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A study on relationship between flat foot and health status in differently abled children

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Abstract
Flat foot is one of the common orthopaedic issues in paediatrics as well as adult health practice. The prevalence of flat foot is not much known possibly because there is no comprehensive meaning, proper categorization and different radiographic criteria for defining a flat foot. The purpose of the study was to establish a possible correlation between health status in terms of body mass index and posture in terms of foot angle of visually impaired, hearing impaired as well as mentally challenged children. A total of 111 students with special ability admitted to Blind (N=42), Hearing Impaired (N=36), and mentally challenged (N=33) served as subjects for the study. All inmates of all the three schools irrespective of gender were selected from Shivamogga Taluk for the present study and their age ranged between 11 to 18 years. The body mass index of subjects was calculated by using the following formula BMI = Kilograms / Meter^2. In order to assess flat foot incidence among disabled children most convenient method called pedograph was utilized. The statistical techniques employed for this study were Mean, Standard Deviation and Pearson product moment correlation coefficient to find out any significant co-relation between body mass index and flat foot angle. Present study will be analysis of data reveals that disabled children in Shimoga Taluk was found to be “underweight”. In case of foot angle, it was observed that the group selected for the study was “Normal” and correlation obtained between Body Mass Index and foot angel was observed to be in significant. In other words, there do not exists any significant correlation between the two variables.

Keywords: Flat foot, disabled, special population

Introduction
Physical disability or any other types of disability is a part of the human condition. Every person will be temporarily or permanently impaired at some point in life, and those who survive to old age will knowledge growing difficulties in functioning. Posture can be defined as the relative arrangement of body parts or segments, but generally it is the term used to describe the way a person stands. When we consider good or poor posture, the bones should represent a series of links connected by joints being held together by muscle and ligaments.
Flat foot is one of the common orthopaedic issues in paediatrics and adult health practice. The prevalence of flat foot is not much known possibly because thereis no comprehensive meaning, proper categorization and different radiographic criteria for defining a flat foot (Periyaand, Alagesan, 2017) [5]. The growth of foot arch is fast between two and six years of age and becomes structurally developed around twelve or thirteen years of age. A flexible flat foot has an arch that is present in open kinetic chain (non-weight bearing) and lost in blocked kinetic chain (weight bearing). Ainflexible flatfoot has loss of the longitudinal arch height in open and closed kinetic chain, common classification of flat foot deformities that differentiated between flat feet due to physiological and pathological etiologies. Causes of flat foot can be Congenital flat foot, adult flexible flat foot, posterior tibial tendon dysfunction, tarsal coalition, peroneal spastic flat foot, latrogenic, post traumatic arthritis, charcot foot, neuromuscular flat foot (Bhoir, Anapand, Diwate, 2014) [1]. Foot position is an established issue in determining the function of the inferior limb and may therefore have a function in a predisposition to repetitive injury. The flat foot abnormality is commonly encountered in paediatric orthopaedic and rehabilitation practices. Flat foot is a biomechanical problem consisting of a group of physical features that includes excessive (Ezema, Abaraoguand, Okafor, 2014) [3]. The flexible flat foot commonly occurs in childhood and may carry on to adulthood.

The word “flexible” means that the foot is flat in weight bearing, while the foot arch back to normal when weight is removed (Ueki, Sakumaand, Wada, 2019) [7]. The flat foot print examination using a pedograph is a simple, quick and cost-effective technique. The three dimensions usually used in the analysis of flat foot using a pedograph are: Clarke’s angle, the Chippaux-Smirak index and the Staheli index (Gonzalez-Martin, Pita-Fernandezand, Pertega-Diaz, 2018) [4].

The objective of the study

The purpose of the study was to establish a possible correlation between health status in terms of body mass index and posture in terms of foot angle of visually impaired, hearing impaired as well as mentally challenged children.

