

Prevalence Of Altered Foot Posture In Athletic And Non-Athletic University Students - An Observational Study

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ABSTRACT

Background: The study aims to explore foot characteristics among athletic and non-athletic individuals, with a particular focus on foot balance and stability during heel-to-toe walking. It also investigates the use of the foot index to assess overall foot function and alignment in these populations.

Materials & Methods: The study recruited participants from a university setting, with Group A consisting of athletic individuals and Group B comprising non-athletic individuals. Demographic data, including age, weight, and height, were collected for both groups. Heel-to-toe (foot) and heel-to-ball (arch) distances were measured for the right leg using standardized protocols. The foot index scoring system was employed to evaluate foot function and alignment for both right and left legs.

Results: Group A demonstrated significantly longer heel-to-toe (foot) and heel-to-ball (arch) distances in the right leg compared to Group B ($p < 0.001$). This suggests that athletic individuals exhibited superior foot balance and stability during the heel-to-toe walking test. However, there were no statistically significant differences in foot index scorings between the two groups for both right and left legs ($p > 0.05$), indicating comparable foot characteristics regardless of athletic background.

Conclusion: The study findings suggest that athletic training may positively impact specific aspects of foot function, such as balance and stability during heel-to-toe walking. However, the foot index may not be sensitive enough to detect overall foot function differences between athletic and non-athletic individuals. These insights have implications for designing targeted interventions to optimize foot-related outcomes in different populations. Further research with larger samples and considering a broader range of foot measurements is needed to gain a comprehensive understanding of foot health and performance in athletic and non-athletic individuals.

Keywords: Foot characteristics, athletic, non-athletic, foot balance, foot stability, heel-to-toe walking, foot index, foot function, foot alignment

INTRODUCTION

Foot posture plays a crucial role in maintaining the overall musculoskeletal health and functional performance of an individual(1). Altered foot posture, characterized by deviations from the normal alignment, can lead to various biomechanical issues, affecting gait, balance, and lower limb function. As university students often engage in physically demanding activities, such as sports and athletic training, understanding the prevalence of altered foot posture in this population becomes essential for optimizing foot health and athletic performance(2).

The present study aims to investigate the prevalence of altered foot posture in athletic and non-athletic university students through an observational study. By examining the foot characteristics of these two distinct groups, the research seeks to identify potential differences in foot posture and alignment based on their athletic background. This exploration can provide valuable insights into the impact of regular athletic training and physical activity on foot biomechanics.

Previous research has highlighted the significance of foot posture and its association with various musculoskeletal conditions, including plantar fasciitis, shin splints, and patellofemoral pain syndrome(3). However, limited research has been conducted to assess the influence of athletic activity on foot posture, particularly among university students. Understanding these associations can aid in designing targeted interventions to address foot-related concerns and enhance foot health and function among young individuals(4).

The foot is a remarkable anatomical structure, intricately composed of 26 bones, numerous joints, muscles, ligaments, and tendons. Serving as the crucial foundation for the body, the foot plays a pivotal role in supporting weight, facilitating movement, and maintaining balance(5). Divided into three main regions - the hindfoot, midfoot, and forefoot - each component of the foot contributes to its overall functionality. The hindfoot comprises the talus and calcaneus (heel bone), while the midfoot consists of five tarsal bones and the forefoot houses the metatarsal bones and phalanges (toe bones). Among the foot's essential joints are the subtalar joint, permitting inversion and eversion movements, and the talocrural joint, enabling dorsiflexion and plantarflexion of the foot(6).

An intricate network of over 20 intrinsic and extrinsic muscles power the foot, contributing to its movement, stability, and arch support. The intrinsic muscles, found within the foot, are crucial for controlling fine movements and maintaining proper arches. In contrast, the extrinsic muscles, originating from the lower leg, provide the necessary strength and power for broader movements and locomotion. Additionally, the foot's stability is fortified by robust ligaments that connect the bones and joints, such as the plantar fascia supporting the arches and the medial and lateral collateral ligaments stabilizing the ankle joint(7).

