N* = 27)					**11 years old (*N* = 43)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,7	3,7	42	57	7%	48,3	5,9	30	59	12%	0,4284
Balance P [%]	50,3	3,7	43	58	7%	51,7	5,9	41	70	11%	0,4284
Balance (variety) [%]	5,8	4,6	0	16	79%	9,2	8,1	0	40	89%	0,0488*
MNDB	-0,4	6,7	-14	14	×	-3,1	10,7	-29	18	×	0,3189
MinDB	-4,4	6,5	-18	11	×	-7,0	11,7	-45	16	×	0,3941
MaxDB	3,8	7,3	-11	22	×	0,7	10,6	-25	22	×	0,3131
Balance (eyes open)	**Age - male**										***p***
	10 years old (*N* = 29)					**11 years old (*N* = 19)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,0	3,7	41	57	8%	49,6	5,0	40	56	10%	0,4903
Balance P [%]	51,0	3,7	43	59	7%	50,4	5,0	44	60	10%	0,4903
Balance (variety) [%]	6,5	4,1	0	18	63%	8,5	4,9	2	20	58%	0,1470
MNDB	-1,6	6,5	-16	11	×	-0,5	9,7	-19	11	×	0,4391
MinDB	-5,4	6,7	-21	9	×	-5,8	10,6	-27	8	×	0,6459
MaxDB	2,2	6,8	-12	15	×	5,1	10,1	-16	18	×	0,1790

Balance measured in age group 10 and 12 shows statistically significant differences only for minimum balance difference (Min DB) and applies to entire age category test (Tab.5, Fig.2,3).

Tab.5. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes open (EO), p - Mann-Whitney test

Stability metric Parameters (eyes open)	**Age- complete group**										***p***
	10 years old (*N* = 56)					**12 years old (*N* = 47)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,3	3,7	41	57	8%	48,7	4,0	40	60	8%	0,2863
Balance P [%]	50,7	3,7	43	59	7%	51,3	4,0	40	60	8%	0,2863
Balance (variety) [%]	6,1	4,3	0	18	70%	6,6	5,3	0	20	81%	0,8252
MNDB	-1,0	6,6	-16	14	×	-2,7	8,1	-21	20	×	0,1964
MinDB	-4,9	6,5	-21	11	×	-6,9	7,9	-25	16	×	0,0566*
MaxDB	3,0	7,0	-12	22	×	1,4	8,8	-17	26	×	0,1987
Balance (eyes open)	**Age - female**										***p***
	10 years old (*N* = 27)					**12 years old (*N* = 25)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,7	3,7	42	57	7%	49,3	4,4	40	60	9%	0,5857
Balance P [%]	50,3	3,7	43	58	7%	50,7	4,4	40	60	9%	0,5857
Balance (variety) [%]	5,8	4,6	0	16	79%	6,8	5,4	0	20	80%	0,5129

MNDB	-0,4	6,7	-14	14	×	-1,3	8,6	-21	20	×	0,6895
MinDB	-4,4	6,5	-18	11	×	-5,5	8,6	-25	16	×	0,4670
MaxDB	3,8	7,3	-11	22	×	2,4	9,1	-17	26	×	0,5247
Balance (eyes open)	**Age - male**										***p***
	10 years old (*N* = 29)					**12 years old (*N* = 22)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,0	3,7	41	57	8%	48,0	3,6	43	58	7%	0,2853
Balance P [%]	51,0	3,7	43	59	7%	52,0	3,6	42	57	7%	0,2853
Balance (variety) [%]	6,5	4,1	0	18	63%	6,3	5,3	0	16	84%	0,7702
MNDB	-1,6	6,5	-16	11	×	-4,2	7,5	-14	17	×	0,1522
MinDB	-5,4	6,7	-21	9	×	-8,5	6,7	-22	4	×	0,1522
MaxDB	2,2	6,8	-12	15	×	0,3	8,4	-12	26	×	0,2294

In the age category 11 and 12 differences statistically significant concern a group of boys in the case of the minimum and maximum difference of balance and balance differences' 8,5% i 6,3% on right lower limb (Tab.6, Fig.2,3).

