PREVALENCE OF FOOT DEFORMITY IN PRIMARY SCHOOL CHILDREN

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Abstract: The frequency of occurrence of acquired flat feet increases with the development of civilization, because the gripping function has completely disappeared and today the foot is exclusively used for support. The correct shape and function of the foot directly depends on a properly built bone structure and a good balance of the strength of the muscles involved in standing and walking. If this balance is disturbed, as a result, the vaults descend. The aim of the work was to analyze the prevalence of lowered foot arches in boys and girls aged 6 to 11 from Bijeljina and Brčko (Bosnia and Herzegovina). The research was transversal in nature, only one measurement was carried out. 235 children of both sexes, 111 boys and 124 girls, took part in the analysis of the arches of the feet. The diagnosis of flat feet is based on the valgus position of the heel and the lowered arches of the feet. The subjects' feet were scanned in a standing position with a computer digital podoscope SupOrt. This measuring instrument analyzes the status of the arch of the foot in 5 degrees, four degrees refer to a flat foot and one to the so-called indented foot. The research results show a high prevalence of lowered foot arches in the analyzed sample of respondents of 63%. Male respondents had a significantly higher prevalence of lowered foot arches compared to female respondents. This research is one of the few that uses a reliable digital computer podoscope to analyze the arches of the feet. Children with increased body mass had a higher prevalence of foot deformities.

Keywords: Prevalence, foot deformities, younger school age,

1. INTRODUCTION
Foot status is an established factor in determining lower extremity function and may therefore play a role in predisposing to repetitive strain injury (Nigg, Cole, Nachbauer, 1993; Nawoczenski, Saltzman, Cook, 1998; Dahle, Mueller, Delitto, Diamond, 1991; Hamel, 2021). The foot is one of the most complicated anatomical segments of the body, consisting of 26 bones, 32 joints, 114 ligaments, and 20 muscles (Jovicic, 2007), and its stability and elasticity are achieved with three points of support. Foot deformities are frequently encountered in pediatric orthopedic and rehabilitation practices. Dropped arches of the feet (pes planus) represent a biomechanical problem. The frequency of occurrence of acquired flat feet increases with the development of civilization, because the gripping function has completely disappeared and today the foot is exclusively used for support. Another reason is hypokinesia (decreased movement), which is especially dangerous for children who live in cities, because they walk exclusively on a flat, hard surface. Namely, permanent uniform loads lead to weakening and loosening of the musculature of the lower legs and feet. Improper footwear, which constrains and limits muscle activity, also adversely affects the development of the feet. Children who live in rural areas and walk barefoot on uneven terrain are much less likely to have flat feet. The correct shape and function of the foot directly depends on a properly built bone structure and a good balance of the strength of the muscles involved in standing and walking. If this balance is disturbed, as a result, the vaults descend.

Based on research conducted by a large number of domestic and foreign authors and scientific workers in the field of kinesiology and physical deformities in school-age children in primary schools, it can be established that the number of children with impaired physical status is increasing (Jovović, Čanjak, 2011; Bizača, Kučić, 1999). The most fundamental factor affecting the morphology of the foot is the medial longitudinal arch. It is considered that the age of six is the critical age for the development of the medial plantar arch (Mortazavi, Espandar, Baghhdadi, 2007). After 6 years, arch development slows down to an almost constant rate, until the foot stops at about 12 to 13 years of age (Forriol, Pascual, 1990). Looking at differences in relation to gender, a large number of authors (Wozniacka, et al. 2013; Chang et al. 2009; Pourghasem et al. 2016; Đokić and Stojanović 2010; Chen, Chung & Wang, 2009, Chou et al. al., 2009, Bogdanović and Marković, 2010) prove that the deformity of the flat foot is more present in boys, in contrast to girls, where a lower prevalence was observed (Obradović & Milošević, 2008; Milošević & Obradović, 2008).