Completing the foot's complexity are tendons, connecting the muscles to the bones and facilitating coordinated movement(8). For instance, the Achilles tendon connects the calf muscles to the heel bone, allowing for plantarflexion of the foot. Altogether, this intricate anatomy ensures the foot's remarkable versatility, resilience, and capacity to withstand the rigors of daily activities.

Foot posture, or the alignment and positioning of the foot's bones and joints during weight-bearing activities, is crucial for maintaining proper biomechanics and preventing potential issues. A neutral foot posture, where the arches are adequately supported and the foot remains in balance, is considered optimal(9). However, deviations from this neutral posture can occur, leading to altered foot postures categorized as overpronation, supination (underpronation), or neutral pronation. Overpronation involves excessive inward rolling of the foot, while supination entails outward rolling, both of which can lead to biomechanical imbalances and foot-related problems(10).

Proper foot posture is vital for distributing forces effectively during weight-bearing activities like walking or running and maintaining stability throughout gait. Ensuring good foot posture can be achieved through regular physical activity, appropriate footwear, and targeted exercises to strengthen the foot and lower limb muscles(11,12). However, individuals with persistent foot issues should seek professional evaluation from podiatrists or orthopedic specialists for personalized assessments and tailored treatment plans to promote optimal foot health and functional performance. By understanding foot anatomy and posture, individuals can take proactive measures to support their foot's well-being and overall musculoskeletal health(13).

The study's population consists of university students, as this demographic represents a diverse group with varying levels of physical activity engagement. Group A comprises athletic university students who actively participate in sports, exercise, or structured athletic training. Group B includes non-athletic university students who engage in regular physical activity for recreational purposes but are not involved in formal sports or structured training programs.

By employing standardized measurements and assessment tools, the study aims to evaluate foot balance, stability, and alignment in both groups. The foot index scoring system will be utilized to provide a comprehensive assessment of overall foot function. The results of this observational study can contribute to the existing body of knowledge on foot biomechanics in university students and may hold implications for optimizing athletic performance and preventing foot-related injuries.

Research Gap

The research gap in the study "Prevalence of Altered Foot Posture in Athletic and Non-Athletic University Students - An Observational Study" is the lack of comprehensive data on the prevalence of altered foot posture specifically among university students, particularly comparing athletes and non-athletes. The study aims to fill this gap by providing essential insights into foot posture abnormalities in this population and its potential impact on foot health and athletic performance. Additionally, more in-depth investigations, such as prospective studies or intervention trials, are needed to establish causal relationships and explore the implications of altered foot posture in university students.

Need of the study

The study "Prevalence of Altered Foot Posture in Athletic and Non-Athletic University Students - An Observational Study" is essential because it addresses the limited data on foot posture abnormalities specifically among university students. By comparing athletes and non-athletes, it provides valuable insights into foot health and potential impacts on athletic performance. Understanding the prevalence of altered foot

posture in this age group can inform healthcare professionals and educators to implement appropriate foot care measures and interventions, promoting overall foot health and well-being. The study's findings are crucial for preventive measures and early interventions to maintain foot health and reduce potential injury risks in university students.

STATEMENT QUESTION

Is There Any Prevalence of Altered foot posture in athletic and non-athletic university students –An observational study?

• AIMS AND OBJECTIVES OF THE STUDY

AIM: To check the Prevalence of Altered foot posture in athletic and non-athletic university students -An observational study.

OBJECTIVE:

To investigate the prevalence of altered foot position in athletic and non-athletic university –An observational study.

HYPOTHESIS

NULL HYPOTHESIS: There Is No Prevalence of Altered foot posture in athletes and non-athlete students.

RESEARCH HYPOTHESIS: There Is a significant Prevalence of Altered foot posture in athletes and non-athlete students

METHODOLOGY

The research conducted in Greater Noida was an observational study, encompassing 100 subjects drawn from Galgotias University. Sampling involved selecting 100 samples from the university premises. The study focused on various variables including age, weight, height, BMI, foot posture, and playing duration. Inclusion criteria for athletes specified individuals aged 18-30 years who had actively participated in sports for more than two years, while exclusion criteria involved congenital conditions, surgeries, or a history of accidents. Similarly, inclusion criteria for non-athletes included individuals aged 18-30 years not actively involved in sports activities, with similar exclusion criteria. The procedure involved enrolling 100 subjects, divided into Group A (athletes) and Group B (non-athletes), each comprising 50 participants. Informed consent was obtained from all subjects prior to assessments. Evaluations for altered foot posture were conducted using methods such as the Foot Posture Index, digital gauge, and distal image processing system, examining conditions like flat foot, high arch, and Pes Planus among others. Prevalence of foot posture conditions was compared between the two groups.