Tab.6. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes open (EO), p - Mann-Whitney test

Balance (eyes open)	**Age- complete group**										***p***
	11 years old (*N* = 62)					**12 years old (*N* = 47)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	48,7	5,6	30	59	12%	48,7	4,0	40	60	8%	0,4967
Balance P [%]	51,3	5,6	41	70	11%	51,3	4,0	40	60	8%	0,4967
Balance (variety [%]	9,0	7,2	0	40	81%	6,6	5,3	0	20	81%	0,1058
MNDB	-2,3	10,4	-29	18	×	-2,7	8,1	-21	20	×	0,3554
MinDB	-6,7	11,3	-45	16	×	-6,9	7,9	-25	16	×	0,4514
MaxDB	2,0	10,5	-25	22	×	1,4	8,8	-17	26	×	0,2982
Balance (eyes open)	**Age - female**										***p***
	11 years old (*N* = 43)					**12 years old (*N* = 25)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	48,3	5,9	30	59	12%	49,3	4,4	40	60	9%	0,7048
Balance P [%]	51,7	5,9	41	70	11%	50,7	4,4	40	60	9%	0,7048
Balance (variety) [%]	9,2	8,1	0	40	89%	6,8	5,4	0	20	80%	0,3426
MNDB	-3,1	10,7	-29	18	×	-1,3	8,6	-21	20	×	0,7909
MinDB	-7,0	11,7	-45	16	×	-5,5	8,6	-25	16	×	0,8202
MaxDB	0,7	10,6	-25	22	×	2,4	9,1	-17	26	×	0,7715
Balance (eyes open)	**Age - male**										***p***
	11 years old (*N* = 19)					**12 years old (*N* = 22)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,6	5,0	40	56	10%	48,0	3,6	43	58	7%	0,1409
Balance P [%]	50,4	5,0	44	60	10%	52,0	3,6	42	57	7%	0,1409
Balance (variety) [%]	8,5	4,9	2	20	58%	6,3	5,3	0	16	84%	0,2168
MNDB	-0,5	9,7	-19	11	×	-4,2	7,5	-14	17	×	0,0501*
MinDB	-5,8	10,6	-27	8	×	-8,5	6,7	-22	4	×	0,2370
MaxDB	5,1	10,1	-16	18	×	0,3	8,4	-12	26	×	0,0540*

