

## ORIGINAL ARTICLE

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## Flatfoot decreases school functioning among children <11 years of age

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### ABSTRACT

#### BACKGROUND

Flatfoot is a musculoskeletal abnormality commonly found in children that could result in a reduction of quality of life because of its related symptoms and functional abnormalities. This study aimed to determine the association between flatfoot and the quality of life among children 5-18 years of age.

#### METHODS

A cross-sectional design was used in this study of children aged 5-18 years. The diagnosis of flatfoot was made in accordance with the Chippaux-Smirak Index classification, whereas general and domain-specific quality of life were measured using the Indonesian version of PedsQL™ that has been previously validated. Mann Whitney test was used to compare quality of life between children with flatfoot and normal feet, along with other variables that potentially may influence a child's quality of life.

#### RESULTS

A total of 79 out of 120 subjects was used to analyze the data. There was a statistically significant difference in the quality of life score in the school functioning domain between children with flatfoot ( $64.46 \pm 18.22$ ) and those with normal feet ( $75.90 \pm 17.29$ ) in children <11 years of age ( $p=0.029$ ). Apart from this, the study did not find any statistically significant differences in the total quality of life score or in other quality of life domains between the two groups.

#### CONCLUSIONS

Flatfoot significantly decreases children's quality of life in the school functioning domain. Early detection and correction of flatfoot may be necessary to improve the educational attainment of children suffering from this condition.

**Keywords:** Musculoskeletal deformity, flatfoot, quality of life, children

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## INTRODUCTION

Flatfoot or *pes planus* is the relatively common condition in which the whole or almost the whole foot contacts the ground as a result of flatness of the medial longitudinal arch.<sup>(1,2)</sup> For example, a study in Surakarta found that the prevalence of flatfoot in elementary school students was 27.4% of 1089 students examined.<sup>(3)</sup> Similarly, the study conducted by Ezema et al.<sup>(4)</sup> in Nigeria found a prevalence of 22.4% among 474 children aged 6-10 years. A Taiwanese study even showed that the prevalence of flatfoot attained 59% among 2083 children aged 7-12 years.<sup>(1)</sup>

Around 65% of children with flatfoot experience symptoms, such as pain, with some 68% having functional limitation.<sup>(5)</sup> Continuous pain accompanied by functional limitations may be the cause of disturbed learning activities, difficulty in social contacts, decreased participation in recreational activities, increased needs for health services, and ultimately may decrease quality of life.<sup>(6)</sup>

Assessment of quality of life may be performed to determine the magnitude of the impact of symptoms and also the functional limitations in a person with flatfoot. Quality of life itself is a multidimensional comprehensive construct that may further be subdivided into domains, such as quality of physical, emotional, and social functioning.<sup>(7)</sup> Assessment of quality of life in children may also evaluate the impact of functional limitations in more specific aspects, including the ability of the children to go to school or to play.<sup>(8)</sup>

A study on the quality of life of children with flatfoot was conducted in the UK by Kothari et al.<sup>(9)</sup> who showed a significant decrease in the quality of life in the physical, emotional and school domains in children with flatfoot compared with children with normal feet. On the other hand, a study in Colombia did not find a significant difference in the quality of life of children aged 6-12 years with different types of foot arch.<sup>(10)</sup> These inconsistent study results

call for further studies. Therefore, there is a need to conduct a study to compare the quality of life of children with flatfoot aged 5-18 years.

## METHODS

### Design of the study

The present study used secondary data taken from a cross-sectional study on children's health that was conducted in Soreang subdistrict, Bandung district, from September - October 2016.

### Subjects of the study

Children aged 5-18 years with neutral and flatfoot posture were recruited for the study. The exclusion criteria were presence of neurological abnormalities, lower limb surgery, and current use of orthoses. The prevalence of children with poor quality of life was 0.25<sup>(11)</sup> and for  $\mu=0.05$  and error level=0.05, the required minimal sample was 120.

Two villages in Soreang subdistrict, i.e. Pamekaran and Sadu, were selected on the basis of the number of children with recorded data at the *posyandu* and the excellent activity of the health cadres. Subsequently 20 children in each of the age groups of the PedsQL™<sup>(12)</sup> Quality of Life Inventory (5-8, 9-12, and 13-18 years) were selected from each village to ensure a uniform subject distribution.

### Data collection

The cadres in each village invited the parents of the candidate subjects who resided in the area to their homes to complete the quality of life survey at the appointed days. For children aged 5-7 years and children who were unable to read, the questions were read out and the questionnaire filled in by the investigators in accordance with the guidelines. On the other hand, for children aged 8-18 years, the filling in of the questionnaire was performed by the parents and the children themselves, so that the responses of the children could be confirmed by the responses of the parents.

