Impact Among Body Mass Index, Q-Angle and Flat Foot in Students of University of Lahore

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Original Research Article

Introduction:
A wide range of ligament and tendon defects that cause substantial deformity and impairment are included in ankle and foot disability. Despite the lack of extensive epidemiological investigations, reported rates for women over 40 and all persons over 65 are both over 3 percent and over 10 percent, respectively³. In the lower extremities, the patellar tendon and quadriceps pull are joined to generate the Q-angle. The Q-angle is used to assess the mechanical status of the knee joint in athletes. Females typically have a higher range of Q-angle than males, who typically have a low range, with the normal range being between 12 and 20 degrees²,³.

The risk factors for increased Q-angle include ankle sprains, dynamic balance issues, patella instability, anterior cruciate ligament injuries, overuse injuries, osteoarthritis of the knee, chondromalacia patella, patella dislocation and subluxation, and patella-femoral pain PEP. Chondromalacia, patella Alta, and patella-femoral pain PEP are further conditions that could reduce Q-angle⁴,⁵.

The human foot exhibits a system of three arches that can be flattened and slightly recoiled by upward pressure, bearing flexibility. Two arches run longitudinally, and one arch runs transversely. The longitudinal arch attaches to the scaphoid, three cuneiforms and inner three metatarsals after beginning at the calcaneal tuberosity. The transverse arch connected to the scaphoid, five metatarsals, and three cuneiform cuboids from the tarsus. Walking causes mechanical harm to the lower limbs because of flat feet's anatomical and functional defects. It is further described as increased hindfoot evasion and decreased medial longitudinal arch height during weight bearing. Though less obvious and more frequent in youngsters, the development of musculoskeletal injuries as a result of foot type⁶. Idiopathic or neurological conditions can be the cause of pes cavus. Clinical management of these individuals is highly challenging due to the lack of knowledge about the mechanism underlying pes cavus-related foot discomfort. One of the most frequent reasons people seek medical attention is idiopathic pes cavus. Tibial internal rotation during running is delayed to reach maximum if Q-angle is larger than 15 degrees, although it is slowed down by 10 to 20 milliseconds in participants with Q-angles greater than 17 degrees⁷.

Idiopathic flatness in children can be symptomatic or asymptomatic. The characteristics of the flat foot include increased hallux dorsiflexion, supination, adduction, and increased eversion at the tibia of the hindfoot as internal and external rotation. Due to open growth plates in children, certain postural problems, such as flat feet, may be accompanied by musculoskeletal injury. Arch height affects the alignment of the pelvis, the amount of lumbar acceleration, and the activity of the glutes and erector spinae. Therefore, the knee, ankle, and hip areas of youngsters with flat feet are more painful and distressed⁸. The prevalence of flat feet varies depending on the kind of population, age, and presence of any co-morbidity. According to a study, flat feet are more common in children between the ages of 2 and 6 (between 21 and 57 percent) and less common in adults (13.6 to 26.62 percent). In a healthy person, the longitudinal arch in the middle is raised 15–18 mm from the surface, while the arch on the side is raised 3–5 mm. Based on the numbers above, pes planus is a condition in which the height of the foot goes down. Pes cavus develops if the foot height is greater than 18mm⁹.
Early infancy shoe wear, a higher BMI, and extensive ligamentous slackness are all precipitating factors in flat feet, albeit the precise etiology is yet unknown. Individuals typically complain of foot pain at the end of the day. Flat feet depend on the intrinsic muscles’ active contraction to maintain the foot's arch, which can wear out the muscles and make your feet feel sore and tired. There is proof that being overweight results in flat feet, foot pain, and gait problems. Widespread ligamentous laxity that is inherited elevated BMI, the type of shoes worn in early infancy, and many other triggering events all contribute to the development of flat feet. However, the precise root reason remains unknown. At the conclusion of the day, the person typically laments feeling achy in the feet. This is due to the flat foot’s increased reliance on the intrinsic muscles’ active contraction to maintain the arches, which causes overuse, tiredness, and an “achy sensation” at the end of the day. This is a result of a chronic inflammatory reaction10,11.

BMI is used as the basis for classification, screening, and diagnosis of overweight and obesity. Being overweight is designated by a BMI of 25 to 29.9 kg/m2, and obesity is indicated by a BMI of over 30 kg/m2. BMI measures weight and height rather than adipose tissue, where fat deposits lead to obesity12.

People who have a normal BMI have healthy eating habits. Food preferences vary by gender, with women more likely to consume fruits and vegetables than men, who prefer soft drinks. People with risk factors for postoperative problems frequently exhibit malnutrition and weight loss prior to surgery. Malnutrition, on the other hand, is correlated with low (BMI), weight loss, and reduced muscle mass. A study was conducted in China to examine the relationship between low body mass index and the mortality risk from COPD in the case of low BMI. Adult-onset flatfoot deformity numbers nine13.

It is assumed that persons with BMI > 25 kg/m2 have documented risk factors such as cardiovascular diseases, metabolic disorders, and musculoskeletal diseases. Flatfoot pes planus promotes contact between the patellar articulation surfaces and mechanical pressure in the knee, both of which contribute to knee pain. Due to severe loading and ligament stretching over their elastic limit, weight growth can increase the likelihood of developing flat feet14,15.

Obesity prevalence has recently expanded quickly in both industrialized and developing nations. By 2025, it is predicted that the rate of obesity will continue to climb quickly, reaching a global prevalence of 18% for men and more than 21% for women. According to statistics from the Centers for Disease Control between 2011 and 2014, 36.5% of American adults and 17 percent of American kids are obese16.

