Pes planus (PP) and pes cavus (PC) are frequent disorders of the foot. It is known that standing still for a long time, bony and neurological problems such as congenital tarsal coalition and cerebral palsy, trauma, inappropriate shoes, generalized ligamentous laxity, sole disorders in relatives and muscle imbalance all aggravate sole problems. Since foot is the contact point during weight bearing and ambulation, the mechanical characteristics of the foot determine the energy transfer into the lower extremity, and therefore it helps to define the pattern of weight bearing and the potential for injury to the lower extremities. The presence of sole problems is the important intrinsic factor in overuse injuries. However, numerous studies have indicated that there are neutral or even beneficial effects.
The sole arch indices of adolescent basketball players

Methods. Junior level basketball players (16-18 age, n=48) along with non-player controls (n=45) were included in the study. This study was carried out in the Sports Education, Health and Research Center, Ankara, Turkey, between November 1998 and December 1998. To understand the effects of basketball on sole arch index, we compared the sole AI of junior players with their control. We also tried to find out the correlation between sole AI and training age. The training age of subjects was different (between 1-7 years) and all subjects had a training of 8 hours per week since the beginning of the basketball. Compromised body weight and height are measured before breakfast. Subjects were asked to stand still on the podoscope. Both sole images in the podoscope were transferred to computer by using video camera. On the stored images, AI was calculated by the division of the narrowest part of the sole to the widest part of the heel, then multiply the ratio by 100 (Figure 1).

In our preliminary experiment by using same method on 30 foot arch indices, intra-class correlation coefficient of the sole AI was found as 0.982. The significance of the differences between the 2 mean tests was calculated and the Pearson correlation test was used. Significance level was accepted as \( p < 0.05 \).

Results. The height, weight, age, body mass index (BMI) and arch indexes of both feet of the players and non-player controls are shown on Table 1. The height and weight in players were significantly higher than that of the controls. Body mass index of both study and control groups were less than 25 and neither foot sole AI nor BMI were different between players and control groups (\( p > 0.05 \)).

There was a significant negative correlation between sole AI and training age in players (right sole AI \( r = -0.3312, \ p < 0.01 \); left sole AI \( r = -0.3056, \ p < 0.01 \)). On the other hand, we could not find any significant relation between sole AI and height, weight and BMI (\( p > 0.05 \)).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Players (N=48)</th>
<th>Control groups (N=45)</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>17.34 ± 0.63</td>
<td>17.18 ± 0.68</td>
<td>0.257</td>
</tr>
<tr>
<td>Height</td>
<td>184.55 ± 7.38</td>
<td>169.34 ±15.12</td>
<td>0.000</td>
</tr>
<tr>
<td>Weight</td>
<td>74.68 ± 10.34</td>
<td>67.10 ± 12.88</td>
<td>0.000</td>
</tr>
<tr>
<td>Body mass index</td>
<td>21.87 ± 2.31</td>
<td>22.66 ± 3.29</td>
<td>0.181</td>
</tr>
<tr>
<td>Right foot AI</td>
<td>56.74 ± 17.21</td>
<td>59.62 ± 23.26</td>
<td>0.497</td>
</tr>
<tr>
<td>Left foot AI</td>
<td>55.13 ± 17.33</td>
<td>54.54 ± 23.72</td>
<td>0.890</td>
</tr>
</tbody>
</table>

Figure 1 - Calculation of sole arch index (AI) by using the formula: \( AI = \frac{A}{B} \times 100 \). A - minimum width on mid-foot arch, B - maximum width on heel arch.
Discussion. This study was designed to find out the difference between the sole arch indices of adolescent basketball players and age matched non-athletic controls. In this study, we used footprint analysis, which has been found high intra-rater reliability. Footprint analysis is a simple, readily available, low-cost, reliable and non-invasive technique. Therefore, it can be used for screening of the foot problems. It is well known that there is a unilateral overhead athlete who may demonstrate an obvious discrepancy with increased external rotation and decreased internal rotation compared with the opposite side. These changes were an important indicator of sport specific adaptation in musculo-skeletal system. Indeed, in longitudinal study, Volkov has demonstrated that intense regular training (18-30 hour per week) results in flat foot for 10-11 years old children. Klingele showed that endurance running and alpine skiing have an increased risk of longitudinal foot arch insufficiency. In our study, although there was no difference in sole arch indices of adolescent male basketball players compared with non-athletic controls, we have found a significant negative relationship between sole AI and training age (right sole AI r=-0.3312, p<0.01; left sole AI r=-0.3056, p<0.01). The reason for the discrepancy between our finding and Volkov’s study might be the differences of training hours per week for basketball players in studies.

Since our study had a cross-sectional design, we have not strictly established our findings as results of sport specific adaptation. Longitudinal studies started in childhood could better demonstrate the effects of different sports on sole AI. Nevertheless, this study has shown that sport specific adaptations in musculo-skeletal system might include changes in sole AI.

References