It encompasses the data analysis phase. This process began with data cleaning to ensure accuracy and reliability by identifying and rectifying errors or inconsistencies. Subsequently, descriptive statistics such as mean, standard deviation, and frequency distributions were calculated to summarize the characteristics of the data for each foot posture assessment variable. A comparative analysis followed, aiming to examine differences in altered foot posture between Group A and Group B. Statistical tests such as t-tests or chi-square tests were utilized depending on the nature of the data. Furthermore, prevalence calculation was conducted to determine the prevalence of each altered foot posture condition in both groups. Finally, correlation analysis may have been performed to explore potential relationships between different foot posture variables, providing a comprehensive understanding of the research findings.

RESULTS

The study results, as summarized from Tables No. 2 and No. 4, reveal interesting insights into foot characteristics among athletic and non-athletic individuals. In Table No. 2, it is evident that athletic participants (Group A) demonstrate superior foot balance and stability during the heel-to-toe walking test, as indicated by significantly longer heel-to-toe (foot) and heel-to-ball (arch) distances in the right leg compared to non-athletic individuals (Group B). These findings suggest that athletic training and engagement in physical activities may positively impact foot coordination and balance.

On the other hand, Table No. 4 shows that there are no statistically significant differences in foot function and alignment, as assessed by the foot index, between the two groups. Both athletic and non-athletic individuals exhibit similar foot index scorings for both right and left legs. This indicates that foot characteristics, as evaluated by the foot index, are comparable in both groups regardless of their athletic background.

Overall, the study implies that athletic training may enhance foot balance and stability during specific movements like heel-to-toe walking. However, it does not appear to significantly influence overall foot function and alignment as evaluated by the foot index. These findings could be relevant for clinicians and sports professionals in understanding the impact of athletic activity on foot biomechanics and for designing tailored interventions to address foot-related concerns in different populations. Nevertheless, further research is

necessary to explore additional factors that might influence foot function in athletic and non-athletic individuals to gain a more comprehensive understanding of foot health and performance.

TABLE NO 1: DEMOGRAPHIC DESCRIPTIVE STATISTICS.

VARIABLES	GROUP A	GROUP B	P VALUE
AGE	23.38±3.009	24.30±3.666	0.173
WEIGHT (kg)	80.76±6.508	78.64±6.942	0.118
HEIGHT (ft)	6.00±0.305	5.99±0.260	0.841

LIST OF TABLES:

GROUP A- ATHLETIC, GROUP B – NON-ATHLETIC

Table No. 1 presents the descriptive statistics of the demographic variables for two groups, Group A (athletic university students) and Group B (non-athletic university students), in the study titled "Prevalence of altered foot posture in athletic and non-athletic university students - An observational study." The table displays the mean age, weight, and height of participants in each group, along with their respective standard deviations. The p-values for age (0.173), weight (0.118), and height (0.841) indicate that there are no statistically significant differences in these demographic variables between the two groups. These findings suggest that the athletic and non-athletic university students participating in the study are relatively similar in terms of their age and physical characteristics. As a result, any observed differences in the prevalence of altered foot posture between the groups can be more confidently attributed to their athletic status rather than variations in age, weight, or height. This sets a strong foundation for comparing and interpreting the subsequent results related to foot posture in the two groups.