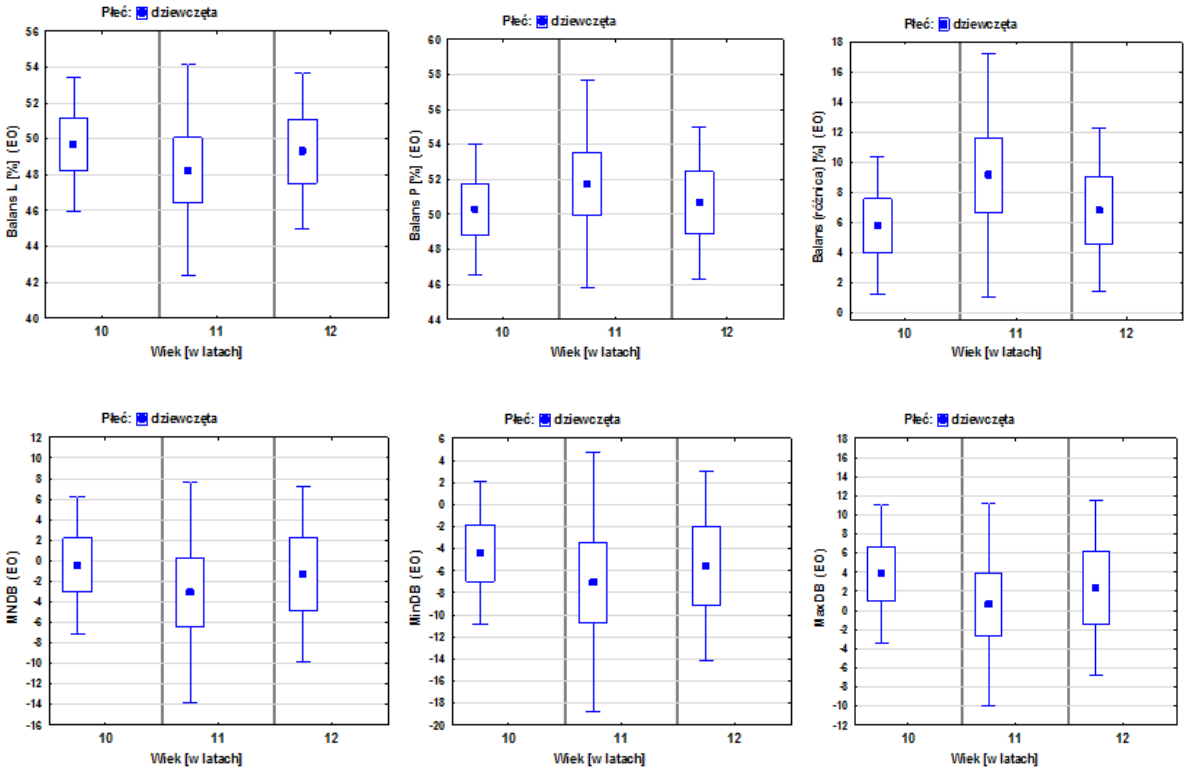


Fig. 2. Comparison of the symmetry loading in lower limbs in a group of girls 10-12 in position with eyes open (EO)

Figure 2 translation: Płeć: dziewczęta – sex (female), Wiek (w latach) - age (years), Balans – balance Balans (różnica) – balance (variation)

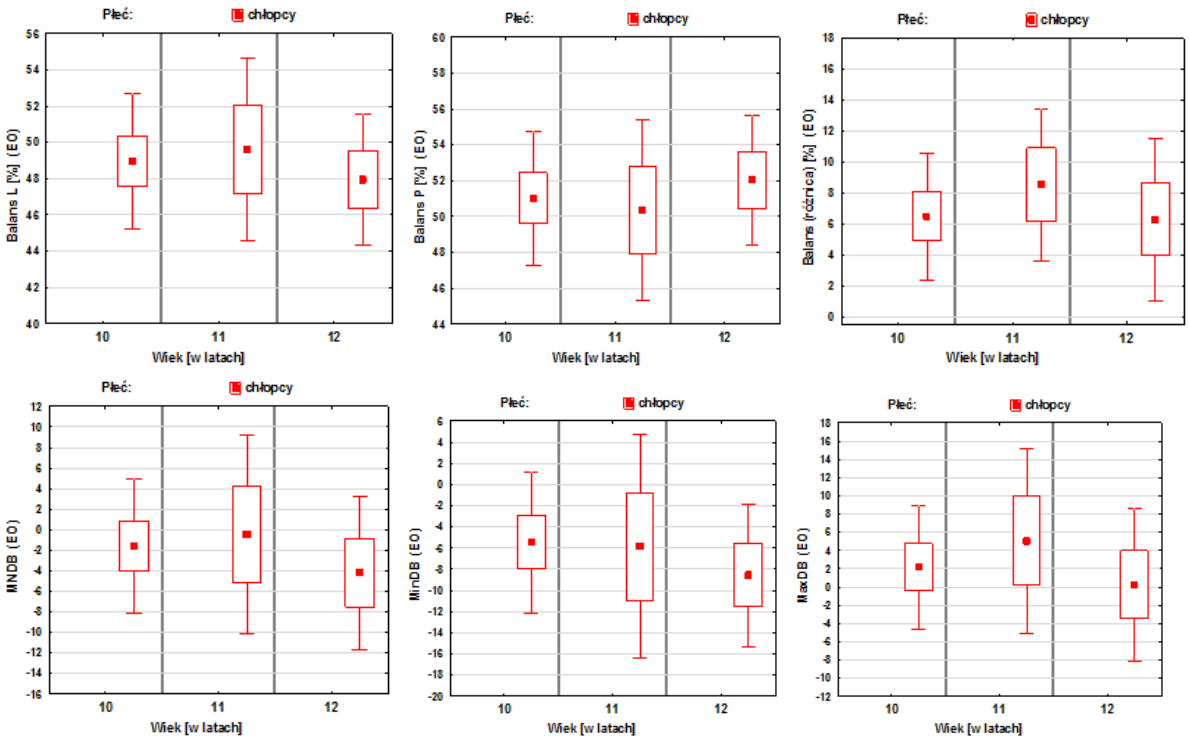


Fig. 3. Comparison of the symmetry loading in lower limbs in a group of boys 10-12 in position with eyes open (EO)

Figure 3 translation: Płeć: chłopcy – sex (male), Wiek (w latach) - age (years), Balans – balance Balans (różnica) – balance (variation)

Comparison of balance parameters and balance variations of children in age categories 10-11, 10-12 and 11-12 in position with eyes closed (EC).