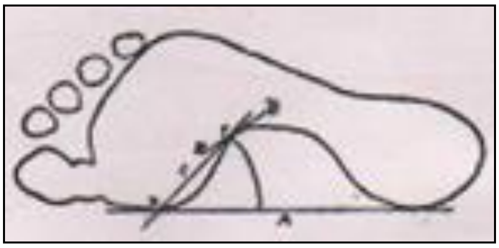
Methodology

A total of 111 students with special ability admitted at Sri Sharada Devi Residential school for Blind (N=42), Tharanga higher primary school for Hearing Impaired (N=36), and Asha Kirana Residential school for mentally challenged (N=33) served as subjects. All inmates of all the three schools irrespective of gender were selected from Shivamogga Taluk for the present study and their age ranged between 11 to 18 years.

The height measurement was done by following the standard procedure (Stewart and Marfell-Jones, 2001) [6]. The height of an individual was measured by using an instrument called (Indosurgicals portable stadiometre) stadiometer. The heavy outer garments, hair ornaments and shoes were removed before taking the height measurement of an individual and then made to stand by keeping their arms hanging naturally by the side of the body and kept their heel, buttocks and upper part of the back with vertical bar and look straight ahead along the pole of the audiometer. They were placed their head in Frankfort plane and maintain the normal breathing. The head piece of the stadiometer bar and the sliding part of the measuring rod was lowered up to the top of the head of an individual. The researcher took the height measurement from the floor to the highest point of the head and the reading was recorded in meters. The weight measurement was carried out by following the standard protocol. Before taking the weight measurement, an individual was asked to remove their outer covering except shorts. An individual was made to stand on the electronic digital weighing machine (Ozeri pro max digital weighing machine) and stood erect over the centre of the machine with distributed their body weight evenly on both the feet. An individual was made to keep their arms hanging freely on either side of the body with palm facing the thigh and stood with face foreword without any movement and normal breathing and the score was recorded in kilograms. The body mass index of an individual was calculated by using the following formula

BMI = Kilograms / Meter^2.

In order to assess flat foot incidence among differently abled children most convenient method called pedograph was utilized. In this, a sheet of paper was inserted under the inked foot of subjects and foot print recorded. Although there were number of ways to score the foot prints, a method proposed by Clarke was employed.



Clarke method for measuring internal longitudinal arch

1) Draw line “A” to present the medial border of the foot between the points of the imprint at the base of the first metatarsal bone (base of the big toe) and the calcaneus (heel bone).
2) Draw line “B” to present the slope of the inner segment of the longitudinal arch at its junction with the metatarsal border of the arch.
3) “X” is located at the point where line “A” first touches the imprint; “Y” is located at the point where line “B” first touches the metatarsal border of the arch.
4) Draw line “C” between points “X” and “Y” this line is intended to represent the slope of the metatarsal border of the longitudinal arch.
5) Measure the angel at the junction of the lines “A” and “C” with a protractor.

The data was collected at the residential schools with prior intimation and permission. The statistical techniques employed for this study were Mean, Standard Deviation and Pearson product moment correlation coefficient to find out any significant co-relation between body mass index and flat foot angle. The statistical analysis was carried out using statistical package for social sciences (SPSS). Where ever required tables and graphs were used for effective representation of results.

Findings of the study

The raw data pertaining to body mass index and foot angle of differently abled children were subjected to statistical analysis and descriptive statistics such as Mean, Standard Deviation and Pearson product moment correlation of coefficient. The test of significance applied in this case was two-tailed.

Lowest and highest body mass index, Mean and Standard Deviation of differently abled children (N=111) is Presented in table 1.

Table 1: Data Pertaining to Descriptive Statistics for Body Mass Index

Factor	No. of subjects	Minimum	Maximum	Mean	Standard Deviation	Normative Response
Body Mass Index	111	12.00	34.55	16.66	3.07	Under Weight

From the above table it is evident that the minimum body mass index, was 12.00 and the highest was 34.55. In this case the Mean and Standard Deviation is 16.66 ± 3.07. Therefore it can be concluded that on the basis of norms available, the group comes under ‘Under Weight’ category. The above information is graphically presented in figure 1 as below.