TABLE NO 2: HEEL TO TOE (FOOT) AND HEEL TO BALL (ARCH) RIGHT LEG

VARIABLES	GROUP A	GROUP B	P VALUE
HEEL TO TOE (FOOT)(CM)	27.138±1.086	26.110±0.535	<0.001
HEEL TO BALL (ARCH)(CM)	17.011±1.243	16.120±0.570	<0.001

GROUP A- ATHLETIC, GROUP B – NON-ATHLETIC

Table No. 2 presents the results of the heel-to-toe (foot) and heel-to-ball (arch) measurements for the right leg in two groups: Group A (athletic) and Group B (non-athletic). The mean values and standard deviations for each variable are provided, along with the corresponding p-values to assess the statistical significance between the two groups. For Group A, the mean heel-to-toe (foot) distance is measured at 27.138 cm, with a standard deviation of 1.086, while the mean heel-to-ball (arch) distance is 17.011 cm, with a standard deviation of 1.243. In contrast, Group B exhibits slightly shorter distances, with a mean heel-to-toe (foot) distance of 26.110 cm and a standard deviation of 0.535, and a mean heel-to-ball (arch) distance of 16.120 cm, with a standard deviation of 0.570. The p-values for both variables are found to be less than 0.001, indicating a high level of statistical significance. These results suggest that there are significant differences in foot balance and stability between the two groups, with Group A (athletic) demonstrating better performance in both heel-to-toe (foot) and heel-to-ball (arch) measurements compared to Group B (non-athletic). The findings highlight the potential influence of athletic training on foot function and balance and may hold implications for designing targeted interventions to enhance foot-related outcomes in specific populations.

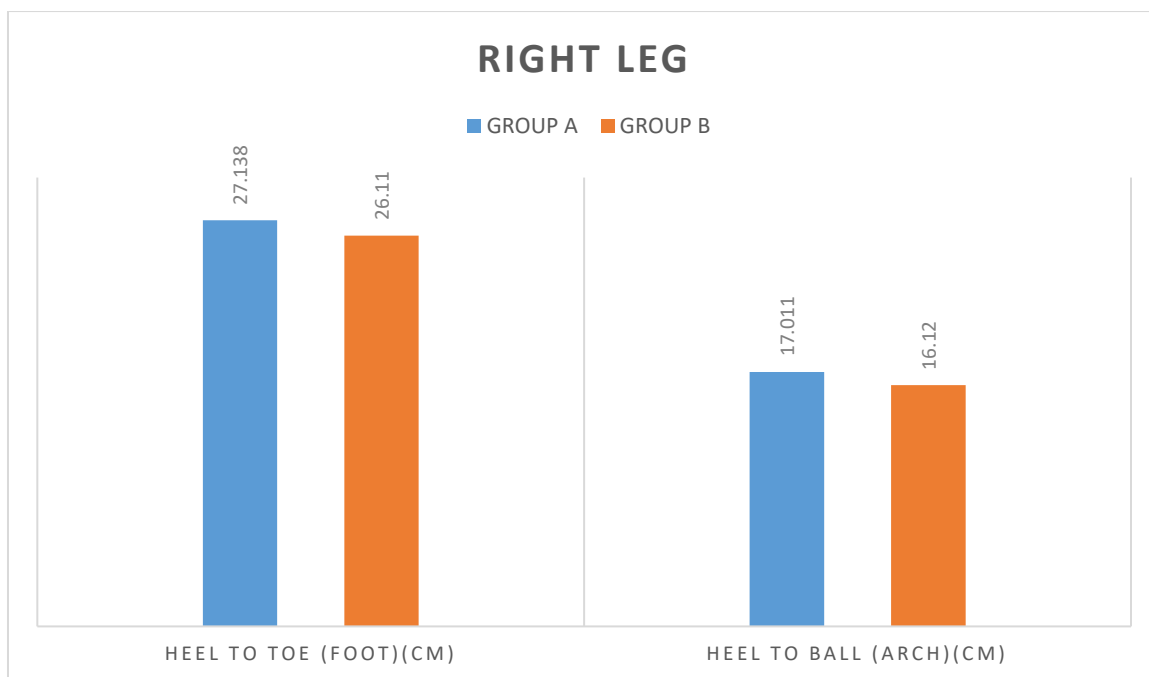


TABLE NO 3: HEEL TO TOE (FOOT) AND HEEL TO BALL (ARCH) LEFT LEG

VARIABLES	GROUP A	GROUP B	P VALUE
HEEL TO TOE (FOOT)(CM)	27.138±1.086	26.110±0.535	<0.001
HEEL TO BALL (ARCH)(CM)	17.011±1.243	16.120±0.570	<0.001