Lack of visual inspection has not influence on differences in balance of both tested wide age category 10 and 11 and boys or girls (Tab.7, Fig.4,5). Lower right limb and left one are equally loaded, even though values are higher for the balance on right lower limb.

Tab.7. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes closed (EC), p - Mann-Whitney test

Balance (eyes closed)	**Age- complete group**										***p***
	10 years old (*N* = 56)					**11 years old (*N* = 62)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,4	4,0	41	58	8%	49,2	4,6	33	57	9%	0,8699
Balance P [%]	50,6	4,0	42	59	8%	50,8	4,6	43	67	9%	0,8699
Balance (variety) [%]	6,7	4,6	0	18	68%	6,8	6,2	0	34	91%	0,6308
MNDB	-1,2	7,2	-17	13	×	-1,6	8,4	-24	13	×	0,8869
MinDB	-5,9	7,4	-23	11	×	-6,6	8,9	-35	8	×	0,9550
MaxDB	3,6	7,8	-12	19	×	3,6	8,9	-22	24	×	0,8657
Balance (eyes closed)	**Age - female**										***p***
	10 years old (*N* = 27)					**11 years old (*N* = 43)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,7	4,0	41	56	8%	48,8	4,5	33	56	9%	0,4426
Balance P [%]	50,3	4,0	44	59	8%	51,2	4,5	44	67	9%	0,4426
Balance (variety) [%]	6,4	4,6	0	18	72%	6,5	6,7	0	34	103%	0,5895
MNDB	-0,5	7,2	-17	11	×	-2,6	8,1	-24	13	×	0,2486
MinDB	-4,9	6,9	-21	4	×	-7,0	8,8	-35	8	×	0,3307
MaxDB	3,9	7,5	-12	15	×	2,2	8,2	-22	17	×	0,3680
Balance (eyes closed)	**Age - male**										***p***
	10 years old (*N* = 29)					**11 years old (*N* = 19)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,0	4,2	43	58	8%	50,3	4,6	43	57	9%	0,3462
Balance P [%]	51,0	4,2	42	57	8%	49,7	4,6	43	57	9%	0,3462
Balance (variety) [%]	7,0	4,7	0	16	67%	7,6	5,0	0	14	66%	0,6762
MNDB	-1,8	7,2	-12	13	×	0,6	8,8	-14	13	×	0,3571
MinDB	-6,9	7,9	-23	11	×	-5,7	9,4	-23	7	×	0,5307
MaxDB	3,2	8,3	-10	19	×	6,8	9,8	-10	24	×	0,1860

In age category 10 and 12 differences statistically significant concern the maximum difference in balance (Max DB) among boys with larger balance difference on the right foot for boys at 12 (Tab.8, Fig.4,5).

In the age category 11 and 12, most of the statistically significant differences concern group of boys in EC position. Differences as follow: balance on left lower limb (50,3% / 49,7%) – 11 year olds, on right lower limb (47,5% / 52,5%) - 12- year olds and minimum and maximum of balance (tab.9, ryc.4,5).

Tab.8. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes closed (EC), p - Mann-Whitney test