Children who completed the questionnaire on the Quality of Life Inventory were then invited again for taking their footprints to measure the medial arch. The study subjects included in the analysis were those who had data on quality of life and footprint results.

### Assessment of foot shape

Assessment of foot shape was performed by final stage resident physicians at the Department of Physical Health Science and Rehabilitation, Dr. Hasan Sadikin Hospital, Bandung. Briefly, the assessment was performed by taking the children's footprint on a sheet of paper. The foot shapes of the children were then grouped into flatfoot or normal feet, based on the Chippaux-Smirak Index (CSI), which is the ratio of the minimum width of the foot arch to the maximum width of the metatarsals.<sup>(13)</sup> A value of CSI  $\geq 45$  was categorized as flatfoot.<sup>(13,14)</sup>

### Assessment of quality of life

The assessment of quality of life was performed using the questionnaire of the Pediatric Quality of Life Inventory (PedsQL™) 4.0 Generic Core Scales.<sup>(13-15)</sup> PedsQL™ is an instrument of quality of life measures in children,

that may be used in healthy children as well as children with given medical conditions such as asthma, cancer, or gastrointestinal tract disorders.<sup>(16,1)</sup> There are two forms of the instrument, i.e. reports of parents on the children (parent proxy-report) or reports of the children themselves (child self-report).<sup>(13)</sup> In addition to the total quality of life score, PedsQL™ also assesses the children's quality of life in five different functioning domains, i.e. physical, psychosocial, emotional, social, and school functioning. PedsQL™ has been translated into 60 languages, including the Indonesian language, and all language versions have been validated.

### Statistical analysis

To determine if the condition of flatfoot influences the quality of life score, a multiple linear regression test was performed. The total quality of life score and the quality of life score in each PedsQL™ domain was used as dependent variable and foot shape (flatfoot or normal) as an independent variable. Other variables that potentially influence quality of life in children, i.e. age, gender, parental occupation, educational level of the children, and body mass index, was used in the model as control variable. The level of statistical significance was set at  $p\text{-value} = 0.05$ .

Table 1 Demographic characteristics of study subjects

Variable	Flatfoot (n=32)	Normal (n=47)	p value
Mean age ( $\pm$ SD)	8.7 (2.5)	11.8 (3.4)	<0.001*
Gender			
Male	17 (53.1%)	19 (40%)	0.266
Female	15 (46.9%)	28 (60%)	
BMI ( $\pm$ SD)	18.21 (4.57)	17.50 (2.82)	0.395
Educational level			
$\leq$ Elementary School	30 (93.8%)	28 (59.6%)	0.001*
$>$ Elementary School	2 (6.2%)	19 (40.4%)	
Education of father			
$\leq$ Elementary School	10 (31.2%)	17 (36.2%)	0.651
$>$ Elementary School	22 (68.8%)	30 (63.8%)	
Education of mother			
$\leq$ Elementary School	12 (37.5%)	19 (40.4%)	0.796
$>$ Elementary School	20 (62.5%)	28 (59.6%)	
Village			
Pamekaran	15 (46.9%)	16 (34%)	0.252
Sadu	17 (53.1%)	31 (66%)	

Table 2 Comparison of mean quality of life between children with flatfoot and normal foot

	Mean		p value
	Flatfoot	Normal	
Physical Functioning	81.84 ± 14.7	79.80 ± 14.09	0.488*
Social Functioning	80.80 ± 19.23	83.69 ± 17.46	0.642*
Emotional Functioning	64.53 ± 19.97	66.38 ± 14.51	0.634
School Functioning	66.09 ± 18.03	72.60 ± 16.08	0.161*
Psychosocial Functioning	70.16 ± 16.21	73.98 ± 12.50	0.247
Total	74.99 ± 13.38	76.11 ± 11.29	0.975*

\*Analysis: Mann Whitney U-test

### Ethical clearance

The primary and secondary studies passed ethical clearance and were approved by the Ethics Commission on Health Research, Padjadjaran University, Bandung, under Nos. 790/UN6.C1.3.2/KEPK/PN/2015 and 334/UN6.C.10/KEPK/PN/2017.

### RESULTS

Of 120 children who became the subjects of this study, 79 (65.8%) had complete quality of life data and footprints, with statistically equal gender distribution. A total of 32 (40.5%) subjects had flatfoot. The mean age of the children with flatfoot ( $8.7 \pm 2.5$  years) was significantly different from that of the children with normal feet ( $11.8 \pm 3.4$  years) ( $p=0.001$ ). Most of the children with flatfoot were still in

elementary school or kindergarten. There was no significant difference between the two groups in mean body mass index and parental educational level (Table 1). There were no significant differences in quality of life or in functionings (Table 2). Therefore a stratified analysis should be conducted based on age of the children.