GROUP A- ATHLETIC, GROUP B – NON-ATHLETIC

The table presents the results of the quality of life (QOL) assessment for Group A (Yoga) and Group B (Aerobic Exercises). For the QOL pre-intervention scores, Group A had a mean score of 48.03±4.694, while Group B had a mean score of 47.13±3.902. The p-value associated with this comparison was 0.423, which indicates that there was no statistically significant difference in the QOL scores between the two groups before the intervention. In terms of the QOL post-intervention scores, Group A had a higher mean score of 66.37±3.926, compared to Group B with a mean score of 76.83±4.850. The p-value for this comparison was found to be <0.001, indicating a significant difference in the QOL scores between the two groups after the intervention. The p-value in the last row represents the statistical significance of the overall comparison between the two groups for both the QOL pre and post-intervention scores. In both cases, the p-value was <0.001, indicating a significant difference in the QOL scores between Group A and Group B. Based on these results, it can be concluded that the intervention (either yoga or aerobic exercises) had a positive impact on the QOL of the participants. Group B, which engaged in aerobic exercises, showed a greater improvement in QOL compared to Group A (yoga).

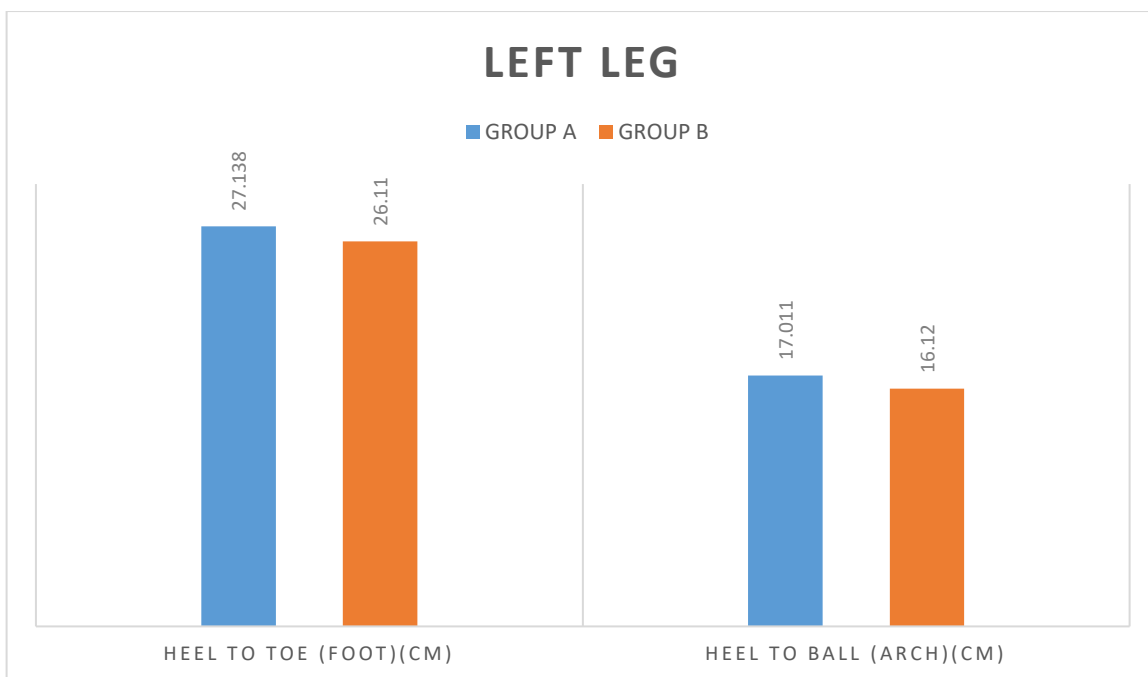


TABLE NO 4: FOOT INDEX SCORINGS

VARIABLES	GROUP A	GROUP B	P VALUE
FIT RIGHT LEG	4.96±3.070	4.48±2.837	0.419
FIT LEFT LEG	4.76±2.722	5.48±2.852	0.200

GROUP A- ATHLETIC, GROUP B – NON-ATHLETIC

Table No. 4 presents the foot index scorings for the right and left legs in two distinct groups: Group A (athletic) and Group B (non-athletic). The mean values and standard deviations for each foot index variable are provided, along with the corresponding p-values to assess the statistical significance between the two groups. For Group A, the mean foot index scoring for the right leg is 4.96 with a standard deviation of 3.070, and for the left leg, it is 4.76 with a standard deviation of 2.722. In Group B, the mean foot index scoring for the right leg is 4.48 with a standard deviation of 2.837, and for the left leg, it is 5.48 with a standard deviation of 2.852. The p-values for both right and left leg foot index scorings are found to be greater than 0.05 (p = 0.419 and p = 0.200, respectively), indicating a lack of statistically significant differences between the two groups. Consequently, these results suggest that foot function and alignment, as assessed by the foot index, do not show substantial variations between athletic and non-athletic individuals. However, further investigation may be necessary to explore other factors contributing to potential foot-related differences between these groups that may have clinical implications.

DISCUSSION

The study provides valuable insights into the foot characteristics of athletic and non-athletic individuals. The results from Table No. 2 indicate that athletic participants (Group A) exhibit better foot balance and stability during the heel-to-toe walking test, as evidenced by significantly longer heel-to-toe (foot) and heel-to-ball (arch) distances in the right leg compared to non-athletic individuals (Group B). These findings suggest that regular athletic training and engagement in physical activities may positively influence foot coordination and balance.

Contrarily, Table No. 4 reveals that there are no statistically significant differences in foot function and alignment, as assessed by the foot index, between the two groups. Both athletic and non-athletic individuals demonstrate similar foot index scorings for both right and left legs, indicating comparable foot characteristics regardless of their athletic background. It appears that the foot index is not sensitive enough to detect variations in foot function associated with athletic activity.