Balance (eyes closed)	**Age- complete group**										***p***
	10 years old (*N* = 56)					**12 years old (*N* = 47)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,4	4,0	41	58	8%	48,6	4,3	39	61	9%	0,2923
Balance P [%]	50,6	4,0	42	59	8%	51,4	4,3	39	61	8%	0,2923
Balance (variety) [%]	6,7	4,6	0	18	68%	6,9	5,9	0	22	87%	0,6803
MNDB	-1,2	7,2	-17	13	×	-2,2	8,1	-17	19	×	0,3503
MinDB	-5,9	7,4	-23	11	×	-6,6	8,2	-24	13	×	0,6186
MaxDB	3,6	7,8	-12	19	×	2,0	9,1	-15	27	×	0,1786
Balance (eyes closed)	**Age - female**										***p***
	10 years old (*N* = 27)					**12 years old (*N* = 25)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,7	4,0	41	56	8%	49,5	4,1	41	59	8%	0,7164
Balance P [%]	50,3	4,0	44	59	8%	50,5	4,1	41	59	8%	0,7164
Balance (variety) [%]	6,4	4,6	0	18	72%	6,4	5,2	0	18	81%	0,8275
MNDB	-0,5	7,2	-17	11	×	-0,3	8,2	-17	17	×	0,9421
MinDB	-4,9	6,9	-21	4	×	-4,6	7,7	-19	12	×	0,9566
MaxDB	3,9	7,5	-12	15	×	3,9	9,6	-15	24	×	0,8134
Balance (eyes closed)	**Age - male**										***p***
	10 years old (*N* = 29)					**12 years old (*N* = 22)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,0	4,2	43	58	8%	47,5	4,4	39	61	9%	0,2221
Balance P [%]	51,0	4,2	42	57	8%	52,5	4,4	39	61	8%	0,2221
Balance (variety) [%]	7,0	4,7	0	16	67%	7,4	6,8	0	22	92%	0,7846
MNDB	-1,8	7,2	-12	13	×	-4,4	7,6	-15	19	×	0,1816
MinDB	-6,9	7,9	-23	11	×	-8,9	8,2	-24	13	×	0,4674
MaxDB	3,2	8,3	-10	19	×	-0,2	8,2	-11	27	×	0,0500*

Tab.9. Value of balance to left and right limb and balance variety (arithmetic mean, median, standard deviation, minimum and maximum value, variability) in group of children 10-12 in position with eyes closed (EC), p - Mann-Whitney test

Balance (eyes closed)	**Age- complete group**										***p***
	11 years old (*N* = 62)					**12 years old (*N* = 47)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	49,2	4,6	33	57	9%	48,6	4,3	39	61	9%	0,2256
Balance P [%]	50,8	4,6	43	67	9%	51,4	4,3	39	61	8%	0,2256
Balance (variety) [%]	6,8	6,2	0	34	91%	6,9	5,9	0	22	87%	0,9878
MNDB	-1,6	8,4	-24	13	×	-2,2	8,1	-17	19	×	0,4775
MinDB	-6,6	8,9	-35	8	×	-6,6	8,2	-24	13	×	0,7444
MaxDB	3,6	8,9	-22	24	×	2,0	9,1	-15	27	×	0,1627
Balance (eyes closed)	**Age - female**										***p***
	11 years old (*N* = 43)					**12 years old (*N* = 25)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	48,8	4,5	33	56	9%	49,5	4,1	41	59	8%	0,7236
Balance P [%]	51,2	4,5	44	67	9%	50,5	4,1	41	59	8%	0,7236
Balance (variety) [%]	6,5	6,7	0	34	103%	6,4	5,2	0	18	81%	0,7426
MNDB	-2,6	8,1	-24	13	×	-0,3	8,2	-17	17	×	0,3174
MDDB	-2,5	8,0	-24	13	×	-0,2	8,2	-17	18	×	0,2875
MinDB	-7,0	8,8	-35	8	×	-4,6	7,7	-19	12	×	0,3897
MaxDB	2,2	8,2	-22	17	×	3,9	9,6	-15	24	×	0,5957

Balance (eyes closed)	**Age - male**										***p***
	11 years old (*N* = 19)					**12 years old (*N* = 22)**					
	$\bar{x}$	*s*	min	max	*V*	$\bar{x}$	*s*	min	max	*V*	
Balance L [%]	50,3	4,6	43	57	9%	47,5	4,4	39	61	9%	0,0574
Balance P [%]	49,7	4,6	43	57	9%	52,5	4,4	39	61	8%	0,0574
Balance (variety) [%]	7,6	5,0	0	14	66%	7,4	6,8	0	22	92%	0,5603
MNDB	0,6	8,8	-14	13	×	-4,4	7,6	-15	19	×	0,0446*
MinDB	-5,7	9,4	-23	7	×	-8,9	8,2	-24	13	×	0,2168
MaxDB	6,8	9,8	-10	24	×	-0,2	8,2	-11	27	×	0,0114*

