



Relationship of Foot Arch and Foot Length with Selected Physical Fitness Components of Sprinters

Tanuja S. RAUT¹ & Saurav TRIPATHY²

¹Professor & Head, Department of Physical Education, Sant Gadge Baba Amravati University, Amravati, India, <https://orcid.org/0000-0002-8073-4770>

²Ph.D. Scholar, Department of Physical Education, Sant Gadge Baba Amravati University, Amravati, India, <https://orcid.org/0000-0003-0461-3990>

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Özet

Ayak morfolojisi ve ayak anatomisi herhangi bir atletik etkinliğin performansında önemli bir rol oynar. Çalışmanın amacı, ayak kavisi ve ayak uzunluğu ile sprinterlerde hız, çeviklik ve denge gibi seçilmiş fiziksel uygunluk bileşenleri arasındaki ilişkiyi ortaya çıkarmaktır. Araştırmacı, ayak uzunluğu ile seçilen fiziksel uygunluk bileşenleri arasında anlamlı bir ilişki olacağı hipotezini öne sürdü. Araştırmacı ayrıca ayak kemeri ile seçilen fiziksel uygunluk bileşenleri arasında anlamlı bir ilişki olacağını belirtti. Bu amacı gerçekleştirmek için konular Maharashtra eyaletindeki Amravati şehrinin Sant Gadge Baba Amravati Üniversitesi kampüsünün farklı akademik bölümlerinden seçilmiştir. Bu çalışma için SGB Amravati Üniversitesi'nin yaşları 20-24 arasında değişen ve en az bir kez üniversiteler arası yarışmaya katılmış olması gereken 18 erkek sprinter Basit tesadüfi örnekleme tekniği ile seçilmiştir. Araştırmacı, kağıt üzerinde ayak izini alarak terazi ve kalem kullanarak ayak uzunluğunu ölçtü ve ayrıca iletke kullanarak ayak kavisini ölçtü. Toplanan veriler MS-Excel formatında tablollaştırıldı ve Pearson korelasyon testi kullanılarak analiz edildi. Hesaplamaya dayanarak hız ve çevikliğin ayak uzunluğuyla negatif ancak anlamlı bir ilişkisi olduğu bulundu. Bu çalışmada da hız ve dengenin ayak kemeri ile negatif ilişkisi vardır ve anlamlıdır.

Anahtar Kelimeler: İlişki, Ayak uzunluğu, Ayak kavisi, Fiziksel kondisyon, Sürat, Çeviklik, Denge, Sprinterler

Abstract

Foot morphology and foot anatomy plays an important role in the performance of any athletic event. The purpose of the study is to find out the relationship of Foot arch and foot length with selected physical fitness components like Speed, agility and balance of sprinters. The researcher it was hypothesized that there will be significant relationship between foot length and selected physical fitness components. Researcher also stated that there will be significant relationship between foot arch and selected physical fitness components. For fulfilling the purpose, the subjects were selected from different academic departments of the Sant Gadge Baba Amravati University campus of Amravati city in Maharashtra state. For the present study 18 male sprinters of SGB Amravati University were selected by Simple random sampling technique whose age were ranging between 20-24 years and have to be participant of inter-university at least single time. Researcher measured the foot length using scale and pencil by taking a footprint on a paper and also measured the foot arch using the protractor. The collected data were tabulated in MS-Excel format and analyzed using Pearson correlation test. On the basis of calculation it was found that speed and agility has a negative relationship with foot length but significant one. In this study also, speed and balance has a negative relationship with foot arch, and it is significant one.

Keywords: Relation, Foot length, Foot arch, Physical fitness, Speed, Agility, Balance, Sprinters

INTRODUCTION

In the present scientific period, there is little possibility for progress in sports unless scientific ideas are properly used. To make sports more appealing and popular, the game's level, as well as the quality of the players, coaches, and organizers, should be upgraded on an ongoing basis. Knowledge of the scientific principles of a certain game, as well as the anthropometry of the players, must be considered during practice in order for the athlete to get a better outcome or performance. (Sukumar Das, 2018)

The foot, an organ that allows people to move from one location to another, is also considered to be an indication of athletic ability since it keeps our bodies in balance by establishing postural reflexes. Furthermore, they play a significant role in the anatomical coordination of the bone, muscles, and joints that comprise its structure, as well as motor tasks like walking and running. (Cengiz Taşkın, et al., 2020)

The foot arch is the curved structure formed by the bones, tendons, and ligaments that span the sole of the foot. It serves as a natural shock absorber, distributing the forces generated during walking, running, and other weight-bearing activities. Our feet play an important role in supporting our body weight and assisting us in navigating our surroundings. (Website 1) The arch of the foot is actually an excellent design decision. Arches strengthen the feet and aid to maintain balance and flexibility. (Website 2) Furthermore, the anatomy of the foot arch influences several areas of athletic performance, including speed, agility, and explosive leg strength. The foot is categorized into three categories based on arch height: high arch (Pes cavus), normal arch, and low arch (Pes planus), often known as flat foot.

