

PREVALANCE OF FLATFOOT DEFORMITY IN BOYS DEPENDING ON THEIR AGE

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Abstract

Literature reports a growing number of foot deformity cases in pre-school and school children. In order to confirm the above assumption, we carried out a scientific measurement of the foot deformity in pre-school 4- to 7-year-old boys. In order to establish the deformity type, we applied the computerised digital podography (CDP) method which features a podoscope box with a glass top illuminated by fluorescent lights, a digitalised video camera, a PC with a video card and adequate software, and color printer. The obtained results indicated the great prevalence of deformity so the conclusion was drawn that the deformities are most frequent in the group of 4- to 7-year-old boys. The results were presented in tables and graphs and submitted to the relevant institutions.

Key words: foot, deformity, age, status, differences

Introduction

Flatfoot deformity is one of the most common problems in school children. Since the physiological development of the foot is only completed when children reach 7 years, great attention should be paid to the load children are exposed to, in particular the education-related loads which depend on the school-grade the boys are attending.

According to the data presented in literature, and other related sources of research dealing with the postural status issue in pre-school and school children, a firm conclusion may be drawn that a great majority of children of this age have the foot deformity. Based on these assumptions, we examined pre-school boys and girls population in the "Radosno detinjstvo" kindergarten institution of the City of Novi Sad.

The aim

The aim of this study was to reconstruct and establish the functioning of the initial foot status in 4- to 7-year-old boys, with the intention to demonstrate the foot occurrence depending on age, and difference between the age groups in terms of their respective deformity frequency.

The results should be presented before the relevant institutions in order to provide much needed preventive treatment.

Methods

The study has been implemented in the "Radosno detinjstvo" kindergarten institution in the territory of the City of Novi Sad. A total of 287 boys aged 4-7 years were included using the random choice method, and divided into four age sub-groups. The variable pattern included the following: collapsed transversal arch (PESTRAN); generalised joint laxity (CALVAL); high arch foot (PESCAVUS); and Deformity Type representing the four degrees of pes planus – pes planus 1 (PP1); pes planus 2 (PP2); pes planus 3 (PP3); pes planus 4 (PP4); and foot without deformity (BO).

The foot deformity was measured using the computerised and digitalised podography (CDP) method; the podoscope device consists of a box with a glass top illuminated by fluorescent lights, a digitalised video camera, a PC with a video card and adequate software, and color printer. The main features of CDP are the following: measures and records the pressure points of the patient's feet in both static and dynamic mode; shows the calibrated values of the exerted pressure; shows the examined foot in time intervals; generates the image of the maximum exerted pressure; prints diagnostic reports. The measurements were made and interpreted by competent professionals capable of both diagnosing the foot deformity type and creating the foot deformity correction programme.

Results and discussion

The foot deformities are presented per age groups both in tables and graphs. The descriptive procedure allows only for giving flatfoot deformity degree outlines, whereas the statistically significant difference will be discussed later in the paper.

Table 1 Numerical (n) and percent (%) occurrence of PES CAVUS per age group

Age	Def.		No Def.	
	n	%	n	%
4	53	93.0*	4	7.0
5	88	88.0	12	12.0
6	82	89.1	10	10.9
7	28	73.7	10	26.3*

It is obvious (Table 1) that in the 4-year-old group there is the largest number of boys without foot deformity, that is 53 boys (93.0%) out of a total number of 57, which is the largest observed prevalence of non-deformity with only few deformity cases (4 boys 7.0% $p=.000$). In the group of 5-year-old boys as much as 88% of them were not treated against the foot deformities and only 12% have the foot deformity. Almost the same ratio is observed in 6-year-old boys. Somewhat lower percentage of boys without deformity was observed in 7-year-old boys, 26% of whom have foot deformity. Based on the obtained results, it is possible to establish differences between the examined age groups in terms of PES CAVUS. It may be concluded that the occurrence of this specific deformity is the lowest in the group of 4-year-olds (93%), and the highest in the group of 7-year-olds. Since $p = .038 \chi^2$ – of the test, and $\chi = .169$ with the confidence interval (.036; .302) that does not contain a zero, it may be concluded that age and PES CAVUS are not tightly related (Table 5).

Table 2 Numerical (n) and percent (%) occurrence of PES TRANSVER. per age group

Age	No Def.		Def.	
	n	%	n	%
4	2	3.5	55	96.5
5	4	4.0	96	96.0
6	10	10.9*	82	89.1
7	4	10.5	34	89.5

Table 2 shows that the highest occurrence of this type of deformity was in 4- and 5-year-olds, that is 96.5% and 96%, respectively.

Boys in the group of 6-year-olds and 7-year-olds had somewhat lower percentage of deformity occurrence that is around 89%. Namely, when speaking in percentages, these two age groups, if compared with the former two age groups, had less frequent flatfoot deformity. Based on the obtained results, it is possible to establish differences between the examined age groups in terms of PES TRANSVER. and draw a conclusion that the deformity occurred more frequently in the younger boys. Since $p = .150 \chi^2$ – of the test, and $\chi = .135$ with the confidence interval (.028; .242) that does not contain a zero, it may be concluded that age and PES TRANSVER. are not tightly related (Table 5).

Table 3 Numerical (n) and percent (%) occurrence of CALCANEO VALGI per age group

Age	Def.		No Def.	
	n	%	n	%
4	3	5.3	54	94.7
5	4	4.0	96	96.0*
6	10	10.9*	82	89.1
7	4	10.5	34	89.5

The *calcaneo valgi* deformity is most frequent in 4- and 5-year-old boys, as much as 96%, whereas in 6- and 7-year-old boys it is less frequent for almost 10% (89.1% and 89.5%, respectfully). Based on the obtained results, it is possible to establish the differences among the all examined age groups in terms of CALCANEO VALGI and draw the following conclusion: the group of 4-year-olds are boys *with more frequent deformity*; the group of 5-year-olds are boys *with more frequent deformity*; the group of 6-year-olds are boys *without deformity*; and the group of 7-year-olds are boys *without deformity*. Since $p = .234 \chi^2$ – of the test, and $\chi = .121$ with the confidence interval (.013; .229) that does not contain a zero, it may be concluded that age and CALCANEO VALGI are not tightly related (Table 5).