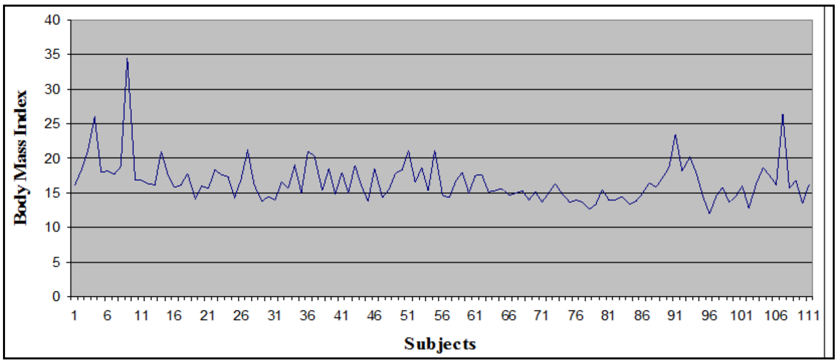


Fig 1: Graphical representation of data on body mass index

Lowest and highest Foot Angle, Mean and Standard Deviation of differently abled children (N=111) is presented in table 2.

Table 2: Data pertaining to descriptive statistics for foot angle

Factor	No. of subject	Minimum	Maximum	Mean	Standard Deviation	Normative Response
Foot Angle	111	1.00	77.00	55.86	13.99	Normal

From above the table it is evident that the Minimum Foot Angle observed was 1.00 and the highest was 77.00. In this case the Mean and Standard Deviation is 55.86±13.99. Therefore it can be concluded that on the basis of norms available the group comes under "Normal" category. The above information is graphically presented is figure 2 as below.

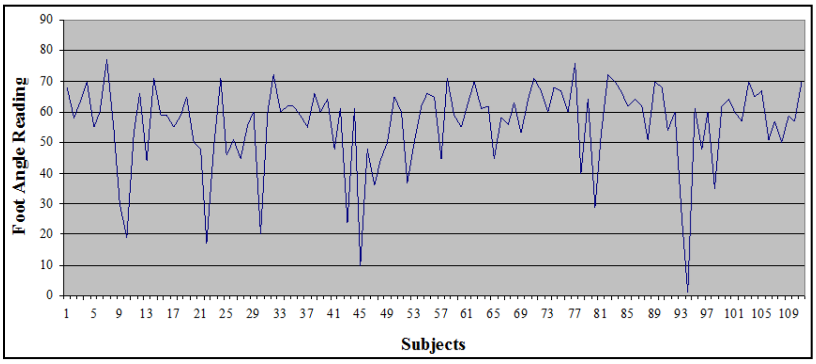


Fig 2: Graphical presentation of data on foot angle

Cumulative data depicting descriptive statistics for Body Mass Index and Foot Angle of differently abled children is presented in table 3.

Table 3: Data pertaining to descriptive statistics for body mass index and foot angle

Factors	Subjects	Min.	Max.	Mean	S.D	Normative Response
Body Mass Index	111	12.00	34.55	16.66	3.07	Under Weight
Foot Angle	111	1.00	77.00	55.86	13.99	Normal

From the above table it is observed that the group selected for the study had Body Mass Index of 16.66 ± 3.07 and Foot Angel of 55.86 ± 13.99.
Data related to correlation between Body Mass Index and foot Angle in terms of Pearson product movement correlation coefficient of differently abled children (N=111) is presented in table 4.

Table 4: Data depicting results for Pearson product moment correlation coefficient

		Foot Angle
Body Mass Index	Pearson Correlation	-.106
	Sig. (2-tailed)	.267
	N	111

From the above table it is clear that obtained correlation between Body Mass Index and Foot Angle of differently abled children at two tailed significance is 267. The above information is graphically represented with the help of a Scatter gram in figure 3 as below.

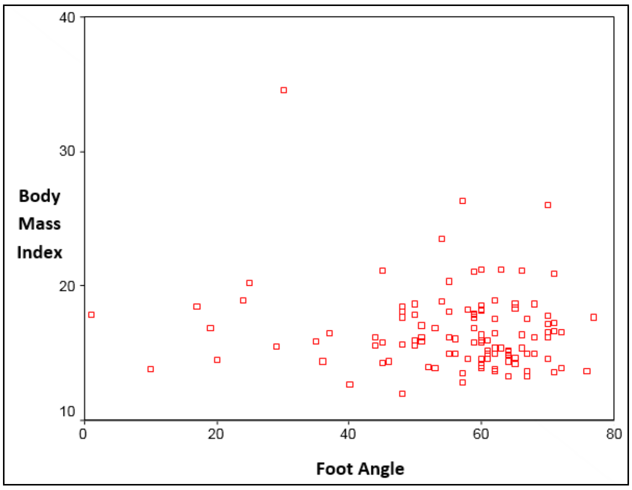


Fig 3: Graphical representation of data on correlation between body mass index and foot angle

Discussion on findings

From table 1 it is evident that, on the basis of given norms, the differently abled children sample selected for this study are under weight. Their Mean Body Mass Index was reported to be 16.66 and the homogeneity of this sample is indicated by standard deviation which is not higher than 3.07.