2. MATERIALS AND METHODS
The sample of respondents of children of younger school age was determined by the non-probability method of stratified quota sampling, on the population of the first five grades of primary schools "Meša Selimović" in Janja,
"Knez Ivo od Semberije" and "Jovan Dučić" from Bijeljina, "Sveti Sava" in Foča, "Tr. school" Brčko. The parents confirmed their children's participation in the testing with their signature, which is in accordance with the Helsinki Declaration on Biomedical Research (1964).

The research was conducted in the period from September 2021 to March 2022. The sample of respondents included 235 respondents aged 6 to 11 years (+/- 6 months), who attended junior grades of primary schools in the Republic of Srpska.

Measurement of the status of the arches of the feet

Various causes (sudden heavy loads, weakness of the ligaments, obesity, irregular lifestyle, hormonal disorders) lead to the stretching of the ligaments that maintain the arches of the feet and to their lowering and changing the direction of the load lines. Permanent load in the wrong direction causes a definite deformation of the architecture of the feet, which can result in deformities of the spine, knees, and hips.

The main task is to:
- We recognize static deformities
- Let's apply the treatment of changes - correction

Thanks to the state-of-the-art method of computerized digital podography, which is a combination of computer technology and medical science, cases requiring treatment can be separated with great precision.

The procedure for photographing children's feet will take place as follows:
1. Filling in the questionnaire with data
   A foot examination begins with filling out a data questionnaire. In the questionnaire, you can see the data that you must fill in, so that we can continue the review.

   **Figure 1. Archive photo for filling out the respondent's record.**

Using the χ² test, the differences in the representation of lowered and raised foot arches in the analyzed sample of respondents were calculated;

### 3. RESULTS

<table>
<thead>
<tr>
<th>Variables</th>
<th>%</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>No deformities</td>
<td>19.61</td>
<td>8.82</td>
<td>10.78</td>
</tr>
<tr>
<td>Pes cavus</td>
<td>10.78</td>
<td>4.90</td>
<td>5.88</td>
</tr>
<tr>
<td>Pes planus I</td>
<td>17.65</td>
<td>8.82</td>
<td>8.82</td>
</tr>
<tr>
<td>Pes planus II</td>
<td>22.55</td>
<td>12.75</td>
<td>9.80</td>
</tr>
<tr>
<td>Pes planus III</td>
<td>16.67</td>
<td>8.82</td>
<td>7.84</td>
</tr>
<tr>
<td>Pes planus IV</td>
<td>12.75</td>
<td>4.90</td>
<td>7.84</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 5.765 \ p = 0.330 \ \text{df} = 5 \]

<table>
<thead>
<tr>
<th>Variables</th>
<th>%</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>No deformities</td>
<td>20.83</td>
<td>9.64</td>
<td>11.20</td>
</tr>
<tr>
<td>Pes cavus</td>
<td>10.16</td>
<td>5.73</td>
<td>4.43</td>
</tr>
</tbody>
</table>
Based on the results of the $\chi^2$ test and its statistical significance ($\chi^2 = 5.765$ $p=0.330$ df=5), we see that there are no statistically significant differences in children in the first grade of primary school, but we certainly notice a high percentage of children who have some of the foot arch deformities.

Interpreting table 2, which shows the analysis of the status of the arches of the feet in children in the second grade, we can see that the number of children without deformities in the second grade has increased by about one percentage point compared to children in the first grade. Based on the results of the $\chi^2$ test and its statistical significance ($\chi^2 = 36.156$ $p=0.000$ df=5), we see that there are statistically significant differences among children in the second grade of elementary school. Analyzing the values individually, we see that these differences are manifested in favor of boys.

The results of Table 3, which shows the analysis of the status of the arches of the feet in children in the third grade, show that the number of children without deformities in the third grade is similar to the previously analyzed ages in this research. Based on the value of the $\chi^2$ test and its statistical significance ($\chi^2 = 53.420$ $p=0.000$ df=5), it is observed that there are statistically significant differences in children in the third grade of primary school in favor of girls.