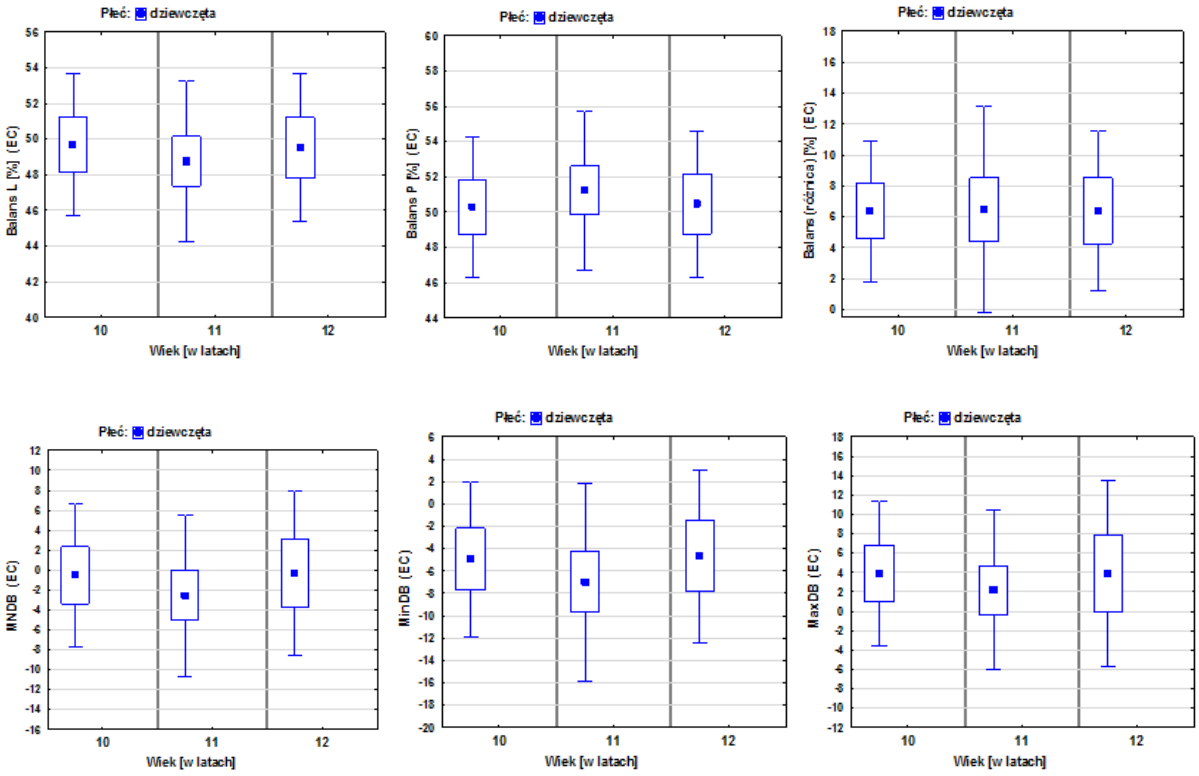
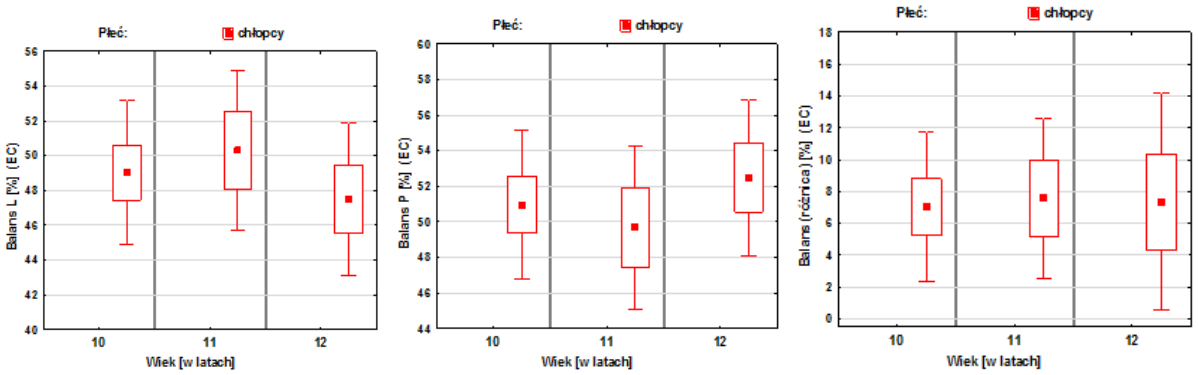