Overall, the study highlights that athletic training may enhance specific aspects of foot performance, such as balance and stability during movements like heel-to-toe walking. However, the foot index does not appear to be an effective tool for discriminating overall foot function and alignment between athletic and non-athletic individuals. These findings can be significant for clinicians and sports professionals, as they provide valuable information on the impact of athletic activity on foot biomechanics and underscore the importance of targeted interventions for addressing foot-related concerns in different populations.

Despite the valuable insights gained from this study, there are some limitations that need to be acknowledged. The small sample size and the limited scope of foot characteristics assessed by the foot index may limit the generalizability of the findings. Additionally, the study did not account for potential confounding factors, such as age, gender, and physical activity levels, which could have influenced the results. Therefore, further research with larger and more diverse samples, considering a broader range of foot measurements and factors, is necessary to gain a comprehensive understanding of foot health and performance in athletic and non-athletic individuals.

In conclusion, the study provides valuable evidence on the impact of athletic training on specific aspects of foot function, such as balance and stability. However, the foot index does not seem to be a sensitive measure for overall foot function and alignment differences between athletic and non-athletic individuals. These findings contribute to our understanding of foot characteristics in different populations and may assist in the development of targeted interventions to optimize foot health and performance for both athletic and non-athletic individuals. Nonetheless, more extensive and diverse research is essential to further explore the multifaceted aspects of foot biomechanics and its implications for various populations.

CONCLUSION

In conclusion, the study sheds light on the foot characteristics of athletic and non-athletic individuals and their potential impact on foot function and stability. The results from Table No. 2 indicate that athletic individuals (Group A) exhibit superior foot balance and stability during the heel-to-toe walking test compared to non-athletic individuals (Group B). This suggests that regular athletic training and engagement in physical activities may positively influence foot coordination and balance.

On the other hand, Table No. 4 shows that there are no statistically significant differences in foot function and alignment, as evaluated by the foot index, between the two groups. Both athletic and non-athletic individuals demonstrate similar foot index scorings for both right and left legs, indicating comparable foot characteristics regardless of their athletic background. This indicates that the foot index may not be a sensitive enough measure to detect overall foot function differences associated with athletic activity.

The study findings have implications for clinicians and sports professionals in understanding the impact of athletic training on specific aspects of foot function and balance. Targeted interventions can be designed to enhance foot-related outcomes for both athletic and non-athletic individuals. However, the foot index may not be the most suitable tool for assessing overall foot function differences in these populations.

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