Both athletes and healthy people might have different foot postures. During walking, the foot muscles are used for balance and to correct the foot on uneven terrain. People who have flat feet experience foot tiredness more easily. (Selvaraj Sudhakar, et al. 2018) A well developed foot arch functions as a natural spring, storing and releasing energy effectively with each stride. This elastic energy return can increase running pace by lowering the energy required for each step. The arch increases the foot's ability to push off the ground. A taller or more stiff arch can increase propulsion and boost sprinting performance. A well functioning foot arch gives more stability and balance, which is required for fast changes in direction. This stability is essential for retaining control during agile movements. The arch absorbs and distributes stresses during dynamic motions. Efficient shock absorption reduces the chance of damage and allows for faster recovery between activities. (Peter McGinnis, 2013) It is more common for those with flat feet to experience muscle imbalances in their legs, hips, and ankles. This condition may make balance problems worse and potentially cause lower back discomfort. (Website 3)

The length and breadth of the foot are quite important while executing fundamental actions like standing, running, and jumping. The athlete is the component that serves as the foundation for the body's motions, while the toes, particularly the thumb, aid in movement and balance. The feet are also associated with physical talents such as balance, agility, and the capacity to guide voluntary motions toward a specific objective, particularly while changing direction and maintaining body equilibrium when performing offensive and defensive skills. (Nowzad Hussien Darwish, 2015) The length of an athlete's foot can affect sports performance, but it is

not the only factor. Its influence varies by activity, although it frequently plays an important part in activities that require specialized foot mechanics. Foot length is the distance between the back of the heel and the tip of the longest toe. It can vary greatly between individuals and is typically measured in inches or centimeters. According to a research out of Ritsumeikan University in Japan, runners with noticeably longer forefoot bones may have an edge over other distance runners. (Susan Lacke, 2019)

Ashwin Satish, et al, (2023) detected a significant association between foot posture and agility in amateur soccer players. Selvaraj Sudhakar et al, (2018) found that Short distance runners with high arch foot have improved dynamic balance and speed when compared to low and neutral arch foot.

METHOD

The purpose of the study is to find out the relationship of Foot arch and foot length with selected physical fitness components like Speed, agility and balance of sprinters.

On the basis of literature reviewed by the researcher it was hypothesized that there will be significant relationship between foot length and selected physical fitness components i.e. Speed, agility and balance of sprinters. It was also hypothesized by the researcher that, there will be significant relationship between foot arch and selected physical fitness components i.e. Speed, agility and balance of sprinters.

Research Model

Survey cum correlation model was used for this study. Survey of foot length and foot arch of the sprinters was considered and its relationship with their speed, agility and balance was done on the basis of Pearson correlation Method.

Working Group

Author and Co-author were worked together for this study. Both are related to Sports and Physical Education. So, they are having the expertise in this area. They have also taken the help from athletic coaches to clarify some doubts regarding this study.

Data Collection Tool

Sl. No.	Variables	Measure
1.	Foot length	Paper, Steel measuring tape and pencil
2.	Foot arch	Paper, Scale, Pencil & protractor
3.	Speed	100m Sprint
4.	Agility	T-Test
5.	Balance	Beam Walk Test

Personal Information Form

For the present study the subjects were selected from different academic departments of the Sant Gadge Baba Amravati University campus of Amravati city (MS) of India. Total 18 male sprinters of SGB Amravati University were selected by Simple random sampling technique. The age of the subjects were ranging between 20-24 years and have to be participant of inter-university at least single time. Out of these 18, 7 from physical education department, 3 from Bio-technology, 4 from Physics, 3 from chemical technology and 1 from chemistry department

were selected as sample. Before, gathering data every subject was asked about their concern to participate in this study. Without any hesitation all are agreed to provide time for data collection

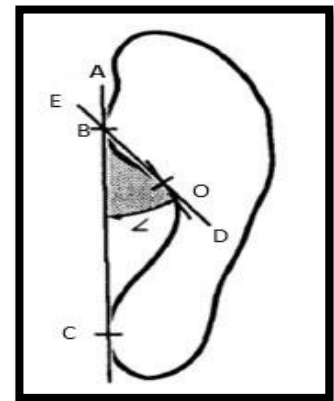
Administration of the Tests

The data pertaining to the study was collect by below mentioned method. At first the researcher described about the aim and importance of the study to the respondents and also the administration of the tests. Then, they were provided a blank page and ask them to write down their name on it. Then, they were provided (12 X 18 inches) ink pad for making foot print on the paper. After that, the researcher was assured the respondents about the confidentiality of their data.

Measuring Angle of Foot Arch

Angle of foot arch was recorded by foot print of right foot taken down on a paper with the help of ink pad. Procedure was adopted for the foot print of illustrate in the figure.

