Prevalence Of Pes Cavus And Pes Planus Among School Going Children Of Bhaktapur District, Nepal

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ABSTRACT

The aim of this study was to determine prevalence of Pes cavus and Pes planus in a population of 5-10 years old children. A total of 157 children (72 girls and 85 boys) of five to ten years from the school of Bhaktapur district were included in this study. Foot print were taken from both feet by inked method and the obtained foot print were then classified as planus, normal or cavus foot on the basis of Staheli Index (SI). Non parametric chi square tests and independent sample 't' test were applied and compare among gender, side of foot, and ages. Pearson's correlation was computed to establish relationship among the variables.In the present study overall prevalence of pes planus was recorded to be 5.1% on both feet. The cavus foot was 25.5% and 17.8% in right and left foot respectively. The mean arch index in female was 0.52 in right and 0.54 in left foot and in male it was 0.59 and 0.61 in right and left foot respectively. Prevalence of planus foot was more in male compared to female in each age group. There were very high percentages of flat foot among 5 year old children while the percentages were much less among 6-7 year old children, tending to little variation after that age. The present study showed significantly positive correlation between right and left foot($r=0.753$, $p=0.000$). Prevalence of flat feet were found more in male than in female, while the finding was just opposite for the prevelance of cavus foot. The proportion of flat feet decreases with age in both genders.

Keywords: Arch of foot, Foot print, Planter arch index, Pes planus, and Pes cavus

INTRODUCTION

Normally among the primates, only in human has arched foot with visible concavity in the sole. But in infants and young children, accumulation of fatty connective tissue in the sole results foot to appear flat. There are longitudinal and transverse arches recognized in human.[1] The arches act as shock absorbers, springboards for propulsion during walking, running, jumping and as an adaptable supportive base of the entire body as well as receives and distributes body weight. Deviation in the normal structure of the arches produces unbalanced, functionally unstable conditions of foot, leading to adverse effects on weight bearing, force dissipation and gait.

Two of the commonest deformity of arches of foot namely; Pes Planus and Pes cavus are most prevalent among children. Pes planus is commonly referred to as a "Flat foot" because of its low medial longitudinal arch (MLA) while Pes Cavus is referred to as "high arch" because of its abnormally high MLA that does not flatten with weight-bearing. Studies have shown that type of foot arch is associated with different injury patterns. Since 1952 quantitative information on arches of foot was initiated.[2] No such study have been carried out till date, pertaining to Nepalese children. Hence this study aims to bring out quantitative information (baseline data) among Nepalese children of Bhaktapur district which will be of value for further management of the cases related to the arch of foot.

MATERIALS AND METHODS

The study of 202 school children, to encompass a wide range of foot types, varying in degree of cavoid, normal and planus foot, within the age group of 5-10 years were included in the study. This age group as five to ten years were chosen, because in this age group arches of foot become apparent where as in children below five years almost all children foot show flat pattern.[3] The criteria for inclusion were: no previous history of foot fractures and no history of trauma or pain to either foot, or lumbosacral region. While the exclusion criteria include; children who could not bear weight on one foot long enough (5 seconds), children having foot drop, Poliomyelitis, and obese children (according to CDC a BMI $\geq$85 percentile)[4] whose weight may affect the footprint profile. The study was performed after obtaining ethical clearance from

the Institutional Review Committee (IRC) of Nepal Medical College Teaching Hospital. Further, consent was obtained from the Principal and subjects' class teacher of the concerned school.

Foot print study

Foot prints of both feet were obtained using the ink method, with the help of stamp pad. The subject was then asked to stand up and place the painted foot on to the white A4 paper kept on aboutthree inch high wooden stool to prevent unusual wobbling during the period of weight bearing on one foot. The procedure was repeated for the opposite foot as well. (Figure 1)

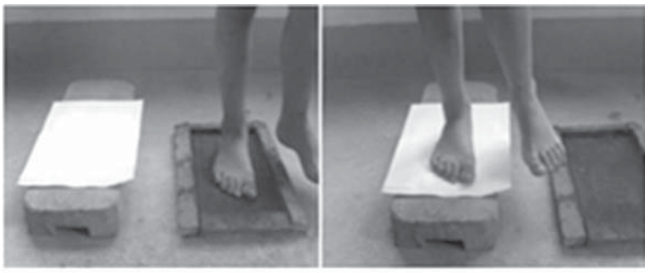

Fig 1: Taking footprint

Calculation of planter arch index

The planter arch index was calculated as follows: two parallel cross-sectionalstraight lines were drawn: the first over the narrowest section of the medial longitudinal arch (segment b) and second between the most medial and most lateral points of the heel region to obtain its widest segment (segment a). The two segments were measured in centimeter with the help of a scale, and the value of 'b' was divided by 'a' to get Staheli's Index.[5](Figure 2)

Fig 2: Method of grading footprints using Staheli Index

The result was then calculated and compared with the values obtained by other researchers.