Fig.4. Comparison of loading lower limbs among girls of 10-12 in the position with eyes closed (EC)
Figure 4 translation: Płeć: dziewczęta – sex (female), Wiek (w latach) - age (years), Balans – balance Balans (różnica) – balance (variation)



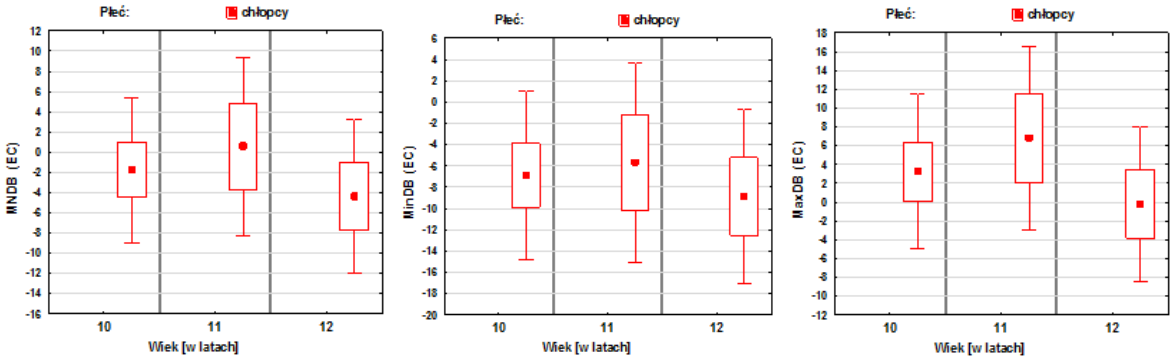


Fig.5. Comparison of loading lower limbs among boys of 10-12 in the position with eyes closed (EC)
Figure 5 translation:Płeć: chłopcy – sex (male), Wiek (w latach) - age (years), Balans – balance Balans (różnica) – balance (variation)

CONCLUSIONS

For stabilization of bipedal standing position, which is characteristic only for human species, an important part of morphological development of the body is formation of lower limbs and feet (Prętkiewicz-Abacjew 2002, Wicart, Morton 2003). An intense increase in limb length results in a lowering of the overall system of body mass, and stronger abdominal muscles allow its "flattening" so 7-year-old child's silhouette becomes similar to the posture of the adult's body (Kasperczyk 2004). Children until the age of 12 achieve efficiency of visual and vestibular stimuli use to control the body posture (Petersonn and co-authors 2006).

Obtained in the course of the study results have made it possible to assess balance and load of right and left limb on the basis of stabile graph measurements in EO and EC's position in the various age groups 10-12. Most of the surveyed attempts are characterized by a very small minority of asymmetry of the distribution in burdens of lower limbs, but greater load is on right lower limb as a not dominated limb. The researched population loads more intensive right lower limb regardless of the control eyes and age, but statistical significance is exiguous.

In conclusion, it was found small differences between dominant left limb and right limb, which the body load is larger on. The difference applies to most boys 12 and 11 and girls 10 and 11 for benefit of younger children.

Asymmetry in functioning and posture of human body to some extent is normal phenomenon, and perfect symmetry in the biological system does not exist. Natural human body asymmetry clearly points out during the growth process (Malinowski 2004). Children aged 3-4 tend to overburden left lower limb than right one, but children aged 5 and older show an equal load of both lower limbs, what is a characteristic among adults (Hoffman and co-authors 1998, Greve and co-authors 2007). Symmetrical or unsymmetrical load on the lower limbs during development may be a good predictor of body posture, both in the direction of normal development as well as deviations from the norm.

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