The results indicate that the differently abled children of Shimoga Taluk are malnourished and ill fed. From health point of view this development in Body Mass Index is beneficially for people with special needs. At the same time care should be taken to uplift them from underweight category to normal.

From table 2 it is observed that, on the basis of this study subject selected have a normal foot angle. The Mean score of the group is observed to be 55.86 and the homogeneity of sample is indicated by Standard Deviation, which is not higher than 13.99.

The outcomes indicate that the differently abled children of Shimoga Taluk have normal foot angle and are free from flat foot problem and its consequences. The reasons for this result may be associated with moderate activity level, and malnourishment, as observed earlier. Another reason for this may be the genetic makeup of the group.

Table 3 shows the correlation between Body Mass Index and foot angle of differently abled children in Shimoga Taluk for establishing correlation between two set of scores and finding any significant relationship Pearson product moment correlation coefficient was utilized. In this contest correlation observed between two set of scores was 267. The test of significance applied was a two tailed test.

To ascertain the degree of relation between two variables (two sets of scores) Pearson product moment correlation was applied. It compared the joint variance (co-variance) of Body Mass Index and foot angle and provided us the correlation coefficient (r).A relationship of 267 is not significant and tells us that the two sets of scores have a low relationship to one another.

As the results suggest low correlation between the Body Mass Index and foot angle of differently abled children in Shimoga Taluk, it is understood that there is no significant relationship what so ever between the two variables selected for this study. In other words Body Mass Index which predicts Health status has nothing to do with the foot angle.

Thus the hypothesis stated that there will be significant correlation between health status and flat foot incidence in special population is rejected, as the existing correlation of. 267 is very low. In this instance null hypothesis is accepted.

Similar results were observed in a study conducted by (Evans, Scutter, 2007) [2] the study investigated and compared findings of foot posture and functional health between groups of children aged 4 to 6 years with and without leg pain (describe as growing pains). The null hypothesis stated that there was no difference in measures of either foot posture or functional health between groups of children with and without leg pain. A stratified random sample of children was obtained. The children were identified with and without leg pain using a validated questionnaire for parents. The examiner was blind to the children's pain status. The schools and child care centres were from each geographical quadrant of metropolitan Adelaide and a northern rural region of south Australia. One hundred and eighty children (94 boys, 86 girls) entered and completed the study. Children whose parents returned a completed questionnaire and consent from were entered into the study. All participants were assessed by the one examiner. The foot posture measures used were those found to be most reliable in previous studies and for which the intra-rater reliability of the examiner was ascertained. Initial analysis of foot posture measures between the leg pain and no leg pain groups indicated a statistically significant result for the measure of navicular height, but only on the lef side (P=0.033). Logistic regression modelling showed that navicular height (Left foot only) was positively yet weakly related to growing apins (odds ratio, 1.072; 95% confidence interval; 0.991-1.160) and the effect was not significant (P= 0.08). Measures of functional health returned many statistically significant yet weakly correlated relationships. In conclusion the null hypothesis of the present study was supported in terms of clinical significance. While the foot posture measure of navicular height on the left foot was statistically significant it was not predictive for growing pains nor clinically significant as a measure between groups. The present study does not support the anatomical theory for growing pains and does not find a meaningful relationship between foot posture or functional health measures and leg pain in young children.

Conclusion

Present study will be analysis of data reveals that differently abled children in Shimoga Taluk was found to be "underweight". In case of foot angle, it was observed that the group selected for the study was "Normal" and correlation obtained between Body Mass Index and foot angel was observed to be in significant. In other words, there do not exists any significant correlation between the two variables.

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