Methodology to Classify Foot Type:

Planter arch index approaching zero indicates a high arched foot while a low arched foot has an arch index nearer to one. For study, the following arch index values will represent the following foot types (Table 1)[5]

Table 1. Classification of foot type

Arch Indices	Foot type classification based on arch index values		
	Pes Planus	normal foot	Pes Cavus
Staheli Index	≥0.9	0.44 to 0.89	≤0.43

Data Analysis

The obtained data were entered in Statistical Package for Social Sciences software (SPSS 15). Different statistical parameters were calculatedwhich included: percentage, frequency, chi-square test as a non parametric variables and 't' test was also computed to find the significant variation and Pearson's correlation between variables.

RESULTS

The data for the present study were collected from schools of Bhaktapur district. Out of 202 total children, 126 boys and girls were considered, who had BMI within 5th to 85th percentile, according to CDC growth chart.[6] Thirty-one children were underweight, 15 of them were obese and 30 children came under overweight group. As referred in material method, 15 obese and 30 overweight children were excluded, and total of 157 children were included in this study. The prevalence of pes cavus and pes planus depends on gender or age of the individual. Usually there is a planus foot in early childhood, because of planter amassed fatty connective tissue,[1] which gradually changes into adult form with progressive appearance of transverse and longitudinal arches, prominence of heel and development of planter flexor group of muscles.

Planus foot were less prevalent in comparison to that of cavus foot and cavus foot was more prevalent in right than in left foot (Table 2).

Table 2. Prevalence of Foot Type

Foot type	Right foot N (%)	Left foot N (%)
Pes cavus	40 (25.5%)	28 (17.8%)
Normal foot	109 (69.4%)	121 (77.1%)
Pes planus	8 (5.1%)	8 (5.1%)
Total	**157 (100%)**	**157 (100%)**

Statistical analysis showed high positive correlation between right and left foot(Pearsons correlation r =.767, p=0.000) (Figure 3).

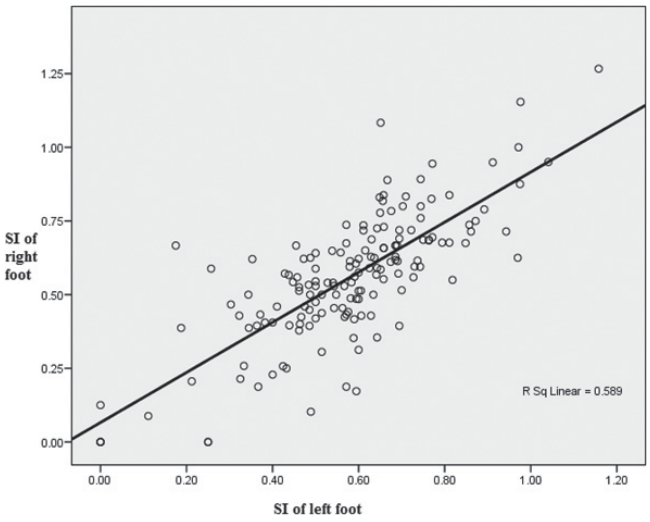

Figure 3: Correlation between right and left foot (Staheli index)

The mean Satheli Index of right and left foot according to age and gender of the children was relatively low in female than in male in each of the age group. The mean index of right foot is relatively less than left foot in both genders. (Figure 4: a,b).

