PES PLANUS: INCIDENCE AMONG AN ADULT POPULATION IN ANAMBRA STATE, SOUTHEAST NIGERIA

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Abstract
The prevalence of pes planus was determined in an adult Nigerian population in Anambra State, Southeast Nigeria. A total of 649 subjects comprising 325 males and 324 females aged 18-27 years were used for the study. The dynamic footprints of the subjects were obtained using endorsing ink and plain duplicating paper. Based on the objective index developed by Qaura et al, (1980) the contact index II was determined as the ratio of the contact width to the total width of the footprints. Descriptive statistics for each variable included mean and standard deviation (SD). Mean ±1-2SD was regarded as normal but greater than that was considered as pes planus. A total of 45 subjects had pes planus comprising 22 males and 23 females. The overall prevalence of pes planus was 13.9% with a prevalence of 6.8% among males and 7.1% among females. Bilateral pes planus was commoner among males (4.9%) than females (4.0%). Unilateral pes planus was commoner among females (3.1%) compared to males (1.9%). The results showed that the prevalence of pes planus was higher (P<0.05) among females than males in our study.

Keywords: Pes Planus; Incidence; Anambra State; Nigeria

1. Introduction
The tarsal and metatarsal bones are arranged in longitudinal and transverse arches that add to the weight bearing capabilities and resiliency of the foot1. They act as shock absorbers for supporting the weight of the body and for propelling it during movement. The resilient arches of the foot make it adaptable to surface and weight changes. Between the various weight bearing points in the foot are the relatively elastic arches of the foot that become slightly flattened by body weight during standing but they normally regain their curvature (recoil) when body weight is removed (e.g. during sitting). Pes planus is a condition in which there is loss of the longitudinal arch of the foot. The other names are flat foot, pes planovalgus, fallen arches and foot pronation2,3.

Most children are born with flat foot, but as they begin to walk, they develop normal arches within the feet in the first decade of life4,5. Flat arches in children usually become proper arches and high arches while the child progresses through adolescence and into adulthood. Besides visual inspection, parents should notice whether a child begins to walk oddly or clumsily for example, on the outer edges of the feet, or to limp, during long walks, and to ask the child whether he or she feels foot pains or fatigue during such walks. Pain or discomfort may also develop in the knee joints.

The causes of flat foot in adults which are mostly acquired are due to injury, illness, unusually or prolonged stress to the foot, faulty biomechanics or as part of the normal aging process. Pes planus can also occur in pregnant women as a result of temporary changes, due to increased elasticity during pregnancy. However, if developed by adulthood, flat feet generally remain flat permanently.

Analysis of bare footprints is often carried out in developing countries like India where the footprints are frequently recovered at the crime scene6. Analysis of footprints can reveal very important clues which can be used as forensic evidence in crime scene investigation. The dimensions of the foot have been used for the determination of sex, age, and stature of an individual7. The aim of this study was to determine the incidence of pes planus among adult Nigerian population at the Anambra State, Southeast Nigeria and to establish a baseline data for the study population for research purposes in the field of podiatrics and clinical biomechanics.

2. Materials and Methods
A total of 649 subjects of Anambra State origin with an age range of 18-27 years volunteered for the study. The subjects were
students of Anambra State University, Uli, Southeast Nigeria. The study populations consisted of 325 males and 324 females. Research ethics committee guidelines relating to the use of human subjects for research purposes were duly followed. All the volunteers had no deformities of the lower limb or history of fractures of the foot. For each volunteer, dynamic footprints were obtained using cyclostyling ink and plain duplicating paper.

2.1 Experimental protocols
The plantar surfaces of the feet were cleaned and dried. A footprint was obtained by applying cyclostyling ink to the cleaned sole and the subject made to stand on a clean white sheet of paper placed on a horizontal surface. The outline of the foot was drawn with a vertically held pencil with lead exposed to approximately 2cm. The procedure was then repeated on the other foot.

