



**ASSESSMENT OF PLANTAR ARCH INDEX AND PREVALENCE OF PES PLANUS -
HEEL VALGUS AMONG INDIGENOUS OSONI MALE AND FEMALE (18-45 YEARS)
RESIDING IN RIVERS STATE**

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ABSTRACT

Pes Planus, known as flat foot results commonly from collapsed or low medial longitudinal arch of the foot, a condition often seen in association with valgus deformity of the heel and plantar fasciitis. There has been no literature on flat foot incidence among indigenous people of Ogoni tribe. The research therefore aimed to assess Plantar arch index and prevalence of flat foot among Ogoni tribe ranging from 18 to 45 years of age, for the purpose of documentation. The study was conducted randomly on 145 subjects from Ogoni tribe using the convenience sampling technique. Footprints of all subjects were obtained using the simple ink method. Staheli's method was applied in calculating the Plantar arch index, where $PAI = A/B$. If the PAI is $>$ than 1.15, then it is considered as a flatfoot. A total of 29.03% of the subjects had flatfoot among with a score of 20.78% unilateral for (males 5.48%, females: 5.4%) and 8.28% bilateral 4.11% (males: 4.17%, females 4.11%). The study showed that prevalence of flatfoot among Ogoni tribe is low and males appear to have a greater percentage than the females. Vagal deformity of the heel was not found in the sample studied.

KEYWORDS: Flat, Arch, Foot, Plantar, Pes planus, Print.

INTRODUCTION

Flat feet, or pes planus, is a moderately common foot deformity characterized by the disappearance of the medial longitudinal arch of the foot where it hits or nearly contacts the ground.^[1] In adult population, flat foot type exists in about 10-25% and has been found to be associated with valgus heel deformity and related to musculoskeletal symptoms as lower back pain, osteoarthritis of the knee and plantar fasciitis. Presence of an averted rear foot, lowered medial longitudinal arch (MLA), abducted and dorsiflexed mid foot are the characteristic feature of the flat foot. The condition is frequently congenital; in such cases, the arch is present, but becomes blunted with weight bearing.^[2] Overuse syndromes involving the intrinsic as well as the extrinsic muscles of the foot invariably leads to fatigue and muscle cramps.^[3] Precise criteria for identifying and categorizing pes planus has not been fully agreed upon.. previous studies have reported that the condition tend to be more frequently encountered in college students aged two to six years (21 to 57 percent), while in primary school children the prevalence is lower (13.4 percent to 27.6%), compared with a range of 5 and 14 percent in the adult population.^[4] The presence of flat feet is diagnosed

by calculating the plantar arch index (PAI). $PAI = A/B$. If the PAI is >1.15 , then it is considered as flat foot.^[5] Females have been found to have a higher prevalence than males.^[6] Perhaps smaller bone size in women, thicker bones and heavier muscle mass in men could be responsible. These factors with the presence of more estrogen receptors on the bones of pre-menopausal women aid in the maintenance of the arches of the foot.^[7] In a study of athletes in Port Harcourt (Didia and Asomugha, 2004) reported that the prevalence of unilateral flat foot was higher in female athletes (4%) than in males (3 percent).^[8] Results of this study are in agreement with those of (Igbigbi and Mpango, 1998), on the prevalence of Pes planus among students of Mbarara University of Science and Technology in Uganda.^[9] In that study, males had a prevalence of 3.11 percent, while in females it was 6.67 percent. The overall prevalence was discovered to be 9.88%.

MATERIALS AND METHODS

This was a descriptive cross-sectional study carried out in the four local government areas of Ogoni land (Khana, Gokana, Eleme and Tai). Random selection sampling technique was used and 145 subjects (972 males and 73

females) between the ages of 18 and 45 years residing in the selected local government areas in Ogoni region were selected for the study.

The Department of Human Anatomy, Faculty of Basic Medical Sciences, University of Port Harcourt, Nigeria, provided an introductory letter that was distributed to individuals seeking permission to conduct the study. Exclusion criteria included subjects with obvious foot disorders, deformities, injury, fracture, history of surgical

interventions on one or both feet, individuals outside this age group and tribe.

Participants were well informed about the study in accordance with the Helsinki ethics requirements for ethics on human research and each signed informed consent form. Because none of the procedures are invasive, each participant was made to stand or sit comfortably to capture a foot print after a thorough description of the technique. The measurement techniques are as described hereunder:

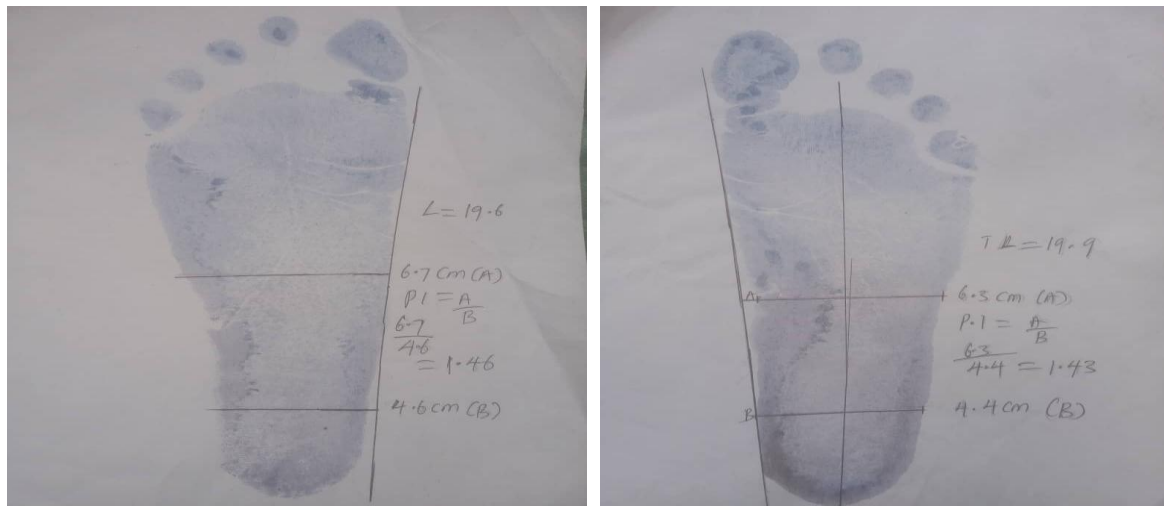


Figure 1: Measurement of plantar arch.

Plantar arch: The respondents' foot prints were taken by cleaning and placing their foot on the foot print box, then on a plain sheet (A4 paper), after which the plantar arch was graded.

A line drawn tangent to the medial forefoot edge and at the heel area was used to measure the plantar arch. The mean position of this line is computed, and a perpendicular line created from there, crossing the foot print (A). The heel tangency was treated in the same way (B). Measurements of the width of the middle part of the foot (A) and the width of the heel region (B) was obtained. After that, division of the A value by the B

value to get the plantar arch index ($PI = A/B$) was done. Foot with a plantar arch index greater than 1.15 Staheli was considered flatfoot.

Data were analyzed using Statistical Package for Social Sciences version 23.0. Descriptive statistics of plantar arch parameters were expressed as mean and standard deviations in the form of tables and figures. The paired sample t-test was used to analyze the differences in these parameters between right and left foot. The prevalence of unilateral and bilateral flat feet was expressed in percentages. Any difference in value ($p < 0.05$) was taken as statistically significant

RESULTS AND DISCUSSION

Table 1: Descriptive statistics of plantar arch Measurements and Indices of left foot (Females).

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
TL	73	20.23	0.85	18.7	22.6
A	73	3.85	1.22	1.1	7.7
B	73	5.13	0.66	4.0	7.9
PAI	73	0.75	0.20	0.23	1.44

TL = Tangent length, A = Plantar width, B = Heel width, PAI = Plantar arch index

From the results as shown in Table-1, the mean value for tangent length of left foot of Ogoni females was

20.23 ± 0.85 cm. The mean plantar width of the left foot of Ogoni females was 3.85 ± 1.22 cm while that of the heel width was 5.13 ± 0.66 cm. Also, the mean plantar arch index for the female Ogonis was 0.75 ± 0.20 .

Table 2: Descriptive statistics of plantar arch Measurements and Indices of right foot (Females).

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
TL	73	19.86	2.22	2.4	22
A	73	3.854.05	1.32	1.6	8.1
B	73	5.13	0.58	4.1	6.1
PAI	73	0.79	0.24	0.33	1.55

TL = Tangent length, A = Plantar width, B = Heel width, PAI = Plantar arch index

From the results as shown in Table-2, the mean value for tangent length of right foot of Ogoni females was 19.86 ± 2.22 cm. The mean plantar width of the left foot of Ogoni females was 4.05 ± 1.32 cm while that of the heel width was 5.13 ± 0.58 cm. Also, the mean plantar arch index for the female Ogonis was 0.79 ± 0.24 .

The mean plantar arch index (left foot) for the female Ogonis was 0.75 ± 0.20 while that of the right foot was

0.79 ± 0.24 . In a similar study carried out in an adult population of Akwa Ibom students of the University of Calabar in the age range of 20 – 30 years as reported by Eluwa *et al.* (2008), the left and right plantar arch indices of the females were 0.49 ± 0.161 and 0.49 ± 0.153 respectively.^[6] These values are lower compared with the current study This could be as a result of differences in age between the study populations as well as differences in the geographical study locations as the Ogoni adult respondents were selected from their communities that are of Ogoni heritage.

Table 3: Descriptive statistics of plantar arch Measurements and Indices of left foot (Males).

