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ASSESSMENT OF FOOT DEFORMITY IN PRE-SCHOOL CHILDREN IN "ALADIN" KINDERGARTEN TUZLA

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Abstract
The preschool years are characterized by additional physical development changes, enhanced motor abilities, and strengthened movement apparatus in the kid. The feet undergo morpho-functional changes at that period, particularly between the ages of 3 and 6, which result in the development of their longitudinal and transverse arches. The aim of this study was to evaluate the actual causes of foot deformity and its degree of severity in preschool-aged children, as well as the distinction in deformity representation between the sexes. The "Institution for preschool education" kindergarten "Aladin" in Tuzla is the focus of this study, which involves 74 children of both sexes, ages 3-6, were measured in 2023. Foot deformities are equally present in girls and boys. Deformities in boys are particularly pronounced: pedes recti 21 (56.8%), pedes planovalgi 6 (16.2%), while in girls: pedes recti 20 (54.1%), pedes excavati 8 (21.6%). With the Chi-square test, we determined the statistical significance of the presence of foot deformities between the sexes. By looking at the size of the chi-square (Pearson Chi-Square) 5.964a and Asymp. Sig. (2-sided) .544 tells us that there is no statistically significant difference in the representation of foot deformities between the sexes and that these deformities are equally represented. Because foot deviations can lead to problems kindergarten kids' foot arches need to be continuously monitored. This allows for timely intervention and the adoption of suitable treatment procedures to avoid the development of deformities.
Keywords: children, preschool strature, foot, deformity, gender.

INTRODUCTION

Reduced physical activity in children until they start school causes not only a decrease in functional and biomotor ability, but also contributes to the more frequent appearance of bad posture and, as a result, the appearance of body deformities. Physical deformity permanently marks a child, both in terms of physical appearance and special psychological condition. That is why the primary task is to detect the deformity in the initial stage and do everything to prevent its further development. Today, it is very well known that until the age of seven, the greatest attention should be paid to the proper growth and development of the lower extremities, especially the feet. Even in modern living conditions, a person's gait remains a basic physiological and social function, where modern conditions of life and work lead to negative consequences for the feet as well. The specific anatomical structure of the foot, its complex function, give rise to the claim that the foot is one of the key segments of the locomotor apparatus. It is often difficult to establish a boundary between normal form and function, and pathological states, because the transitions between these two states are gradual. With 20 muscles, 114 ligaments, 32 joints, and 26 bones, the foot is one of the most complicated anatomical segments of the body (Jovičić, 2007). Three points of support work together to provide the foot's flexibility and stability.

Physical and health education, as well as other curricular and extracurricular activities, including numerous sports activities, through specific kinesiology operators significantly influence the positive and high-quality transformation processes of the anthropological status of students in all its dimensions that make up the personality structure (Hadžikadunić & Balta, 2003; Skender & Kendić, 2002). With his knowledge and experience, the physical and health education teacher should monitor children's body posture, and detect in time spinal deformities (scoliosis, kyphosis, lordosis), crooked neck, chicken breast, winged shoulder blades, pelvic and hip deformities, deformities of the lower extremities O-legs, X-legs, and foot deformities.

The primary goal of this research was to determine the presence, form and degree of foot deformity in children of preschool age in the kindergarten "Aladin" Tuzla in the Tuzla Canton. Although it is a modest study with a single sample, the obtained results will be used for practical purposes in terms of the organization of physical education classes and sports, in order to apply different teaching aids in order to correct or possibly eliminate foot deformities in preschool children.

MATERIALS AND METHODS

Sample of the respondents

In this research, the sample of respondents was children from the pre-school institution (kindergarten) "Aladin" Tuzla, of both sexes. A total of 74 subjects were processed, divided into two subsamples of girls (37 subjects) and boys (37 subjects). The sample is representative only for the city of Tuzla (Bosnia and Herzegovina).

Sample variables

The sample of variables for this research was aimed at the very goals of the research, and the selected methods and measuring instruments were used to completely cover the researched area in order to obtain the best possible insight into the selected sample regarding the presence of foot deformities. Through research using selected methods and measuring instruments, the following foot deformities were determined: pedes recti - indented foot, pedes excavati - indented foot, pedes plani - dropped foot, pedes valgi - inverted foot, pedes planalgi - twisted foot, pedes transversoplani - transversely dropped foot, pedes transversoplanovalgi, pades aducti. This sample includes all children who were in the mentioned kindergarten during the measurement period.