The results of a stratified analysis based on the children's age showed that in children aged <11 years, the quality of life in the school functioning domain was significantly lower in the flatfoot group compared with the normal group. In the other functioning domains no significant differences were found, showing that school functioning decreased significantly in the flatfoot group (Table 3). On the other hand, in children aged  $\geq 11$  years no significant decrease in school functioning was found in the flatfoot group.

Table 3. Comparison of quality of life between children with flatfoot and normal foot by age

	Flatfoot	Normal	p value
Age <11 years			
Physical Functioning	80.80 ± 15.24	78.17 ± 16.68	0.563
Social Functioning	79.07 ± 20.00	77.50 ± 21.58	0.799*
Emotional Functioning	63.03 ± 20.51	65.90 ± 16.37	0.594
School Functioning	64.46 ± 18.22	75.90 ± 17.29	0.029*
Psychosocial Functioning	68.45 ± 16.67	72.50 ± 15.53	0.388
Quality of life	73.63 ± 13.82	74.45 ± 14.14	0.838
Age $\geq 11$ years			
Physical Functioning	89.08 ± 7.85	81.25 ± 11.51	0.179
Social Functioning	92.50 ± 5.00	89.37 ± 10.03	0.612
Emotional Functioning	75.00 ± 12.90	66.80 ± 12.98	0.228
School Functioning	77.50 ± 13.22	69.58 ± 14.58	0.319
Psychosocial Functioning	81.66 ± 4.08	75.34 ± 9.02	0.185
Quality of life	84.23 ± 1.88	77.62 ± 7.87	0.111

## DISCUSSION

The results of this study showed that flatfoot was significantly correlated with decreased quality of life in the school functioning domain in children aged <11 years. On the other hand, flatfoot was not correlated with quality of life in the other domains and the total quality of life score.

Flatfoot in children is known to cause symptoms such as pain in the sole and also to cause functional limitations such as limitations in standing, walking and running.<sup>(5,18)</sup> Pain that is continuously present and the functional limitations may result in abnormal school functioning in the children.<sup>(6)</sup> The fact that flatfoot was not correlated with total quality of life and domains other than school functioning may be explained by the pain resulting from flatfoot, that may more frequently appear in school as a result of the children having to wear shoes. In addition, the pain may also more frequently appear in school because of the limited opportunities for the children to rest their feet at the onset of pain. A literature search found at least one study showing an association between the appearance of pain in flatfooted children and the use of shoes, and a number of studies showing that flatfoot causes increased internal activity and fatigue of the leg muscles and ultimately pain.<sup>(19)</sup>

Similar results were found by Kothari et al.<sup>(20)</sup> who showed that flatfoot may affect quality of life. However, their study found that children with flatfoot also had a lower quality of life in physical and emotional functioning domains as compared with children with normal feet. These differences may be explained as a result of the selection of study subjects in the UK who mostly came from orthopedic clinics, whereas in the present study the subjects came from the community. In addition, the paired t-test used in previous studies also did not control for other possible confounding variables.<sup>(20)</sup> The influence of location on the quality of life of the children also cannot be eliminated. Most locations in

developed countries differ in many respects from such locations as the villages of Sadu and Pamekaran in Bandung district, that may influence the quality of life of children with flatfoot. This includes, but is not limited to, differences in the quality of health services and in the activity of the children in school. These results from Bandung district also show a significant mean difference in mean total quality of life and several specific domains among the children residing in the villages of Sadu and Pamekaran.

Although the variables that potentially may confound the association between quality of life and foot shape were entered into a regression equation, only 16-27% of the variability of the quality of life scores could be explained. This shows that there were other variables affecting the quality of life domains that were present in the regression model. These other factors were among others pathological condition, physical activity, sedentary lifestyle, sleep duration, and the food consumed by the children, that were not assessed in this study.<sup>(21-23)</sup>

Although the present study did not find implications of flatfoot on the children's quality of life in general, the influence flatfoot on school functioning may have practical significance and may form the basis for early interventions in patients with flatfoot. In other words, interventions in children with flatfoot may confer benefits in the form of improved academic performance and, furthermore, improved quality of human resources. The possible interventions are among others the fitting of foot orthoses, selection of appropriate footwear, and, if necessary, surgery. However, the public health significance of flatfoot and early interventions for this condition need to be researched further. Generalization of the study results to the population of children outside the study sample should also be done carefully, because of the possibility that selection bias from the selection of subjects residing nearby the homes of the health cadres may not be fully eliminated.

## CONCLUSIONS

In this study sample, flatfoot had a statistically significant with a decreased children's quality of life score in the school functioning domain. Early detection and management of this condition in school children may be necessary and may contribute to educational attainment in children with flatfoot.


## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with the parties concerned in this study.

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## CONTRIBUTORS

YD and IRD contributed to drafting of the manuscript and composing the study proposal. PFH contributed to data collection and revising the manuscript. YD, PFH and IRD read and approved the final manuscript. 

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