Line AC was drawn between the base of toe and the heel bone to represent the inner border of the foot i.e. at the base of the first metatarsal bone and the calcaneus or the heel bone. Again line ED was drawn from the point at which AC touches the imprint on the inner side of the big toe through the point on the edge of the inside of the arch. The angle $\angle DBC$ was measured with the protractor to get the angle of foot arch.



Measure Foot Length

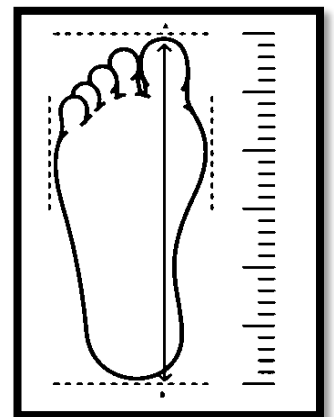
Draw a straight line, longer than your foot, on a piece of paper. Place the paper on a flat surface. Stand on the line with your heel and longest toe centred on the line. Place a mark on the line at the tip of the longest toe and at the back of the heel as AB.

Measure the distance between the marks A & B. Measurement between A & B has recorded in centimetre and taken as the foot length.

Analysis of Data

The statistical analysis and interpretation was done on the basis of data collection. The collected data will be converted into standard one and then will be analyse and interpret by using Pearson Correlation method.

To test the hypothesis given by the researcher the level of significance was set at 0.05 which was considered as reliable and adequate for the present study.



FINDINGS

Table 1. Relationship between foot length and selected physical fitness components

Relationship	Speed 14.18 Sec.	Agility 10.11 sec	Balance 11.24 Sec.	Critical Value
Foot Length 24.14 cm	-0.584*	-0.599*	-0.449#	0.468
0.05 level of Significance				df = 16

Table 1 show that the average of foot length of selected sprinters is 24.14 cm. Also, the average of selected physical fitness components speed 14.18 sec, agility 10.11 sec and balance 11.24 sec. are respectively. To find out the relationship between foot length and physical fitness components the researcher again used the Pearson correlation method. It was found that there is significant relationship between foot length and speed which is -0.584 and also foot length and agility which is -0.599, but no significant relationship between foot length and balance which is -0.449. There is negative correlation between physical fitness components and length of foot. All physical fitness components are moderately correlated with foot length.

Table 2. Relationship between foot arch angle and selected physical fitness components

Relationship	Speed 14.18 Sec.	Agility 10.11 sec	Balance 11.24 Sec.	Critical Value
Foot Arch 42.11°	-0.686*	-0.261#	-0.541*	0.468
0.05 level of Significance				df = 16

Table 2 shows that the average of foot arch angle of selected sprinters is 42.11°. Also, the average of selected physical fitness components speed 14.18 sec, agility 10.11 sec and balance 11.24 sec. are respectively. To find out the relationship between foot arch angle and physical fitness components the researcher again used the Pearson correlation method. It was found that there is significant relationship between foot arch angle and speed which is -0.686 and also foot arch angle and balance which is -0.541, but no significant relationship between foot arch angle and agility which is -0.261. There is negative correlation between physical fitness components and foot arch angle. Here, Speed is strongly correlated with foot arch angle, whereas balance is moderately and agility is weakly correlated with foot arch angle.

DISCUSSION AND CONCLUSION

Discussion

On the basis of calculation on collected data; it was found that Sprint performances i.e., speed has a negative relationship with foot length but significant. Sprinters possessing greater foot length sprinting time will be less, generally performance will be better. The result of this study supports it. On the other side, it is well established fact that, the short distance runners with high arch have improved dynamic balance and speed performance. In this study also, speed has a negative relationship with foot arch, but it is significant which supports the fact.

In this study it was also found that agility has a negative relationship with foot length but significant. It is thought that individuals with longer and wider soles may have more developed balance skills due to the pressure distribution on the soles of their feet, and this may positively affect the values of quickness and agility. Also, the result of this study supports it. On the other

hand, most sports require a high degree of balance, speed, agility, and flexibility to change directions quickly. Commonly with flat feet, it may be somewhat difficult for athletes to achieve such performance levels. In this study also agility has a negative insignificant relationship with foot arch and the result supports the fact.

But in balance there is negative relationship with foot length and insignificant one. In general, the bigger the normalized foot size, the higher balance strategy score. So, here the result does not support it. On the other side, the arches of the feet support the full weight of the body, and without them, issues can arise. In this study, balance has a negative significant relationship with foot arch, which is supporting the statement.

Conclusion

Foot length and foot arch are important factors in various sports, especially for the short distance runners, influencing aspects like shoe fit, stride, balance, propulsion, and cycling efficiency. However, it's just one component among many, but it does not mean that sports persons with improper foot length and arches are unable to perform well in respective sports events. Because performance may be affected by many other factors as well like training, technique, conditioning, and overall body proportions playing crucial roles in athletic performance.

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