Methods and instruments of research

In this research, the specialist in orthopedic surgery of the Clinical Center of the University used visual inspection methods with the use of a podometer (podoscope) and plantography methods in order to determine the status and presence of possible foot deformities in a sample of preschool children as well as possible. Data were collected using the model 2D LFT foot Scaner. The foot scan takes only 10 seconds (ideal for children) and is under the direct control of our central software support. You can then measure sizes, lengths and angles and mark problem areas that require special attention during the production of our insoles. With our 2D foot scanner, you can precisely measure the length and width of the foot (coordinates x and y). The 2D foot scanner uses a CCD processor that can see a certain depth and produce a better image. The values provided by the foot scan are very precise and give reliable results. Using our software support, you can mark problematic places on the pads. This data is then used to produce custom-made 2D inlays. Our 2D foot scanner supports a wide range of operating systems, including Windows 7, 8 and 10, and always comes with the latest updates. It has a maximum load capacity of 200 kg.

The measured data has been processed in a computer data processing department of the Faculty of Physical Education and Sport, Tuzla, Bosnia and Herzegovina , using the SPSS 27.0 (Statistical Package for Social Sciences). Basic statistical parameters have been calculated. The chi-squared test was used to identify the differences between among the male and female subjects, the with the help of the Chi-square test has been used. The level of statistical significance was set at $p < 0.05$.

RESULTS

Descriptive statistical measures represent the basic measures by which we describe our sample based on the obtained data. Descriptive analysis of categorical variables was done in the form of frequencies and percentages of sample representation and the presence of foot deformities in the sample. Table 1 shows the summary frequency distribution of the sample by gender with the percentage of representation in the researched sample, while table 2 shows data on the total prevalence of foot deformities in the researched sample.

Looking at tables 1 and 2, we can conclude that the data on the presence of foot deformities in the researched sample are alarming and require a serious, versatile and studious approach to solving this problem. Tables 1 and 2 show the presence and numerical representation of individual body deformities in relation to gender, from which it is evident that foot deformities are equally more present in girls and boys. Pedes recti 21 (56.8%), pedes planovalgi 6 (16.2%) and pedes recti 20 (54.1%), pedes excavati 8 (21.6%) were particularly pronounced in girls. The reason for this condition of this foot deformity can be found in the anatomical-physiological predispositions of weaker joint-bone connections and the presence of significantly weaker muscle fibers in terms of quality and number. Of course, we must not ignore other factors of this condition, such as less physical mobility, body weight, footwear, and more.

With the Chi-square test (table 3), we determined the statistical significance of the presence of foot deformities between the sexes. The significant value of statistical significance was investigated at the $p < 0.05$ level. Table 3 shows the Chi-Square test, and by looking at the size of the chi-square (Pearson Chi-Square) 5.964a and Asymp. Sig. (2-sided) .544 tells us that there is no statistically significant difference in the representation of foot

deformities between the sexes and that these deformities are equally represented.

Table 1. Summary frequency distribution of the sample by gender with the percentage of representation in the researched sample

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Def. * Gender	74	55.2%	60	44.8%	134	100.0%

