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ANALYSIS OF FOOT WIDTH AMONG ADOLESCENT FEMALES WITHIN DIFFERENT BODY MASS INDEX STRATA – A CROSS-SECTIONAL STUDY

KEYWORDS: Human Foot, Width, Body mass index.

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ABSTRACT *Human foot is the region most affected by anatomical variations in the entire human body. The bones of the foot do not lie in a horizontal plane. Instead, ground with the support of ligaments and muscles, they form longitudinal and transverse arches. The present study is thus a attempt with subsequent evidence for analysis of width of foot among adolescent females within different body mass index strata among adolescent females. . In general, body mass index is classified as underweight (< 18.49) normal (18.5-24.9) overweight (25 – 29.9) and obese (>30). In the current study statistical analysis of foot width between these four Body mass index groups by ANOVA was done. High statistical significance (p value < .001) of foot width right, foot width left between the four BMI groups were observed by ANOVA. Knowledge of the pedographic findings is helpful to anatomists, orthopaedic surgeons, plastic surgeons, physiotherapists, orthoses manufacturers and foot wear designers.*

INTRODUCTION

Human development is a lifelong process of physical, behavioral, cognitive, and emotional growth and change. Adolescent foot morphology is dependent on gender, genetic environmental and lifestyle factors. Human foot is the region most affected by anatomical variations in the entire human body. Walking and running are the most common human movements and probably the most complex. Females in adolescent age have their own way of walking pattern which is unique. The present study is thus a attempt with subsequent evidence for analysis of width of foot among adolescent females within different body mass index strata among adolescent females.

AIM

The aim of the present study is to report the analysis of width of foot among adolescent females within different body mass index strata among adolescent females.

OBJECTIVES

Objectives of the study are as follows

- To measure the foot width and BMI of the participants
- To correlate the BMI with the width of both foot
- To critically consider the significances of BMI and width of footprint

STUDY DATA

The present study is a descriptive cross – sectional study, done in 153 volunteer female students between 18 to 20 years of age from Nursing college in Sri Ramachandra University over a period of 3 years (2013 - 2015)

MATERIALS

The materials used are :

- A4 sheet Paper.
- Weighing machine .
- Measurement scale.
- Draft scale .
- Measuring tape .
- Non-irritant blue ink.

METHODOLOGY

The study is conducted in stepwise manner.

CONSENT

- Written consent is obtained from the voluntary participants

BMI RECORD

- Height of the participant measured as distance from floor to the top of the head in centimetres.
- Weight of the participant measured in kilograms using weighing machine.
- BMI (Body mass index) - weight in kilograms divided by height in meter2 is calculated in kg/m2.

FOOT PRINT RECORD

- A rolling brush is dipped in ink containing tray and painted in the participant's right foot and left foot.
- Foot placed over the A4 sheet paper .
- -mpregnation of foot print obtained.

DATA ANALYSIS

Data analysis done with software-Autocad (2004) : Foot width - The maximum width of the forefoot (FIGURE 1)

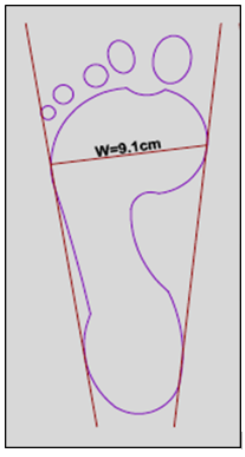

FIGURE -1 : Foot width

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RESULTS

Among 153 participants, Body mass index revealed 21.6 % under weight, 62.1 % normal, 11.8 % overweight and 4.6 % obese participants. Figure 2 reveals the general demography of our study according to each strata of BMI.

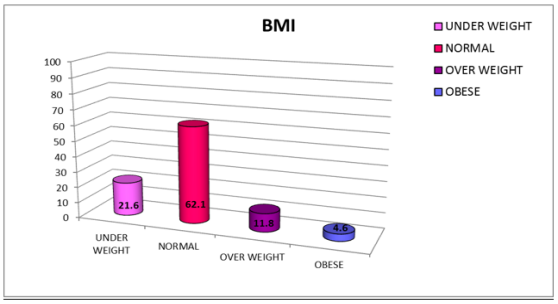

FIGURE -2 : General demography according to BMI.

High statistical significance (p value < .001) of foot width was observed by ANOVA between the four BMI stratas. Further analysis by post hoc test was done to identify the exact significance of each strata when compared with normal BMI. Table 1 shows the comparative analysis of both right foot width and left foot width between BMI stratas by post hoc test.