Table 4 integrally presents all degrees of the flatfoot deformity type, PES PLANUS 1, 2, 3 and 4. Based on the obtained results, it may be concluded that in the group of 4-year-old boys PP4 was most frequent (35.1%). In the group of 5-year-old boys PP3 was most frequent (34%). In 6-year-olds PP2 prevailed (34.8%), whereas in 7-year olds 23.7% of the examined boys did not have this type of flatfoot deformity, and 18.4% of the boys in this group had PP1.

Table 4 Numerical (n) and percent (%) occurrence of Deformity Type per age group

Age	Def.		PP1		PP2		PP3		PP4		BO	
	n	%	n	%	n	%	n	%	n	%	n	%
4	3	5.3	6	10.5	15	26.3	11	19.3	20	35.1*	2	3.5
5	11	11.0	6	6.0	26	26.0	34	34.0*	19	19.0	4	4.0
6	9	9.8	6	6.5	32	34.8*	22	23.9	13	14.1	10	10.9*
7	9	23.7*	7	18.4*	6	15.8	9	23.7	3	7.9	4	10.5

According to such results, this is the group with the lowest occurrence of the examined flatfoot deformity. Also, a conclusion may be drawn that 10% of the 6- and 7-year-olds have no specific bodily characteristics and are justly included in the group with lower deformity occurrence. Since $p = .001$ χ^2 – of the test, and $\chi = .336$ with the confidence interval (.233; .439) that does not contain a zero, it may be concluded that age and PES PLANUS are not tightly related (Table 5).

Table 5 The significance of the differences among age groups per evaluated def. types

	χ	R	F	p
PES CAVUS	.169	.171	2.84	.04
PES TRANSVER.	.135	.136	1.77	.15
CALCANEAO VALGI	.121	.122	1.42	.24
Deformity Type	.336	.267	7.23	.00

Table 6 The significance of the difference among age groups per evaluated deformity

	n	F	p
MANOVA	4	2.348	.006

Based on the variation of coefficient per age group and deformity evaluation (Table 6), it may be concluded that there is a statistically significant difference in flatfoot deformity evaluation between the four examined age groups, $p = .006$.

Table 7 The significance of the difference among age groups per evaluated deformity

	n	F	p
DISCRIM	4	2.368	.006

Since the coefficient, $p = .006$, in Table 7 for four synthesized deformities is statistically important, it may be concluded that there is a statistically significant difference in foot deformity evaluation between the boys divided into four age groups.

Table 8 Discrimination coefficient between age groups and deformity evaluation

	Discr. Coefficient
Deformation Type	.036
CALCANEAO VALGI	.011
PES TRANSVER.	.010
PES CAVUS	.003

Discrimination coefficients presented in Table 8 indicate that the highest discrimination is present in Deformation Type (PES PLANUS), .036. The lowest discrimination is present in PES CAVUS, .003. Hence, it may be concluded that the differences between age groups in terms of foot deformities mostly depend on the discrimination coefficient related to Deformation Type (TIP DEFORM. or PES PLANUS).

Conclusion

The discussion presented so far, which was based on the study sample of 287 boys and evaluated in compliance with the applied methods, leads to the following quite logical conclusion:

- o Although there is no significant biological difference between the examined age groups, the study indicated that there is a higher occurrence of various foot deformities in younger boys. The result was expected, because the physiological development of the foot arch in younger children is still not completed, so the observed statistically significant difference should not be accepted without reserve.

- o The observed PES CAVUS, PES TRANSFERSOPLANUS and CALCANEAO VALGI deformities are frequent in the whole examined population of boys. The cause probably lies in the level of the biological development of the foot in this age, so the statistically significant difference and percentages can not be accepted without reserve.

- Deformities integrated into the Deformity Type group (PP1, PP2, PP3 and PP4) are also related to the level of the biological development of the foot, because younger children had a higher percentage of the longitudinal arch collapse deformity.
- Based on the obtained values, it may be concluded and taken as a fact that foot deformities in boys up to 6 years old can not be qualified without reserve as foot deformity, whereas in boys over 7 years of age the observed foot status may be more reliably qualified as *with* or *without* deformity.

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UČESTALOST DEFORMITETA STOPALA KOD DJEČAKA U ODNOSU NA UZRAS

Sažetak

Deformitet stopala kod djece predškolskog i školskog uzrasta prema literaturnim podacima iz godine u godinu sve je veći. U želji da se potvrdi ta pretpostavka izvršeno je istraživanje tj. mjerenje stopala djece muškog spola predškolskog uzrasta, čija je uzrasna dob 4-7 godina. Za utvrđivanje deformiteta stopala korištena je tehnika mjerenja putem kompjuterizirane digitalizirane podografije (KDP), čiji se princip rada zasniva na podografu, sa specijalnim osvijetljenim staklom, videodigitaliziranom kamerom, kompjuterom sa specijalnom video karticom, specijalnim softverom i kolor štampačem. Dobiveni rezultati iskazali su veliki postotak deformiteta i zaključeno je da se deformiteti najviše pojavljuju kod dječaka 4-6 godina. Rezultati su prezentirani i dostavljeni nadležnim institucijama.

Ključne riječi: stopalo, deformitet, uzrast, stanje, razlike

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