Associations of Sole Morphology with Body Mass Index of Soccer Players

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Abstract: *The foot is one of the most important interaction parts of the body with the ground in upright posture. The structure of the foot is critical to bear the load absorbed by the bones in the foot and the force transferred to lower extremity when performing exercise with weight bearing on foot. Football is usually seen as a team sport whereby players attempt to move the ball, primarily with the action of the foot to an opponent's goal area to score.* <u>*Methods:*</u> *A survey study was carried out on sixty (n=60) National soccer players, aged 18-22 years, belonging to different clubs of Arunachal Pradesh with a view to characterize the associations of Sole Morphology with BMI. Footprint images of both feet were obtained by blue ink on plain paper. Maximum effort and meticulous care have been put to precision and accuracy in the measurements. Footprint indices were calculated: the Arch (Clarke) Angle and the longitudinal Arch length Index.* <u>*Results:*</u> *Arch angle were calculated for both left and right feet, to determine the association between Foot Arch with BMI of soccer players, the data collected were analyzed using Pearson Product Moment Correlation and the level of significance was set at 0.05.* <u>*Conclusion:*</u> *Foot morphology of football players may assist in the design of the best football boots for the sport, and may also be used for talent identification. The foot arch index measured in a static position could be a functional index to predict the dynamic foot functions when running and tackling ball.*

Keywords: Sole Morphology, Footprint, BMI, Soccer Players

1. Introduction

Foot is one of the most important parts of the body with the ground in upright posture. The structure of the foot is critical to affect the load absorbed by the foot and the force transferred to proximal components of lower limbs when performing exercise with weight bearing on foot. Medial longitudinal arch is the largest arch of the foot and the most important arch of the foot from a medical aspect. The bony shape, the ligaments of the foot, and the muscular tones all play an important role in supporting the arches. Football is the most popular sport in the world. Football needs high skilled coordination of different body parts, especially the lower extremities. Football is usually seen as a team sport whereby players attempt to move the ball, primarily with the action of the foot to an opponent's goal area to score. Therefore, in the present study an attempt has been made to observe the association between Sole Morphology with BMI of national soccer players.

2. Materials and Methods

Subjects:
The population of this study was the National level soccer players, age: 18 to 22 years, height 162±3cm, weight 56-59 kgs, Arunachal Pradesh. In reality, since this population in Arunachal Pradesh is very large, this study was delimited to sixty male soccer players n=60). Hence purposive sampling technique was employed for the selection of subject.

Instrumentation:
Sole morphology parameters were measured with the help of different administrating tools, foot print (plain paper), Arch (Clarke) angle, Arch length index, Chippaux-Smirak index ,Staheli index and **BMI** (weight and Height measurement).

Arch (Clarke) angle: This is the angle between the line connecting the medial side-most points of the heel and metatarsal regions and the line connecting the lateral most point on the medial foot border to the medial-most point of the metatarsal region.

Arch length index: This is the ratio of the length of the line between the medial area -most points of the metatarsal and heel regions to the border length of the arch outline between these points.

Chippaux-Smirak index and Staheli index: This is the ratio of the minimum width of the midfoot arch region to the maximum width of the forefoot region.

Statistics
In order to determine the relationship between Sole Morphology with BMI of soccer players Pearson Product Moment Correlation was employed and the level of significance was chosen at 0.05.

3. Results and Discussion

The correlation coefficient of Arch angle, Arch length index, Chippaux-Smirak index and their ratio to BMI are presented in Table1.

Table 1: Coefficient Of Correlation between Sole Morphology with BMI of Soccer Players (N=60)

Variables	Foot Print Indices	Mean	SD	Coefficient of correlation
Sole Morphology (Right Foot)	Arch (Clarke) angle (degree)	51.86	7.64	0.623*
	Arch length index	0.76	0.21	0.831*
	Chippaux-Smirak index	0.54	0.13	0.725*
	Staheli index	0.83	0.20	0.297*
Sole Morphology (Left Foot)	Arch (Clarke) angle(degree)	51.10	7.31	0.681*
	Arch length index	0.74	0.24	0.786*
	Chippaux-Smirak index	0.27	0.11	0.745*
	Staheli index	0.46	0.19	0.282*
Body Mass Index		23.36	4.12	

* Significant at 0.05 level, $r_{0.05}(58) = 0.250$

Arch angle, arch length index, Chippaux-Smirak and Staheli index were calculated for both left and right feet. The results of this study shows from table 1 that in right and left foot, the arch length, Chippaux–Smirak, Staheli footprint and arch angle shows positive correlation with BMI in the soccer players.

Staheli et al. studied an arch index called the Staheli index, Cavanagh and Rodgers described the arch index and studied 107 subjects using an ink footprint method and measurements made with a plan meter. Billis et al, 2007 studied the arch index using a similar method with weight-bearing footprints, except that they acquired the footprint with powder and then input the data to a computer using the AutoCAD software, as these authors did, The results of all of these studies gave higher values than the results described in this research study. In 2004 and 2005 respectively, Urry and Wearing studied the arch index and identified statistically significant differences between some contact areas of the sole using ink footprints and electronic images obtained with pressure platforms (which might skew the results for small contact areas and cause inaccuracies). Their values for the arch index obtained in their 2004 study, using both ink footprints and the pressure platform, were similar to the results obtained in this research, and the ink footprint results from 2005 were also similar to the results obtained in this study.

By contrast, the present study found that these measurements were higher in both feet of football players and they have significant positive co relation with BMI.

4. Conclusion

Although, there are many limitations, this study concludes that –
- Foot morphology of football players may assist in the design of the best football boots for the sport, and may also be used for talent identification.
- This study was therefore to develop and evaluate a simple visual tool for foot posture assessment based on the Arch Index (AI) that could be used in clinical and research settings.
- The foot arch index measured in a static position could be a functional index to predict the dynamic foot functions when running and tackling ball.

5. Acknowledgments

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