PARAMETER	COMPARATIVE BMI	BMI STRATA	MEAN DIFFERENCE	STANDARD ERROR	SIGNIFICANCE (P-VALUE)
RIGHT	NORMAL BMI	UNDER WEIGHT	.1315	.0936	.162
FOOT		OVER WEIGHT	.2189	.1191	.068
WIDTH		OBESE	.4800*	.1814	.009*
LEFT	NORMAL BMI	UNDER WEIGHT	.09727	.09532	.309
FOOT		OVER WEIGHT	.21984	.12127	.072
WIDTH		OBESE	.45913*	.18475	.014*

TABLE -1 : Foot length compared within BMI groups. * p - value < .05

DISCUSSION

The human foot, a highly complex structure with 26 skeletal elements multiple articulations, numerous muscles can be clearly understood by its developmental changes. It is evident that obesity is a major concern for public health and there is greater pontential for overweight children to become obese. BMI has relation with the morphometric changes of our body. In general, body mass index is classified as underweight (< 18.49) normal (18.5-24.9) overweight (25 – 29.9) and obese (>30).

In the current study statistical analysis of foot width between these four BMI groups by ANOVA was done. Existence of high statistical significance (p value < .001) of foot width right, foot width left between the four BMI groups were observed by ANOVA . Further analysis by post hoc test was done to identify the exact significance of each strata when compared with normal BMI which portrayed high significance with obese students compared to normal ones.

Correlation between different parameters of foot, to develop a model to reconstruct a stature from foot breadth in 285 asymptomatic healthy adults (149 males,136 females between 18-23 years of age done revealed, a significant correlation of stature with foot breadth and foot length with foot breadth on both right and left side in males and females, further linear regression equations were derived to calculate foot length and stature from foot breadth.[1]

The relationship between obesity and flatfoot among 1180 high school students (726 boys and 454 girls) in Rasht (North Province of Iran) was done, which revealed that temporary weight increase in the pubertal age between 12 and 15 years causes significant difference in the prevalence of flatfoot[2].

The reasons for flexible flatfoot, that the cause may vary from general soft tissue laxities to intrinsic foot pathologies and suggested that management would be needed if there is complaint, further wait and watch approach with counselling the family would be a best alternative[3]

1,032 schoolchildren (497 boys and 535 girls) of 6– 12 years old classified by BMI as obese, overweight and normal – weight and stated that significant differences were found between the feet of children with normal-weight and overweight (2.6 to 9.0 %) and among children with normal-weight and obese for all variables (3.9 to 17.3 %). The obese children showed more gradual changes in the foot measurements concluded as excess weight affects the foot structure of children[4].

An analysis done on footprint morphometry in young women beween 19 and 36 years. Geometric morphometric methods were applied to study shape variation of the complete footprint outline in a sample of 83 adult women which revealed low arched versus high arched feet, long and narrow versus short and wide feet, relative length of hallux, and relative length of forefoot as major axes of variation in foot morphology. Footprint shape differed on an average between right and left feet and variability of foot print asymmetry increased with BMI[5].

Chippaux – Smirak index is the ratio of the minimum width of the midfoot arch region to the maximum width of the forefoot region (foot width). Hence Chippaux Smirak Index is dependent on foot width. Any slight alteration in the foot width, significantly affects the Chippaux – Smirak index.

A study to determine the relationship between obesity and flatfoot among 1180 high school students (726 boys and 454 girls) revealed that temporary weight increase in the pubertal age between 12 and 15 years causes significant difference in the prevalence of flatfoot. Weight of the subjects positively correlated with chippaux-smirak index (left-0.525, right–0.512) and staheli index (right – 0.286, left – 0.279) in the current study, which are direct indicators of flat foot[2].

CONCLUSION

The current study, with the analysis of gender, BMI specific comparative analysis and advanced with critical elucidation of significance of the foot indices could be used as a quantitative standard by several biomedical specialities and efficient footwear engineering. Knowledge of the pedographic findings is helpful to anatomists, orthopaedic surgeons, plastic surgeons, physiotherapists, orthoses manufacturers and foot wear designers. Further research and categorization of flat foot, normal foot and high arched foot among adolescent females, and supplementary work of analysing the difference in footprint parameters among the females wearing high heels and flat footwears can be taken as future perspectives for this study.

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