Table 2. The total prevalence of foot deformities in the researched sample

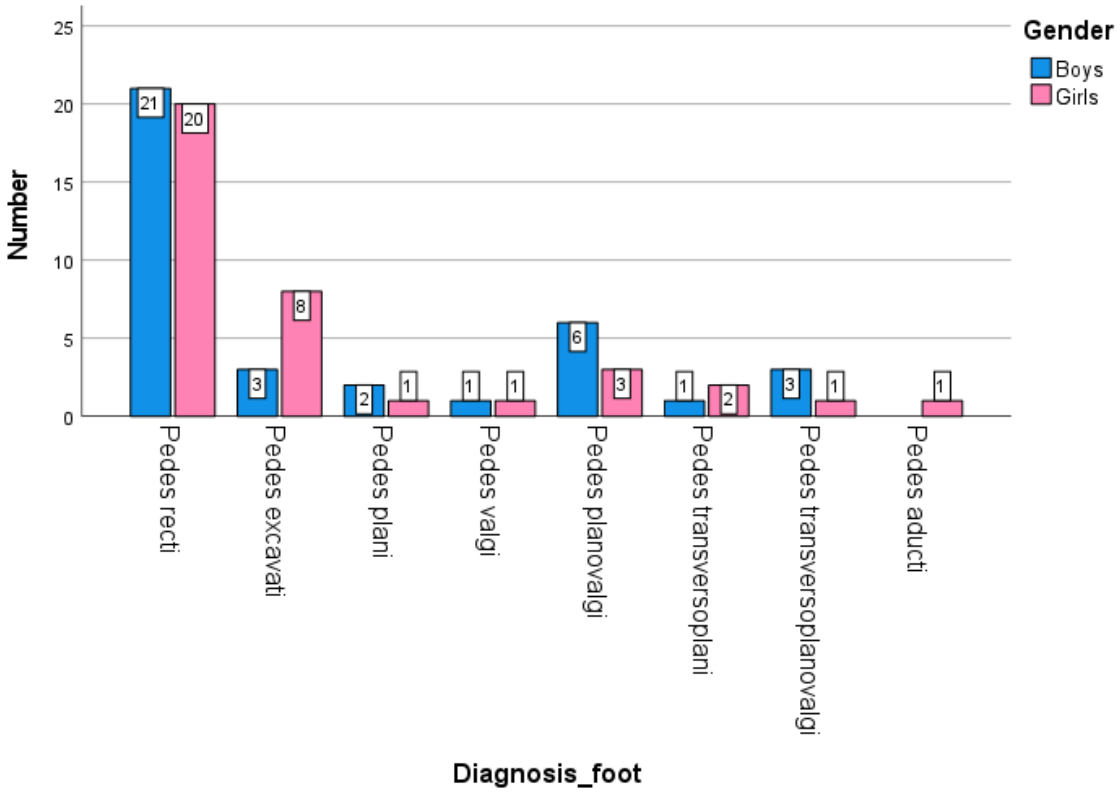
		Gender					
		Boys		Girls		Total	
		N	%	N	%	N	%
Def.	Pedes recti	21	56.8%	20	54.1%	41	55.4%
	Pedes excavati	3	8.1%	8	21.6%	11	14.9%
	Pedes plani	2	5.4%	1	2.7%	3	4.1%
	Pedes valgi	1	2.7%	1	2.7%	2	2.7%
	Pedes planovalgi	6	16.2%	3	8.1%	9	12.2%
	Pedes transversoplani	1	2.7%	2	5.4%	3	4.1%
	Pedes transversoplanovalgi	3	8.1%	1	2.7%	4	5.4%
	Pedes aducti	0	0.0%	1	2.7%	1	1.4%
Total		37	100.0%	37	100.0%	74	100.0%

Table 3. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.964[a]	7	.544
Likelihood Ratio	6.514	7	.481
Linear-by-Linear Association	.263	1	.608
N of Valid Cases	74		

a. 12 cells (75.0%) have expected count less than 5. The minimum expected count is .50.

Chart 1. Representation of deformities by type and by gender



DISCUSSION

Comparison of the our results of the analyzed deformities in artical authors (Videmšek et al., 2006) the sample of subjects included 127 children from 18 kindergartens in Ljubljana, Slovenia. It has been ascertained that 8% children had healthy, normal feet, 20% represented the flat foot borderline cases, and 72% children had flat feet. The results of the analysis of variance indicated that there was no statistically significant difference between three-year-old boys and girls in the incidence of flat feet. However, development of foot arches takes place in childhood, most intensively up to year 3, and it is considered that the development of foot arches ends approximately with the development of walk, approximately by year 12 in both genders when it ends in girls, while the critical period for the development of plantar arch is up to year 6 (Volpon, 1994).

In conclusion (Kendić et al., 2007) upon the examination of 552 pupils of Elementary School "Harmani II", 201 (36.42%) children were found with normal feet (pedes recti) while 351 (63.58%) children had some form of feet deformities. In I grade of Elementary School "Harmani II" in Bihać we found 60.59% pupil with feet deformities (60.00% female and 61.29% male pupils). In II grade 56.37% pupil had feet deformities (65.19% female and 65.54% male pupils). Percentage of feet deformities found in children of IV grade is 60,93% (66.31% female and 52.54% male pupils). Similar research was conducted by the author Čolakhodžić (2017) the goal of the study was to establish, based on determined status, the frequency of foot deformity in children of primary school age in the City of Mostar, Bosnia and Herzegovina. This research was done during the 2015/16 school year on a sample of 2.540 pupils of both sexes. The research results obtained by the plantography method show that 39.65% of children included in this study have some kind of foot deformity. 432 or 17% of the children have flat feet (pedes plani), 413 or 16.25% have twisted feet bent outward (pedes valgi), 59 pupils or 2.32% of the pupils included in this research have twisted flat feet (pedes planovalgi), while 40 of them or 1.57% have lowered transverse arches (pedes transversoplani). The results indicate the necessity of engaging all relevant factors in the system of education in the prevention of occurrence of deformities in children of primary school age. In the research by (Garcia-Rodriguez et al., 1999) on a sample of children aged 4 to 13, it was found that as many as 75% of total flat feet appeared at the age of 4 and 5. Likewise, no gender differences were observed either in a single measurement in this age. These results are opposed to other studies suggesting that boys are more inclined to foot deformities and that the incidence is more noticeable in male gender. There are literature reports on gender differences in preschool children (Pfeiffer et al., 2006; Chang et al., 2009, 2010,