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
TL	72	21.56	1.13	17.9	24
A	72	4.65	1.47	2.2	8.3
B	72	5.43	0.63	4.3	7.0
PAI	72	0.86	0.26	0.4	1.46

TL = Tangent length, A = Plantar width, B = Heel width, PAI = Plantar arch index

From the results as shown in Table-3, the mean value for tangent length of left foot of Ogoni males was

21.56 ± 1.13 cm. The mean plantar width of the left foot of Ogoni males was 4.65 ± 1.47 cm while that of the heel width was 5.43 ± 0.63 cm. Also, the mean plantar arch index for the male Ogonis was 0.86 ± 0.26 .

Table 4: Descriptive statistics of plantar arch Measurements and Indices of right foot (Males).

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
TL	72	21.39	1.04	17.8	23.4
A	72	4.65	1.23	2.7	7.7
B	72	5.56	0.66	4.0	7.0
PAI	72	0.84	0.20	0.45	1.47

TL = Tangent length, A = Plantar width, B = Heel width, PAI = Plantar arch index

From the results as shown in Table-4, the mean value for tangent length of left foot of Ogoni males was

21.39 ± 1.04 cm. The mean plantar width of the left foot of Ogoni males was 4.65 ± 1.23 cm while that of the heel width was 5.56 ± 0.66 cm. Also, the mean plantar arch index for the male Ogonis was 0.84 ± 0.22 .

Table 5: Prevalence of normal Feet and Flat feet in ogoni females.

Variable	Observations	Number of occurrence (Normal feet)	Percentage occurrence (%)	Number of occurrence (Flat feet)	Percentage occurrence (%)
PAI	73	66	90.41	7	9.59

PAI = Plantar arch index

From the results as shown in table 4.5, out of the 73 Ogoni females, 66 of them (90.41%) had normal feet

while 7 of them (9.59%) had either unilateral or bilateral feet.

Table 6: Prevalence of normal Feet and Flat feet in ogoni males.

Variable	Observations	Number of occurrence (Normal feet)	Percentage occurrence (%)	Number of occurrence (Flat feet)	Percentage occurrence (%)
PAI	72	58	80.56	14	19.44

PAI = *Plantar arch index*

While in the male category, 58 out of the 72 males (80.56%) exhibited normal feet while the remaining ones (accounting for 19.44%) exhibited either unilateral or bilateral feet.

This study showed that out of the 73 Ogoni female sample, 66 of them (90.41%) had normal feet while 7 of

them (9.59%) had flat feet while in the male category, 58 out of the 72 males (80.56%) presented normal feet while the remaining ones (19.44%) exhibited pes planus, making it a combined total of 29.03%. Ukoha *et al.* (2008) reported from their study that out of the 649 subjects of both sexes that were assessed in their study, an overall prevalence of 13.9% (males having 6.8% and 7.1% for females) was observed.^[10]

Table 7: Prevalence of Unilateral and Bilateral flat feet among sexes.

	Observations	Number of occurrence (Unilateral)	Percentage occurrence (%)	Number of occurrence (Bilateral)	Percentage occurrence (%)
Females	7	4	5.48	3	4.11
Males	14	11	15.28	3	4.17

It can be seen from table 7 that 5.48% of the female population had unilateral flat feet while 4.11% had bilateral feet. While, 15.28% had unilateral flat feet and 4.17% had bilateral flat feet in the male population.

We observed in this a prevalence higher in males compared to females. Lakstein *et al.* (2010) reported similar findings even though differences between both sexes when subjected to analysis were not statistically significant.^[11] In addition, 5.48% of the female Ogoni population had unilateral flat feet while 4.11% had bilateral feet, while 15.28% had unilateral flat feet and 4.17% had bilateral flat feet in the male Ogoni population. In total, the total prevalence of pes planus for both sexes with regards to unilateral and bilateral feet were 20.78% and 8.28% respectively. Didia and Asomugha (2004) reported from their study on a school children population in Port Harcourt that 2.22% of them had unilateral flat feet while 0.6% had bilateral feet.^[8] In this study, both unilateral and bilateral feet were found to be more common in the male Ogoni population compared to the females. The study by Ukoha *et al.* (2008) reported that while the unilateral feet was observed to be more in their female population, the bilateral feet being more prevalent in their male population.^[10] However, Eluwa *et al.* (2008) concluded that considering all relevant factors unilateral and bilateral feet were more common in the female student population compared to the males.^[6]

CONCLUSION

It can be concluded that the Prevalence of flatfoot among Ogoni tribe is low and the males appears to have a greater percentage than the females. Further studies are needed to find out the prevalence of pes planus-hell valgus deformity in Nigerian populations

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Authors contribution

All authors contributed significantly; concept and design was handled by Prof. Oladipo and Dr. Oyakhire, Review of literature review and data collection by Miss Mirabelle and Miss Rita, manuscript was prepared by Miss Mirabelle and Dr. Oyakhire. Data collection and analysis was done by all the authors, final presentation and proof was carried out by all the authors.

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