Fig I: The measurements of footprint
The midpoints of the posterior margin of the head, X, and the most distal points of the second toe, Y, and the big toe Z, were marked on the outline of the footprint. The footprints examined critically showed that the anterior and posterior portions covering the heads of the metatarsal and the heel had maximum ground contact and therefore, with falling arches, changes in a footprint would be negligible in these portions, but pronounced in the middle of the footprints. The transverse lines CD and GH are drawn at right angles to XY to divide the footprints into anterior 3/10, posterior 3/10 and middle 4/10. An additional transverse line, EF was drawn halves. On the medial border of the foot, the innermost points of the 1st metatarsal and the heel were connected by an anteroposterior line, DJ, similarly the outermost point of the head of the 5th metatarsal and the heel were connected, CK. These lines formed the outer and inner borders of the footprints.

Contact index II was calculated as the ratio of the contact width of the midfoot to the total width of the footprint. Descriptive statistics for each variable included mean and standard deviation (SD). Mean±1-2SD was regarded as normal but greater than this was considered abnormal (flat foot). Test for significant was considered at P<0.05.

3. Results

Table I Mean and standard deviation of Arch Indices of the subjects

<table>
<thead>
<tr>
<th>Sex</th>
<th>No. of subjects</th>
<th>Mean arch index Right</th>
<th>Mean arch index Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>325</td>
<td>0.53±0.113</td>
<td>0.53±0.101</td>
</tr>
<tr>
<td>Female</td>
<td>324</td>
<td>0.51±0.115</td>
<td>0.51±0.108</td>
</tr>
</tbody>
</table>

Table II Prevalence of bilateral flat foot

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Feet</td>
<td>309</td>
<td>311</td>
<td>620</td>
</tr>
<tr>
<td>Flat Feet</td>
<td>16</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>325</td>
<td>324</td>
<td>649</td>
</tr>
<tr>
<td>% Prevalence</td>
<td>4.9</td>
<td>4.0</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Table III Prevalence of unilateral flat foot

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Feet</td>
<td>319</td>
<td>314</td>
<td>633</td>
</tr>
<tr>
<td>Flat Feet</td>
<td>6</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>325</td>
<td>324</td>
<td>649</td>
</tr>
<tr>
<td>% Prevalence</td>
<td>1.9</td>
<td>3.1</td>
<td>5.0</td>
</tr>
</tbody>
</table>

4. Discussion:
Subjects with pes planus are frequently considered unsuitable for military service. However, athletes with pes planus (some long distance runners especially) are not impeded by the condition.

Increase in physical activity and the growth of the plantar fascia, muscles and ligaments give rise to the medial and lateral longitudinal arches. If the foot does not respond to the increased activity, the symptoms of flat foot generally become evident and with this, the extent of the contact width of the sole with the ground increases.

The result of this study in table 1 shows that the mean contact index in the male was 0.53±0.107 and that in the female subjects were 0.51±0.107. Arch indices could range from 0.0-1.0 and are indicative of cavus and...
planus foot respectively. A prevalence of 4.9% and 4.0% bilateral pes planus was observed in the male and female respectively (See Table II). This is a deviation from studies by Eluwa et al who in a study on incidence of Pes Planus amongst Akwa Ibom students in the University of Calabar, stated that the prevalence of bilateral pes planus to be 5.0% and 6.2% in male and female subjects respectively. Also, the present study shows a higher incidence of bilateral pes planus (8.9%) and unilateral pes planus (5.0%) than another study by Didia et al who reported an incidence of 7.5% and 3.5% of bilateral and unilateral pes planus respectively. However, both studies show a higher incidence of bilateral pes planus than unilateral.

This study shows that there was higher incidence of bilateral pes planus amongst males (4.9%) than the females (4.0%) while the female subjects showed a higher incidence of unilateral pes planus (3.1%) than males (1.9%). When the results for bilateral and unilateral pes planus are pooled together for both sexes, we find an incidence of pes planus in females (7.1%) and males (6.8%) with overall prevalence of 13.9% and this is similar to the work by Eluwa et al, 2009 which reports an incidence of 7.6% and 5.8% among females and males respectively. This higher prevalence in females may be due to the fact that adult females tend to have small bones and less bulky muscles.

It was observed that there are significantly (P<0.05) lower contact index values in females than males. It suggests that arches may be better developed at the centre of the foot in males than in females. It may also be due to other factors such as type of foot wear used, physical activities, weight-bearing habits or body stances.

Conclusion

This study has provided the prevalence of pes planus among the adult Nigerian population, as baseline data and for comparison to other regions of the world and possible should initiate a guide in the understanding of plantar heel pain associated with flat foot and associated clinical biomechanics of the affected subjects in the environment.

References

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