2011), as well as in children aged 7-14, whereas Hernandez et al. did not observe significant gender differences in the frequency of deformity in children aged 5-9 (Hernandez, 2007).

Nowadays, we try to protect our children in every place. This, however, is sometimes rather harmful. Let's take an example of walking barefoot. When walking with no shoes on, a foot has to adjust to a variety of surfaces with every step he/ she makes. This way, the muscles are strengthened and form a foot arch, which is very signifi cant for the entire body statics (Kontrec, 1998). While trying to protect our children, we practically eliminate any possibility for them to gain new experience and to strengthen their bodies. Children should be allowed and enabled to crawl, jump, climb and perform a variety of gymnastics movements, because this is how they discover things, gain new experiences, and strengthen their bodies. This way children will develop their motor skills, an important contributor in the locomotor system development, which feet are a part (Atiković et al., 2023). If we allow children to fulfil their needs to move, we will enable them to develop strength, movement coordination, balance and other skills. At the same time, we will prevent their arches from falling and, consequently, prevent fl at feet (Emić et al., 2017). During the measurement (Atiković, et al., 2023), it is obvious that the dominant side of the body is more on the right arm or leg than the left. The results show us that the dominant compared to the non-dominant looks like this: Hands dominant: boys' right hand 85.1%, girls' right hand 96.1%, legs dominant: boys' right leg 80.9%, girls' right leg 88.2%. In general, the left side of the body is used less already in early preschool age. It is important that parents, kindergarten teachers and physical education teachers cooperate well like in kindergarten Aladin Tuzla. With their good example, demonstration and encouragement they can save many a child from a number of problems. Regular and systematic physical activity will certainly reduce the level and frequency of foot deformities in early preschool age in both sexes (Atiković et al., 2023). In 2019, the World Health Organization (WHO) issued global guidelines for children under the age of five, which refer to physical activity. Guidelines suggest that children aged three and four should have at least 180 minutes of physical activity, of which 60 minutes should be of moderate to vigorous intensity (WHO, 2019). The results of movement behaviours of preschool children (3-5 years old) in Bosnia and Herzegovina showed that only 23% of the children met all three guidelines, and compliance rates varied for each guideline. The physical activity time guideline was met by 64% of children, the sleep duration guideline was met by 74% of children, and the screen time guideline was met by 53% of children (Užičanin et al., 2023). Only a low proportion of children met the WHO guidelines.

CONCLUSION

The goal of this research was to obtain accurate data on the diagnosis of the condition of the feet of the researched sample of preschool children in the kindergarten "Aladin" Tuzla. The research was carried out with the expert help of specialists in orthopedic surgery of the Clinical Center of the University of Sarajevo. In relation to the applied technique of investigating the status of the foot, it can be concluded that the method of visual inspection with the use of a pedometer and the method of plantography (the technique of recording and reading a plantogram) gave good insights into the condition of the longitudinal and transverse condition of the foot. The obtained research results indicate a relatively large percentage of deformities of the longitudinal and transverse arch of the foot. Changes in the arches of the feet are mostly in the 1st degree, which makes it possible to improve the condition with the use of corrective exercises in working with children and the use of corrective insoles. In general, based on the obtained results, the conclusion that it is extremely important to identify the occurrence of foot deformities in a timely manner is imposed. Also, that through the proper cooperation of kindergarten teachers, parents, or medical institutions, it is possible to work very effectively to reduce the frequency of these deformities. The cause of this situation certainly lies in the insufficient movement (physical) activity of the examined population, inadequate nutrition and certainly clothing. Children must be provided with movement and continuous physical activity at least twice a week in kindergarten. This is one of the basic needs that a child must satisfy in order to develop properly. Targeted exercise and stretching. especially after peaceful "learning" activities, we will ensure the proper growth and development of children and thus prevent, stop or repair physical deformities that have already occurred.

Conflicts of interest - The authors declare no conflict of interest.

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