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THE RELATIONSHIP BETWEEN AGE, GENDER, AND BODY MASS INDEX TO THE PREVALENCE OF FLATFOOT IN PRIMARY SCHOOL CHILDREN IN LAWEYAN

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ABSTRACT

Background: *Flatfoot is is a postural deformity relating to the collapse or flattening of the medial longitudinal arch. It often appears with symptoms and varying degrees of deformity and disability. Flatfoot can be influenced by two factors; internal and external factors. The purpose of this study is to estimate the correlation between age, sex and body mass index (BMI) with the prevalence of flatfoot in primary school children in Laweyan.*
Methods: *This study was an analytic observational study with cross sectional approach. A sample of 285 subjects was obtained through the sample size calculation with the research formula for the proportion of one group. The subjects were 68 students of SDIT Insan Mulia and 217 students of SDIT Nur Hidayah which obtained by stratified random sampling. Inked foot print test and Chippaux Smirak Index were used to identify the flatfoot.*
Result: *There were 172 people (60.4%) experienced flatfoot with the highest number at age 7 years (67.9%) and there was no association between age and flatfoot ($p>0.05$). The prevalence of flatfoot was higher in male than female and 78.7% of obese children had flatfoot with $p<0.05$. The prevalence of flatfoot grade 1, grade 2, and grade 3 were 82%, 11%, and 6,4% respectively.*
Conclusion: *There was correlation between gender and BMI with flatfoot, but there was no correlation between age and flatfoot. The association between flatfoot and BMI does not mean BMI is a contributing factor to the occurrence of flatfott in children.*

Keywords: *Age, gender, BMI, flatfoot*

INTRODUCTION

Foot posture is an established factor in determining the function of the lower limb and may therefore have a role in a predisposition to repetitive injury [1]. Flatfoot is often a complex disorder with symptoms and varying degrees of deformity and disability. Excessive pronation of the midfoot can cause a change in the joints above it. This may changes tibial and femoral rotation and altering the normal dynamic control of these joints when walking or move. These changes, can result in increased instability and an acute trauma [2]. Paediatric flat foot still a confusing topic in the clinical community. Whether it is important to treat the asymptomatic flat foot in children or not. Treatment of the adult acquired flat foot is often difficult and consume time because the symptoms can be worse by time and can affect another soft tissue linked to the ankle. It is important to prevent it by avoid the risk factors to flat foot at an early age. The factors that can affect flatfoot are age, gender, genetic developmental miles tone, obesity and tibialis muscle disfunction [3,4].

Therefore, this study was aimed at investigating the prevalence of flat foot and its associated personal characteristic to age, gender, and BMI. Laweyan is one of the sub-districts in Surakarta City and was chosen as a research site because researchers based on data obtained in 2018, Laweyan working area had more obese children compared to other regions.

METHODS

This study was an analytic observational study with cross sectional approach. A sample of 285 subjects was obtained through the sample size calculation with the research formula for the proportion of one group. The subjects were 68 students of SDIT Insan Mulia and 217 students of SDIT Nur Hidayah which obtained by stratified random sampling. Inclusion criteria was student age 6-10 years, while exclusion criteria was student who suffered of injury and there was no droup out criteria.

Independent variables were age, gender, and body mass index. While dependent variable was flatfoot. Data was collected by observation. Age and gender obtained by informed concent filled by respondent. Body weight was measured with weight scale, while body height was measured by high meter. Body mass index was obtained by calculated body weight and body mass and the criteria of BMI was determined based on WHO growth reference median. If score of BMI >+2SD is obesity, overweight if more than >+1SD, thin if under <-2SD, and very thin if BMI is <-3SD [5]. Flatfoot dentification begins with an inked foot print test, where the child is asked to dip the sole of the foot into the ink and then stick it on the paper. Then the dyeing results were calculated using CSI where children with >62.7% were categorized as flatfoot.

Data analysis used Chi square because the type of data generated from the two variables is categorical data. Ethical clearence letter was ethicaly approved by Healthy Research Ethic Committee faculty of medicine of Universitas Muhammadiyah Surakarta.

RESULT

Table 1 shows that most subjects involved in this study were 7 years (81 person). While subjects age 6, 8, 9, 10 years were 40 (14%), 55 (19.3%), 50 (17.5%), 59 (20.7%) respectively. Based on gender, the female were 145 person while male's subjects were 140 person where 67.1% of male experienced flatfoot. Based on BMI, 15 subjects were thin, 177 were normal, 46 were overweight, and 47 subjects were obesity where 37 (78.7%) of obesity were flatfoot. Moreover, the prevalence of flatfoot grade 1, grade 2, grade 3 were 82%, 11%, and 6.4% respectively.

Table 1. Subjects Characteristics

Characteristics	N	Percentage
Age (years)		
6	40	14.0 %
7	81	28.4 %
8	55	19.3 %
9	50	17.5 %
10	59	20.7 %
Gender		
Male	140	49.1%
Female	145	50.9%
Body Mass Index (BMI)		
Thin	15	5.3%
Normal	177	62.1%

Characteristics	N	Percentage
Overweight	46	16.1%
Obesity	47	16.5%

Table 2. Distribution of *flatfoot*

Grade flatfoot	N	Percentage
Grade 1	142	82%
Grade 2	19	11%
Grade 3	11	6.4%
Total	172	100%

Shown in Table 3, the chi square test indicated that there was no correlation between age and prevalence of flatfoot ($p>0.05$).

Table 3. Chi Square test between age and *Flatfoot*

Age	Type of Arch		*P Value*
	flatfoot	Normal	
< 7 years	26	14	0.636
> 7 years	146	99	

The result of the analysis indicated there was correlation between gender and flatfoot ($p=0.029$; $r=0.135$; PR=1.755). The correlation test indicated that there was correlation between BMI and flatfoot ($p<0.05$). The PR value showed that skinny children faced the risk of flatfoot about 1.15 times greater than children with a normal BMI. While the risk of flatfoot in overweight children was 0.3 times greater than in children with obesity.

Table 4. Chi Square test between gender and *flatfoot*

Personal Characteristics	Type of Arch		CC (r)	PR	*P value*
	flatfoot	Normal			
Male (n=140)	94 (67.1%)	46 (32.9%)	0.135	1.755	0.029
Female (n=145)	78 (53.5%)	67 (46.2%)			
Thin (n=15)	9 (60.0%)	6 (40.0%)	0.165	1.155	0.046
Normal (n=177)	100 (56.5%)	77 (43.5%)			
Overweight (n=46)	26 (56.5%)	20 (43.5%)		0.351	
Obesity (n=47)	37 (78.7%)	10 (21.3%)			

DISCUSSION

The results of the study indicated that there was no correlation between ages with flatfoot and there was no significant decrease in the number of flatfoot with age. The results of this study were supported by Tong & Kong [6] which showed that the structure of MLA was stable at 7 years old so that the degree of flatfoot in children did not decrease by the increasing of the age. This condition can be influenced by

the shoes wearing factor. The children who wore closed-toe shoes in 7 years indicated the lower MLA than in children with sandals or slippers. The slippers can train the intrinsic muscles and strengthen the structure of MLA when gripping occurs to avoid slipping from the floor. Muller [7] also indicated that MLA will stable after the sixth years.

Gender was correlated to flatfoot and the prevalence of flatfoot was greater in male than female where the risk of flatfoot in male was 1.75 times higher than female. This findings was supported by Ezema [8] who indicated that male children were twice more likely to be affected by flatfoot than female. Study conducted by Chang & Chen [9, 10] indicated that 35% of flatfoot was in male while in female was 20%. Mickle [11] also indicated that the male's foot was flatter than the female's foot. This condition caused by the midfoot differences between male and female. The male's midfoot was 6mm wider than female and the hind foot of male's foot was more valgus [12, 13]. Furthermore, the male development foot process was slower and the plantar fat pad is thicker so that the male was more in the risk of flatfoot than female [14].

This study showed that there was a correlation between BMI with flatfoot, where children with thin BMI are more at risk of flatfoot compared to normal children, and children with overweight are more at risk than obese children. Previous research conducted by Wardanie [15] in 1089 children in the city of Surakarta showed that flatfoot occurred more in children with a very thin body mass index. This finding is not consistent with previous report conducted by Sadeghi-Demneh [16] who indicated that 58.8% obese children experienced flexible flatfoot. Stolzman [17] explained that prevalence of flatfoot increased in overweight and obese children because there was foot morphology difference. In obesity, the plantaris arch is lower and have a thicker fat pad. Moreover, obesity will cause alteration of foot alignment to pronation and MLA collapse while standing because the pressure received by the soles of the feet is greater [18]. Thus, the association between flatfoot and BMI does not mean BMI is a contributing factor to the occurrence of flatfott in children.

CONCLUSION

There was correlation between gender and BMI with flatfoot, but there was no correlation between age and flatfoot. The association between flatfoot and BMI does not mean BMI is a contributing factor to the occurrence of flatfott in children.

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