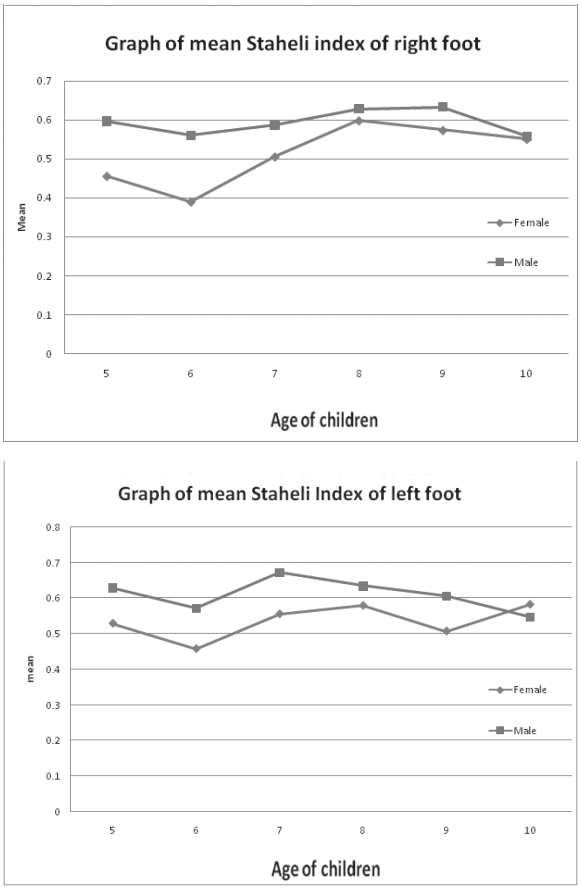

Fig 4: MLA development on right (a) and left (b) foot by mean of the SI

DISCUSSION

Study on frequency of pes cavus and pes planus have shown marked disparity. In the present study prevalence of planus foot was 5.1%(n=8) on both foot which is similar with the study made by many authors who reported prevalence of pes planus to be 2.7%, 5.7%, 4.1%(n=21), 5.5%, and 7.9%. [7-11]

Within the age group of five to 10 years included in this study, normal foot arch type was found to be more prevalent, 69.4% on right and 77.1% on left foot. Prevalence of pes planus recorded was relatively less than pes cavus. Such decreased incidence of flat foot in this study in comparison to the studies made in western countries [8, 12] could be because of children not wearing shoe as concluded by Rao et al [13] in their study. Such finding in this study also can be attributed and correlated with the socio-economic and cultural status of the people living in Bhaktapur district, as the occupation of the majority of population here is agriculture and people have the tradition of walking bare foot in their farm, and wearing shoes is strictly prohibited inside the house and in temple premises.

Prevalence of cavus foot is more on the right foot compared to the left foot which may suggest that right foot is the one which is more responsible for bearing the body weight, therefore it might have been more prone to develop foot deformity. Although Hernandez *et al* [14] showed significant difference regarding right and left foot, but in the present study there is no significant difference between right and left (r=0.759) planter arch indexes as recorded in the study made by Staheli et al [5] where r=0.93.

Many authors found that boys displayed significantly flatter feet than the girls and the boys had a significantly thicker planter fat pad than the girls on both the right and left feet.[11, 12, 15] The present study is in agreement with their study, there was more prevalence of planus foot among male on both foot compared to female in each age group. The reason of more planus foot in male could be due to thicker plantar fat pad in boys suggesting that the development of medial longitudinal arch (MLA) may be progressing at a slower rate in boys than in girls. In this study mean arch index of female was 0.52 in right and 0.54 in left foot, similarly 0.59 in right and 0.61 in left foot of male. This result was in agreement with the study of Staheli et al [5] who found the mean index of female was statistically lower than male with the mean being 0.66 in female and 0.71 in male. In the present study, prevalence of flat feet in male and female of different age group was decreasing age wise. While there was high concentration of flat foot among 5 year old children, among 6-7 year old children, the incidence

is much less, tending to little variation after that age. On statistical analysis the result was not significant ($p > 0.05$), which is similar to the study conducted by others as they noted that the prevalence of flat foot in school going children were infrequent.[8, 16] As suggested by Rao et al [13] wearing shoes at an early age could predispose flat foot, and being more precise, wearing tight shoes (leathers' school shoes) for over eight hours each day. The researchers also found an association between the wearing of shoes in early childhood and flat foot. [17]

The present study was carried out to find out the prevalence of deformity of foot arches among the school going children of Bhaktapur district, Nepal. In Europe and America flat foot is a common reason for attendance at a children's orthopaedic clinic [13] but not much research has been carried out in search of prevalence of Pes cavus and Pes planus amongst Nepalese children. In the study prevalence of planus foot was found to be more in male than in female, while the finding was just opposite for the prevalence of cavus foot. At the age of five year most feet were flat, but the proportion of flat feet decreased with age in both sex.

This study has provided the prevalence of pes planus among the school going children belonging to Bhaktapur district of Nepal as baseline data and for the comparison to other regions of the country. It also gives us a chance to study the changing pattern of arches of foot through the ages. As the child grows, their playful activities increases, thereby changing the pattern of planter arch with the advancement of age.

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