The values in table 4 show the analysis of the status of the arches of the feet in children in the fourth grade show that the number of children without deformities in the fourth grade is slightly higher compared to the previously analyzed ages in this research. Based on the value of the $\chi^2$ test and its statistical significance ($\chi^2 = 41.990$ $p=0.000$ df=5) it is concluded that there are statistically significant differences in children in the fourth grade of primary school in favor of boys.

Based on the results in table 5, we can state that the percentage of children without deformities remained at around 23%, which is still an extremely high percentage, especially if we bear in mind that imbalance in one joint manifests itself in all other joints. At this age, it is increasingly difficult to act on the correction of lowered foot arches with some kinesiological treatment. By reviewing the $\chi^2$ test and its statistical significance, we can conclude that there
are statistically significant differences in the analyzed sample of respondents. Individual observation shows that the largest number of children had Pes planus I degree.

4. DISCUSSIONS
The arch of the foot is formed as the child grows and takes its normal shape until elementary school age, however, a large number of the total population of children have this disorder late in life and it is difficult or impossible to influence it later. Foot geometry and load in children change rapidly during growth. and maturing. Eluwa, Omini, Kpela, Ekanem, Akpantah, (2009) state that girls have a higher prevalence of lowered arch of the foot compared to boys. Research shows that children who wear shoes more during the day than children who spend less time in shoes have a higher prevalence of foot deformities (Rao, Joseph, 1992). Observing the results of the foot arch status in first grade children, it is possible to state the existence of statistically significant differences in favor of girls who had a lower prevalence of foot deformities compared to boys. Similar results are reported by (Igbi, Mpango, 1998; Pfeiffer et al., 2006; Viladot, 1992; Pajuelo, 2017; Alsancak et al., 2021; Mohammadi et al., 2021) who present the results that girls have a lower prevalence of deformities compared to boys.

In the second grade, the differences were manifested in favor of boys with a prevalence of deformities of about 79%. Similar data are presented by Banwell, Paris, Mackintosh & Williams (2018) who report a 62.7% prevalence of deformity at the age of 3 to 6 years, which later decreases to ≥40% at the age of 9 to 16 years. The results in the third grade show a slight decrease in the prevalence of deformities in children and the existence of significant differences in favor of girls who had a lower prevalence of foot deformities at this age. By projecting the results in the fourth and fifth grade, we can see the existence of differences in favor of boys, and the re-growth of the prevalence of feet in children. The most common foot deformity in children at this age is Pes planus I.

5. CONCLUSIONS
The obtained results cannot be generalized, due to the small sample of respondents, but they must be a serious alarm in order to engage all institutions first in the prevention and then in the correction of foot deformities. According to the results from the country and the region, a third of today's children have some form of deformity, which is a devastating data primarily because of the long-term poor health picture of the population in the future, but also materially if we know that one sick resident costs the state around EUR 25,000.

More frequent physical activities would certainly be desirable in that chain of preventive action, especially if we keep in mind the recommendation of the World Health Organization (WHO), which advises daily physical activity for 60 minutes in addition to all daily activities for children. Better coordination between experts and educational institutions is also necessary, which would have to explain to parents how important it is for the child to start exercises to correct foot deformity in a timely manner, because it is much more difficult to correct it later. Also, a more aggressive campaign by the state is needed to highlight this ever-growing problem among children.

In the future, further research is needed on valid and reliable, clinically relevant measures of foot status, including dynamic measures and the effect of age, gender and body mass on the prevalence of flat feet, especially for younger school-aged children. It is necessary to construct threshold values in relation to age.

REFERENCES


Igbidi PS, Mpango C. Prevalence of pes planus amongst the students in Mbarara University of science and technology, Uganda. West Africa. *Journal of Anatomy*, 1998; 6: 2-27