Males and females have high average (BMI). When energy intake is high and energy expenditure is unusually low, body weight increases. Sleep and circadian disruptions, in addition to conventional risk factors, are two additional factors that contribute to obesity and other metabolic problems. These factors can be changed to lessen their negative effects19.

Methods:
1. Study design:
Observational cross-sectional study design was used.

2. Setting:
Data was collected from University of Punjab, University of Lahore, University of Central Punjab.

3 Period of study:
This study was completed in 6 months after approval of the synopsis.

### Table-I Demographic Data

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>20.97</td>
<td>21.00</td>
<td>2.112</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
</tr>
<tr>
<td>BMI</td>
<td>&lt;18 kg/m2</td>
<td>21</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>18-25 kg/m2</td>
<td>124</td>
<td>62.0</td>
</tr>
<tr>
<td></td>
<td>&gt;25 kg/m2</td>
<td>55</td>
<td>27.5</td>
</tr>
</tbody>
</table>

### Step 2: Q-Angle

When checked for Q-Angle, out of total 200 participants, 31 (15.5%) had angle <10cm, 83 out of 200 were having angle >16-20cm whereas 86 (43%) out of total had angle 10-15cm that is normal. Majority of them were having Q angle between 10-15 cm being normal.

<table>
<thead>
<tr>
<th>Angle, cm</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 cm</td>
<td>31</td>
<td>15.5</td>
</tr>
<tr>
<td>&gt;16-20 cm</td>
<td>83</td>
<td>41.5</td>
</tr>
<tr>
<td>10-15 cm(normal)</td>
<td>86</td>
<td>43.0</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Step 3: Plantar Arch Index
When checked for Plantar Arch Index, out of total 200 participants, 95 (47.5%) had index <1.2cm, 62 out of 200 were having index between 1.21-1.28cm whereas 43 out of total (21.5%) had index >1.28cm. Majority of them were having index <1.21cm being normal.

<table>
<thead>
<tr>
<th>Table-III Plantar arch index</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.21 cm</td>
<td>95</td>
<td>47.5</td>
</tr>
<tr>
<td>1.21-1.28 cm</td>
<td>62</td>
<td>31.0</td>
</tr>
<tr>
<td>&gt;1.28 cm</td>
<td>43</td>
<td>21.5</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Step 4: Foot Disability Index

When evaluated Foot Disability Index, out of total 200 participants, 9 (4.5%) had no disability, 61 out of 200 were having mild disability, 108 (54%) had moderate disability whereas 22 (11%) out of total had severe disability. Majority of them were having moderate disability.

<table>
<thead>
<tr>
<th>Table-IV Foot disability index</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disability</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>Mild disability</td>
<td>61</td>
<td>30.5</td>
</tr>
<tr>
<td>Moderate disability</td>
<td>108</td>
<td>54.0</td>
</tr>
<tr>
<td>Severe disability</td>
<td>22</td>
<td>11.0</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Discussion:

In this paper, the flatfoot is discussed as a typical foot form that affects a significant portion of the population. Children have more flat feet than adults do. During the first ten years of life, the arch naturally raises in the majority of children. There is no proof that any external forces or equipment may induce a longitudinal arch in a child's foot. Contrary to ordinary flexible flatfoot, flexible flatfoot with a short Achilles tendon is known to cause pain and incapacity in some adults and teenagers. In those situations, the Achilles tendon lengths. Many flatfeet also have rigid forefoot supination, which must be detected and addressed concurrently during surgical reconstruction if it exists.

The Q-angle of the right knee of the participants increased in a way that was statistically significant (P=0.05), as the mean value of Q-angle was 16.14° with 1.2° in group A, which was made up of healthy male high school students, and 20.6° with 1.2° in group B, which was made up of male high school students with flat feet. There was a statistically significant increase in the Q-angle of the Left Knee of the participants (P=0.05), as the mean Q-angle for healthy male secondary school students in group A was 17.03° and for flat-footed male secondary school students in group B, it was 22.4°. Therefore, there is a strong connection between flat feet and a rising Q angle. People with natural foot arches stand one foot longer than those with impaired arches, undertake a loco motor activity, and tire less easily because the foot's arches absorb the impulses and stresses from the ground. However, irregularities impair the functionality of the static, dynamic, and postural control systems, particularly when it comes to bodily movement. Proprioceptive inputs may be interfered with by abnormalities. Subtalar pronation may be too much of a connection with flat feet (for abnormal compensatory pronation may cause instability and excessive foot joint movement). As a result, while bearing weight, the flat foot may become unstable and affect postural control.

Conclusion:

This study concludes that a higher BMI had a substantial impact on flat feet, plantar arch index, and Q angles. In light of the findings of this study, we came to the conclusion that flat foot deformity may result in an increase in Q angle, but it may also result in patella lateral rotation and an increase in Q angle, both of which cause knee pain.

Acknowledgment:

We are extremely grateful to all participants of this research and our teachers for providing us with the information and assistance we needed to complete this project successfully, as well as our beloved parents for their unwavering support and instinctive affection.

Disclaimer:

This manuscript's abstract has not been presented at a conference or published in a book of abstracts. This article is not a part of a PhD thesis. This study talks about how poor visual ergonomics cause neck pain for computer users.

Conflict of interest:

Nothing to state.

Funding disclosure:

Nothing to state.

References:


