PREVALENCE OF PES PLANUS & PES CAVUS DEFORMITY IN RECREATIONAL MALE SOCCER PLAYER

[1]ANISHA JAIN, [2]ANJALI RASTOGI, [3]ASFIYA FAHEEM, [4]BANTI KUMAR, [5]DANIYA QASEEM, [6]DR.SAMARPITA SENAPATI[PT]
[12345]Students, [2]Professor
[123456]Department of physiotherapy
[123456]Teerthanker mahaveer university, moradabad

I. Introduction

Football, which is frequently referred to as "the world's game," is more than just a sport; it is a phenomenon that has a global cultural impact. Its simplicity—just a ball and a goal—belies its complex strategies and significant social influence, and it has an estimated 4 billion supporters worldwide. Football brings people together through competition and a common passion, whether they are in the crowded streets of Rio de Janeiro or the rural fields of Africa.(1)

Football, commonly referred to as soccer, is the most popular sport in the world, with an estimated 250 million players in more than 200 nations and territories. Participation at the grassroots level and professional engagement both demonstrate its broad appeal. A thorough examination of 87,816 games from 11 major European leagues between 1993 and 2019 demonstrates the high frequency of professional football games, for example. This enormous figure highlights how widespread the sport is and how frequently the best levels of competition are performed. (2)

Strong foot mechanics are crucial in soccer since the game depends on quick sprints, abrupt direction changes, and accurate ball handling. The ability of a player to execute explosive movements and retain balance throughout intricate maneuvers is directly impacted by strong foot structures and mechanics, which improve propulsion, stability, and agility. Specific strength training for the lower limbs has been shown to considerably enhance these qualities. A research conducted on young amateur soccer players, for example, showed that an 8-week strength-training program significantly improved the lower limbs' maximum isometric force and enhanced the velocities of toe and ankle motions during ball contact. These enhancements resulted in improved physical fitness and kicking performance. Furthermore, it has been demonstrated that thorough strength and power training regimens that target the entire neuromuscular system enhance the physiological indicators linked to elite soccer players' performance. As a result, improving foot mechanics via focused training is essential for maximizing performance and lowering the risk of injury in soccer. (17)(18)

Foot abnormalities that influence balance, stability, and injury risk, including pes planus (flatfoot) and pes cavus (high-arched foot), can seriously hinder a soccer player's performance. Particularly on the dominant side, pes planus is linked to worse balance ability, which is essential for making accurate movements when playing video games. According to a research in the Turkish Journal of Sports Medicine, athletes with bilateral pes planus showed much longer oscillations on their dominant side than athletes without foot abnormalities, suggesting that their balance was impaired. During quick direction changes and intricate moves, which are crucial parts of soccer, this imbalance may make it more difficult for a player to keep control. (19)

Pes cavus has also been connected to an increased risk of foot and ankle injuries in soccer players, especially those playing at higher levels. Cavus foot is 30% common among soccer players, according to research published in the Journal of the American Podiatric Medical Association. More seasoned players are more likely to get it. Cavus foot was also noted in the study as a major risk factor for injuries to the ankle and foot. Due to its stiffness and decreased ability to absorb stress, a high-arched foot can cause discomfort and increase the risk of ailments like instability and ankle sprains, which can hinder a player's ability to play at their best during games.(14)

It is essential to comprehend muscle mechanics in order to maximize athletic performance and avoid sports-related injuries. A major factor in enabling fluid and well-coordinated motions is the interaction between agonist and antagonist muscles. Reciprocal inhibition is a neuromuscular process that improves movement efficiency and lowers the risk of muscle strain by relaxing the muscles on one side of a joint to permit contraction on the other.(3)

Analyzing muscle movements during particular technical training offers important insights into improving performance and preventing injuries in sports biomechanics. The isokinetic muscle strength of the hip and knee joints at different angular velocities was investigated in a football player study. The results showed that the electromyographic signals of the flexor and extensor muscles decreased with increasing angular velocity. The hip joint extensors in particular showed signs of incoordination while moving quickly, highlighting the necessity of focused training to correct muscle imbalances and improve coordination.(4)

Furthermore, because mechanical power measures the pace at which work is done or energy is transmitted during movement tasks, it is crucial to quantify it in order to evaluate athlete performance. However, measurement system restrictions frequently limit the ability to estimate mechanical power, which forces the adoption of simpler models. A thorough analysis showed that, in comparison to more intricate joint power models, such simplifications could lead to notable differences, ranging from 10% to 250%. This emphasizes how crucial precise power evaluations are to sports research in order to guide efficient training and performance plans .[5]

From recreational to professional sports, people of all involvement levels can be impacted by sports injuries, which are a frequent occurrence in sporting activity. Any physical harm resulting from internal or external factors that occurs during exercise or sports is commonly referred to as a sports injury. An athlete's performance and general health may be impacted by these injuries, which can range in severity from mild strains to serious fractures and ligament tears.[6]

Sports injuries are caused by a variety of reasons, which can be generally divided into extrinsic and intrinsic causes. Athletes' own bodies can have intrinsic characteristics, such as imbalanced muscles, poor flexibility, irregularities in biomechanics, and inadequate conditioning or warm-up. External influences like bad training methods, insufficient equipment, subpar playing conditions, or direct physical contact with opponents are referred to as extrinsic variables. The nature of the sport frequently determines the kind and frequency of injuries; contact sports like rugby and football have a greater incidence of traumatic injuries, whereas non-contact sports like swimming or running are more likely to suffer from overuse injuries. [6]

Sports injuries, which are frequently brought on by acute trauma, recurrent stress, or poor biomechanics, are a major contributor to musculoskeletal abnormalities in athletes. Inherent structural variations such as excessive femoral anteversion, increased Q angle, or genu varum and valgum can create uneven load distribution across joints, increasing the risk of injury and long-term deformity. Anatomical malalignment is one of the main causes of such deformities. Deformities are also caused by bad posture and bad body mechanics, which change movement patterns and put more strain on particular musculoskeletal tissues. Diseases including scoliosis and lumbar lordosis have been linked to increased injury rates because of biomechanical abnormalities, especially in the knees and spine. In addition, overuse and repetitive stress injuries arise when the body's ability to heal is exceeded by the constant strain on muscles and bones, resulting in conditions such as tendinopathy, stress fractures, and osteochondritis dissecans, which, if left untreated, can cause long-term structural abnormalities that impair an athlete's performance and mobility.[7][8][9]

Sports-related musculoskeletal abnormalities can seriously impair an athlete's performance, longevity in the sport, and general health. These abnormalities eventually reduce an athlete's capacity to compete successfully since they frequently result in functional limitations, chronic pain, and an increased risk of re-injury. Osteoarthritis (OA) is associated with weight-bearing joint injuries, notably those of the hip, knee, and ankle. Former athletes who suffer from malalignment or high-impact trauma are particularly at risk. Ankle ligament damage can result in an incomplete recovery and long-term joint deterioration, which can occasionally manifest decades after the initial injury. Knee injuries are a well-established risk factor for osteoarthritis. Movement limitations and pain are further exacerbated by the prevalence of spinal abnormalities and pathologies in sports including weightlifting, gymnastics, tennis, soccer, and wrestling. Additionally, injuries received prior to or during competition raise the likelihood of athletic failure dramatically because fewer players available impairs both individual and team performance. Studies have indicated that injury prevention techniques are essential for optimizing sports performance, underscoring the significance of proactive conditioning and recovery regimens. Targeted therapies are necessary to address these sports-related abnormalities in order to maintain long-term health and athletic performance.(10)(11)

Athletic performance is greatly impacted by foot posture, with variations such pes planus (flatfoot) and pes cavus (high-arched foot) affecting stability, biomechanics, and the risk of injury. The hallmark of pes planus is a diminished medial longitudinal arch, which causes excessive foot pronation and can lead to biomechanical inefficiencies when moving. According to research, athletes with flat feet burn more energy when running because of their inefficient propulsion mechanics and longer ground contact time. This illness puts athletes at risk for ailments including medial tibial stress syndrome and knee pain by putting undue tension on the soft tissues and joints of the lower extremities. On the other hand, pes cavus is characterized by a very high arch, which causes excessive foot stiffness and inadequate shock absorption. Pes cavus athletes frequently have elevated plantar pressure, which raises their risk of stress fractures, ankle instability, and metatarsalgia. Sports performance may suffer from a lack of foot flexibility, especially when it comes to activities that call for quick direction changes or high-impact landings. By changing gait mechanics and raising the risk of overuse injuries, both disorders have an impact on sports performance. In order to maximize movement efficiency and lower the risk of long-term musculoskeletal issues, athletes with these deformities require proper examination, supportive footwear, and rehabilitation techniques. (12)(13)(14)

Soccer is the most well-liked and physically taxing games in the world, it demands a great degree of stamina, agility, and technical talent. Players are vulnerable to a variety of injuries since the sport requires a lot of running, abrupt direction changes, leaping, and physical contact. Studies show that soccer players frequently get injuries as a result of the game's high intensity, repeated motions, and physical difficulties such tackles and collisions. (15)

Muscle strains, ligament sprains, fractures, and contusions are among the most common soccer injuries, with the lower extremities—especially the knees and ankles—being the most commonly impacted. Because the game is so dynamic, non-contact injuries like rips to the anterior cruciate ligament (ACL) are very common and can have a big effect on a player's career. Soccer players are at a significantly lower risk of injury because to injury prevention techniques including strength training, appropriate warm-ups, and biomechanical evaluations. In order to create training and rehabilitation programs that are successful and eventually improve player safety and performance, it is imperative to comprehend the mechanics and risk factors related to soccer injuries. (15)

Because of the quick sprints, abrupt direction changes, and continuous weight-bearing exercises, soccer puts a tremendous amount of physical strain on players' lower limbs, especially the feet. Performance and injury risk may be greatly impacted by these stressors, which can worsen underlying foot abnormalities such pes planus (flatfoot) and pes cavus (high-arched foot). Reduced stability, diminished balance, and impaired explosive movements—all crucial for soccer performance—have been associated with pes planus, which is typified by a diminished medial longitudinal arch. According to studies, athletes with flat feet have trouble leaping and changing direction quickly, which may increase their risk of overuse ailments including plantar fasciitis and medial tibial stress syndrome. However, pes cavus, which is characterized by an oversized arch, makes the foot more stiff and has poor shock absorption, making it more prone to stress fractures, ankle sprains, and metatarsalgia. According to research, cavus foot is more common among professional soccer players and frequently causes instability and persistent foot discomfort. Proper foot examination, supportive footwear, and remedial training are crucial for soccer players to improve performance and avoid long-term musculoskeletal disorders since these foot abnormalities not only increase the risk of injury but also impair athletic efficiency. (14)(16)

The purpose of (Differences in Sole Arch Indicators in Various Sports) is to ascertain how different sports affect sole arch indices. According to several authors' findings in this study, males who were not athletes had different foot arch indices than soccer players. The cross-sectional research comprised 30 guys who were not athletes and 116 top athletes. The association between left and right foot AI was shown to be low in soccer players and high in those who were not athletes.(20)

There is a substantial knowledge gap about the frequency and effects of foot abnormalities such as pes planus (flat feet) and pes cavus (high-arched feet) among male recreational soccer players because most research on these disorders has concentrated on professional or elite sportsmen.

For example, a research by Prvulović et al. (2019) found that athletes with flat feet are the most common deformity, and that their motor task scores were lower than those of athletes with normal arches. However, rather than concentrating just on recreational soccer players, this study included individuals from a variety of sports backgrounds.(22)

An another research by Satish et al. (2022) looked at the link between amateur soccer players' foot position and agility and discovered a strong correlation between the two. The incidence of certain foot abnormalities, such as pes planus or pes cavus, in this group is not addressed, despite the fact that this sheds light on the functional consequences of foot position.(15)(21)

Also, a study by Alentorn-Geli et al. (2009) found that cavus foot is a risk factor for foot and ankle injuries in soccer players, and that experienced players are more likely to have it. However, this study did not exclude male leisure players despite included a wide age range and different play levels. These results highlight the necessity of doing focused study on male recreational soccer players in order to ascertain the incidence of pes planus and pes cavus abnormalities in this population. It is essential to comprehend these prevalence statistics in order to create treatments and preventative measures that are suitable for this particular demographic.(14)

II. AIMS & OBJECTIVES

Aim and Objectives of the study:

- **Aim**: To observe the prevalence of pes planus & pes cavus deformity in recreational male soccer player
- **Objectives:** To find out the prevalence of pes planus & pes cavus deformity in recreational male soccer player

Hypothesis:

- **Experimental Hypothesis**: There is a significant prevalence of pes planus & pes cavus deformity in recreational male soccer player
- **Null Hypothesis:** There is no significant prevalence of pes planus & pes cavus deformity in recreational male soccer player

III. REVIEW OF LITERATURE

Vauhnik, R., Jeranko, M., & Gabrilo, G. (2025) The study concluded that the navicular drop test possesses excellent intra-rater reliability, with an intraclass correlation coefficient (ICC) of 0.89 for the dominant foot and 0.82 for the non-dominant foot. Furthermore, it showed strong correlations with the Foot Posture Index ($r = 0.68$ for the dominant and $r = 0.59$ for the non-dominant foot). These results validate the navicular drop test as a reliable tool for assessing foot posture in both clinical and sports settings.[23]

Robert Donatelli (2024) The study concluded that foot and ankle biomechanics are essential to proper lower extremity function. Since the foot is the terminal joint of the kinetic chain, its structure and arthrokinematics influence how weightbearing forces are managed. Inappropriate foot mechanics can disrupt the dissipation of compressive, tensile, and rotational stresses, leading to pathologies such as shin splints, neuromas, hallux valgus, and knee pain. This study underscores the importance of biomechanical screening in injury prevention programs for athletes.[24]

Aswin Satish (2023) The study concluded that foot posture, particularly a supinated foot, has a notable influence on agility among amateur soccer players. Supinated feet were linked to greater agility limitations than pronated or neutral foot types. These findings suggest that assessment of foot structure should be an integral component of agility-focused training and rehabilitation plans in soccer training regimens.[25]

Anne-Laure Ménard (2023) The study concluded that cavus foot type was present in approximately 30% of the studied soccer players and was more common in experienced individuals. Injury risks were associated with factors such as female gender, age over 18, advanced playing level, and lower FPI-6 scores. The study emphasized the utility of documenting foot morphology and injury history in order to personalize injury prevention strategies across age groups in soccer.[26]

Afxentios Kekelekis (2023) The study concluded that ligament and muscle injuries among amateur soccer players predominantly occurred during matches, particularly peaking in October and February. These injuries were mostly acute rather than recurrent. The research recommended the integration of regular muscle conditioning—focusing on the hip and thigh regions—into training schedules to help mitigate seasonal injury spikes.[27]

Arif Setiawan (2023) The study concluded that flat-footed athletes are more prone to knee and ankle injuries, with internal biomechanical causes being predominant. The findings encourage athletes to choose sports aligned with their anatomical structure and recommend corrective strategies like balance training and the use of supportive gear. This insight supports personalized training regimens to enhance performance and reduce injury risk.[28]

Fatma Neşe Şahin (2022) The study concluded that athletes with pes planus exhibited decreased vertical jump and impaired balance. These deficits may hinder overall sports performance and predispose athletes to further biomechanical dysfunction. Early detection and structured rehabilitative interventions, including targeted foot-strengthening exercises, were recommended to mitigate these performance limitations.[29]

Akhiruyanto, S., Kusuma, M. S., & Hardi, S. (2022) The study concluded that changes in physical activity levels due to the COVID-19 pandemic negatively impacted the muscular strength and foot morphology of football players. Decreased training loads led to alterations in foot structure, thereby increasing the risk of developing foot deformities. The findings highlight the importance of consistent physical training in maintaining structural foot integrity and athletic capability.[30]

Chatterjee, S., Majumdar, P., & Ray, D. (2021) The study concluded that Cooper's 12-minute run test is a highly valid predictor of VO_2 max in male university students, showing a strong correlation ($r = 0.93$, $p <$

0.001) with directly measured VO_2 max. Despite some prediction variability across fitness levels, the test remains a useful and practical field tool for assessing cardiovascular endurance in athletes.[31]

Alexander, D. P., Fernandes, J., & Chaudhary, V. (2020) The study concluded that external factors such as surface types, footwear, and field conditions significantly contribute to the development of foot deformities like pes planus and cavus in athletes. It emphasized that environmental modifications—such as proper shoe selection and improved ground surfaces—can play a preventive role in reducing sports-related foot injuries.[32]

Arevalo-Mora, L., Reina-Bueno, M., & Munuera, P. V. (2020) The study concluded that abnormal foot posture, particularly flat or high arches, significantly affects children's motor performance, including agility and balance. These early impairments may persist into adolescence and adulthood, potentially impacting long-term athletic development, especially in sports like soccer that demand high coordination and lower-limb control.[33]

Amoako, A. O., Nassim, J. R., & Keller, J. M. (2020) The study concluded that abnormal body mass index (BMI) increases the risk of lower-limb injuries in athletes with foot deformities. Overweight athletes with either pes planus or pes cavus were more susceptible to stress injuries and joint instability. The study recommended continuous monitoring of BMI and foot posture in training environments.[34]

Jayant Sharma & Prashant Upadhyaya (2020) The study concluded that flat-footed athletes demonstrated lower running performance due to altered biomechanical alignment. This compromised structure reduces stride efficiency and increases the energy cost of running. The findings advocate for the inclusion of corrective foot exercises and biomechanical assessments in performance training.[35]

S. Sivachandiran & Dr. G. Vinod Kumar (2020) The study concluded that a corrective exercise program significantly improved foot alignment in athletes with pes planus. Changes included improved medial arch support and better ankle alignment. These outcomes support the application of structured rehabilitation protocols to enhance performance and reduce lower limb injury risk in flat-footed athletes.[36]

William C. Whiting (2020) The study concluded that biomechanical faults in foot posture, especially in contact sports like football, create stress imbalances throughout the lower kinetic chain. Conditions like pes cavus and pes planus predispose athletes to overuse injuries, shin splints, and knee joint misalignments. It emphasized incorporating foot mechanics screening in injury prevention systems.[37]

Carson, M. C., Chou, L. W., & Hart, J. M. (2019) The study concluded that athletes with pes cavus exhibited higher plantar pressure and impulse during athletic movements, leading to increased injury risks compared to athletes with normal arches. These pressure variances can create stress fractures and soft tissue strain. The study recommended cushioning insoles and arch support for cavus-foot athletes.[38]

Leger, L. A., & Mercier, D. (2019) The study concluded that the Cooper 12-minute run test is highly reliable ($\phi = 0.96$) and valid when compared to laboratory VO_2 max assessments. It found no statistically significant differences ($p > 0.05$) between predicted and measured VO_2 max, supporting the use of this test in field-based athletic evaluations.[39]

Arévalo-Mora, L., Reina-Bueno, M., & Munuera, P. V. (2019) The study concluded that children with abnormal foot posture, particularly pes planus, had decreased balance and agility scores, which could potentially affect athletic performance in later stages. The findings stressed the need for early screening and customized intervention strategies in school and youth sports settings.[40]

Sharma, J., & Upadhyaya, P. (2019) The study concluded that pes planus affects running biomechanics by altering shock absorption and foot strike patterns. This leads to decreased running economy and increased fatigue. Rehabilitation efforts targeting foot strength and footwear correction were suggested to mitigate the performance impact.[41]

Setiawan, A. (2019) The study concluded that flat-footed athletes tend to suffer from a higher incidence of overuse injuries in the knee and ankle. Injury origins were primarily internal, indicating a strong link between structural foot deformities and injury prevalence. The study called for individualized rehabilitation, footwear adjustments, and anatomical matching of sports participation to athlete morphology.[42].

IV. METHODOLOGY

Material and Methods:

1- Cooper VO_2 max test
2- Navicular drop test
3- Coleman block test

Source of data: teerthankarmahaveer university, moradabad

Method of collection of data: Convenient

Testing Procedure:

1- The study will be conducted over recreational male soccer players in Teerthanker mahaveer university
2- By using convenient sampling technique , participants of age 18-30 years who will meet the inclusion criteria will be selected
3- Prior to participation , the informed consent form will be taken from each participating individuals and the study will be thoroughly explained to all subjects
4- VO_2 Max Testing**:** The Cooper VO_2 max test will be used to estimate the aerobic capacity of the participants. This is a 12-minute run test performed on a standard 400-meter track or flat surface.

Participants are instructed to cover as much distance as possible in 12 minutes by running or walking. The total distance covered (in meters) will be recorded, and VO_2 max will be estimated using the following formula:

$$VO_2 \text{ max (ml/kg/min)} = \frac{\text{Distance in meters} - 504.9}{44.73}$$

This test is a reliable indicator of cardiovascular endurance and overall aerobic fitness.

5- Navicular drop test will be performed to assess the function of the medial longitudinal arch of foot. In this patient stand with their full weight on their lower extremity , mark the most prominent part of the navicular tuberosity , measure the distance from the floor to the mark, have the patient relax, measure the distance from the floor to the mark again, calculate the difference between the two measurement.
6- Coleman block test will be performed to determine if a patient has a fixed or flexible hindfootvarus deformity.The patient stands with their foot on a block that's about 1 inch (2.5 cm) thick, The patient puts their full weight on the block ,The examiner gently inverts and everts the hindfoot while applying pressure to the leg . Test result- If the heel deformity is correct while weight bearing during this manoeuvre, the deformity is flexible. If the heel deformity does not correct, there is a fixed hindfoot deformity.

Sample Size : 100

Materials to be used:

1- Marker
2- Ruler or measuring tape
3- Wooden or plastic blocks
4- Cones

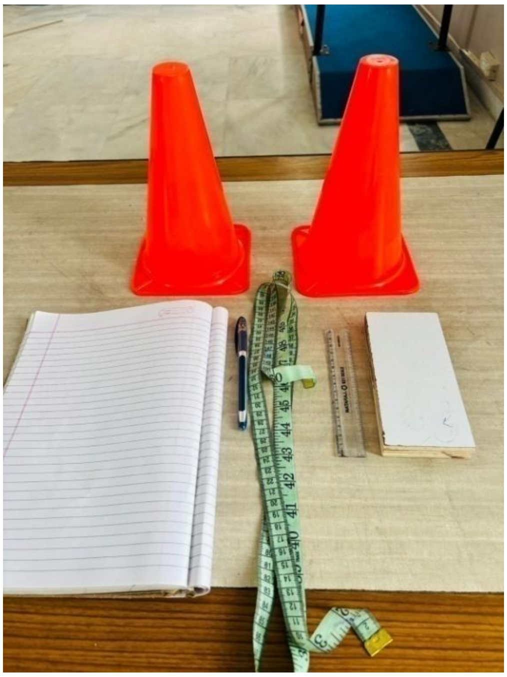
INCLUSION CRITERIA:

1- male
2- Age: 18-30 year old
3- players without any injury from last three to six months
4- Play football for 45-60 minutes twice a week

EXCLUSION CRITERIA:

1. Female players
2. any recent ankle injuries
3. presence of congenital foot deformity
4. Lower extremity injury or deformity
5. Vestibular disorder
6. Concussion within the previous six months

SATISTICAL ANALYSIS: SPSS software



STUDY

study

DESIGN:
Observational

Fig1 :- Image Of Material Used

Fig 2 :- Navicular Drop Test

Fig 3 :- Coleman Block Test

V. DATA ANALYSIS

Descriptive Statistics		
	AGE	VO2 max test
Valid	100	100
Missing	0	0
Mean	21.290	63.575
Std. Deviation	2.426	1.476
Minimum	18.000	60.250
Maximum	29.000	66.280

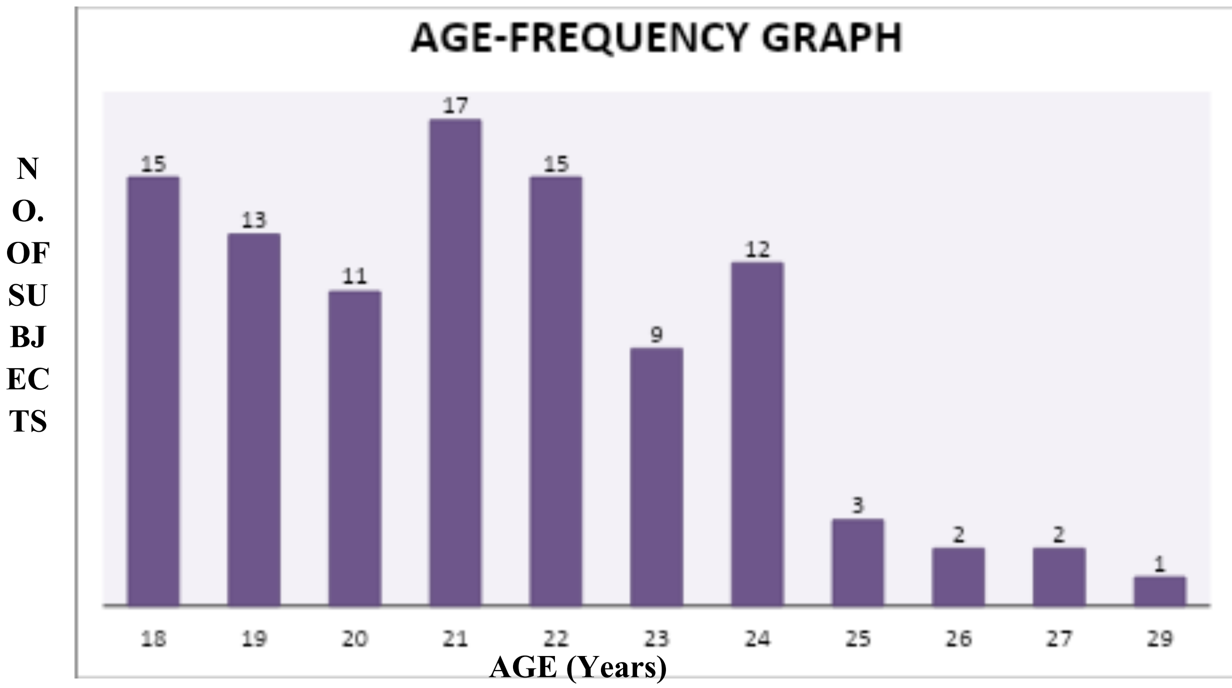
Table 1 :- The table shows basic information about the participants' age and VO_2 max test scores. All 100 participants provided valid data, with no missing values. The average age was 21.2 years, with ages ranging from 18 to 29 years. The average VO_2 max score was 63.58, ranging from 60.25 to 66.28. The standard deviation shows there was some variation in both age (±2.42) and VO_2 max scores (±1.48)

One Sample T-Test		
	Z	p
AGE	212.900	< .001
VO2 max test	635.755	< .001
NDT LEFT	11.300	< .001
NDT RIGHT	11.500	< .001
CBT LEFT	2.700	0.007
CBT RIGHT	2.700	0.007

Table 2:- The one-sample t-test was conducted to determine whether the sample mean significantly differed from a hypothetical population mean. Results showed statistically significant differences in all tested variables. Age (Z = 212.900, $p < .001$) and VO_2 max test scores (Z = 635.755, $p < .001$) showed extremely high levels of significance, indicating strong deviations from the population mean. Similarly, both Navicular Drop Test (NDT) values for the left (Z = 11.300, $p < .001$) and right foot (Z = 11.500, $p < .001$) were highly significant. The Coleman Block Test (CBT) results for both the left and right sides also showed statistical significance (Z = 2.700, $p = .007$), though to a lesser extent compared to the other measures.

Frequencies for AGE				
AGE	Frequency	Percent	Valid Percent	Cumulative Percent
18	15	15.000	15.000	15.000
19	13	13.000	13.000	28.000
20	11	11.000	11.000	39.000
21	17	17.000	17.000	56.000
22	15	15.000	15.000	71.000
23	9	9.000	9.000	80.000
24	12	12.000	12.000	92.000
25	3	3.000	3.000	95.000
26	2	2.000	2.000	97.000
27	2	2.000	2.000	99.000
29	1	1.000	1.000	100.000
Missing	0	0.000		
Total	100	100.000		

Table 3:- The table shows the frequency distribution of age among the 100 participants. The most common ages were 21 years (17%) and 18 years (15%), followed by 22 years (15%). Age distribution ranged from 18 to 29 years, with no missing data. The cumulative percentage indicates that 71% of participants were aged 22 or below.

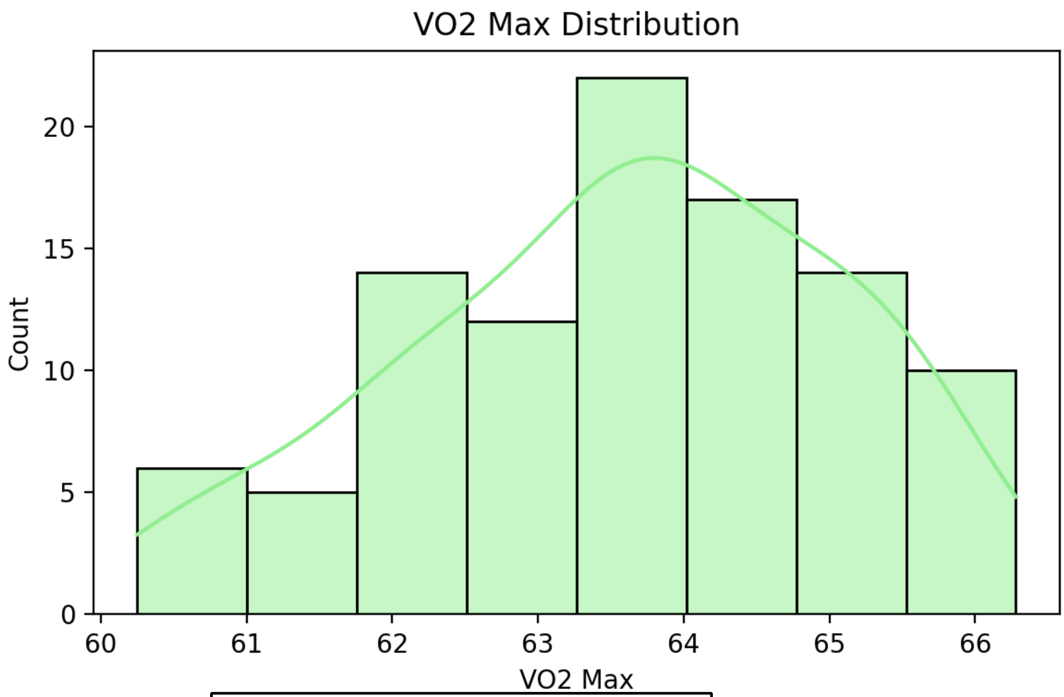


Graph 1:- Age graph

Frequencies for VO2MAX				
VO2MAX	Frequency	Percent	Valid Percent	Cumulative Percent
60.25	2	2.000	2.000	2.000
60.47	1	1.000	1.000	3.000
60.69	2	2.000	2.000	5.000
60.92	1	1.000	1.000	6.000
61.14	3	3.000	3.000	9.000
61.37	2	2.000	2.000	11.000
61.81	3	3.000	3.000	14.000
62.04	4	4.000	4.000	18.000
62.15	1	1.000	1.000	19.000
62.26	5	5.000	5.000	24.000
62.48	1	1.000	1.000	25.000
62.71	5	5.000	5.000	30.000
62.92	1	1.000	1.000	31.000
62.93	2	2.000	2.000	33.000
63.15	4	4.000	4.000	37.000
63.38	8	8.000	8.000	45.000
63.6	3	3.000	3.000	48.000
63.82	11	11.000	11.000	59.000
64.05	5	5.000	5.000	64.000
64.24	1	1.000	1.000	65.000
64.27	3	3.000	3.000	68.000
64.5	5	5.000	5.000	73.000
64.72	3	3.000	3.000	76.000
64.9	1	1.000	1.000	77.000
64.94	4	4.000	4.000	81.000
65.17	6	6.000	6.000	87.000
65.37	1	1.000	1.000	88.000
65.39	2	2.000	2.000	90.000
65.61	4	4.000	4.000	94.000

65.84	4	4.000	4.000	98.000
65.94	1	1.000	1.000	99.000
66.28	1	1.000	1.000	100.000
Missing	0	0.000		
Total	100	100.000		

Table 4:- This table presents the frequency distribution of VO_2 max values among 100 participants. The VO_2 max ranged from 60.25 to 66.28 ml/kg/min. The most frequently occurring VO_2 max value was 63.82 ml/kg/min, observed in 11% of the sample. A majority of the values clustered between 63 and 65 ml/kg/min, indicating relatively high aerobic fitness levels among participants. No missing data were reported.



Graph 2:- VO2 max

Cohen's kappa				
			95% CI	
Ratings	kappa	SE	Lower	Upper
Average kappa	0.834			

NDT LEFT - NDT RIGHT	0.834	0.081	0.676	0.992

Table 5:- Cohen's kappa was used to assess the level of agreement between the left and right foot Navicular Drop Test (NDT) measurements. The average kappa value was 0.834, indicating **strong agreement** between the two sides. The standard error was 0.081, with a 95% confidence interval ranging from 0.676 to 0.992. This suggests that the measurements were highly consistent across the two assessments. The analysis was based on 100 subjects and 2 measurements.

Cohen's kappa				
			95% CI	
Ratings	kappa	SE	Lower	Upper
Average kappa	0.634			
CBT LEFT - CBT RIGHT	0.634	0.058	0.521	0.747
Note. 100 subjects/items and 2 raters/measurements. Confidence intervals are asymptotic.				

Table 6:- Cohen's kappa was calculated to measure the agreement between the left and right foot Coleman Block Test (CBT) results. The average kappa value was **0.634**, indicating a **moderate level of agreement**. The standard error was 0.058, with a 95% confidence interval ranging from 0.521 to 0.747. This suggests a fair to good consistency between the two sides. The analysis included 100 participants and 2 measurements.

Contingency Tables			
	NDT RIGHT		
NDT LEFT	Negative	Positive	Total
Negative	84	3	87
Positive	1	12	13
Total	85	15	100
Note. Each cell displays the observed counts			

Table 7:- **This table describes** the distribution of Navicular Drop Test (NDT) results between the left and right foot among 100 participants. A total of 84 individuals tested negative on both sides, while 12 tested positive on both sides, indicating strong agreement between the two measurements. Additionally, 3 participants were negative on the left and positive on the right, and 1 participant was positive on the left and negative on the right. These results suggest a high level of consistency in NDT findings between the left and right feet.

Chi-Squared Tests			
	Value	df	p
X^2	70.042	1	< .001
N	100		

Table 8:- **This table describes** the Chi-Squared test performed to assess the association between left and right foot Navicular Drop Test (NDT) results. The Chi-Square value was **70.042** with **1 degree of freedom**, and the result was statistically significant (**p < .001**). This indicates a strong association between left and right NDT outcomes, supporting the consistency and reliability of the test across both feet in the sample of 100 participants.

Contingency Tables				
	CBT RIGHT			
CBT LEFT	N/A	T.P. Tigthness	Valgus Forefoot	Total
N/A	80	0	0	80
T.P. Tightness	0	13	0	13
Valgus Forefoot	0	0	7	7
Total	80	13	7	100
Note. Each cell displays the observed counts				

Table 9:- **This table describes** the distribution of Coleman Block Test (CBT) results between the left and right foot among 100 participants. The majority of participants (n = 80) fell into the "Not Applicable (N/A)" category on both sides, indicating no relevant foot deformity requiring classification. Additionally, 13 participants were identified with tibialis posterior (T.P.) tightness on both feet, and 7 participants showed

valgus forefoot on both sides. No cross-category mismatches were observed between the left and right sides. This clear alignment of results suggests a **strong agreement** in CBT findings between both feet.

Chi-Squared Tests			
	Value	df	p
X^2	200.000	4	< .001
N	100		

Table 10:- **This table describes** the Chi-Squared test used to assess the association between left and right foot results in the Coleman Block Test (CBT). The Chi-Square value was **200.000** with **4 degrees of freedom**, and the result was statistically significant (**$p < .001$**). This indicates a very strong association between left and right CBT classifications. The results suggest that the categorization of foot conditions (Not Applicable, T.P. Tightness, Valgus Forefoot) was highly consistent across both feet among the 100 participan

VI. RESULTS

Descriptive statistics showed that the mean age of participants was 21.21 years, with a range from 18 to 29 years and a standard deviation of 2.66. VO_2 max values had a mean of 63.58 ml/kg/min, ranging from 60.25 to 66.28, indicating generally high aerobic fitness among the sample. Frequency distributions revealed that the most common ages were 21 and 18 years, and the most frequently recorded VO_2 max value was 63.82 ml/kg/min.

A one-sample t-test revealed statistically significant differences in all measured variables when compared to a hypothetical population mean. Age ($Z = 212.900$, $p < .001$) and VO_2 max ($Z = 635.755$, $p < .001$) showed highly significant deviations, while both the left and right Navicular Drop Tests (NDT) also demonstrated strong statistical significance ($Z = 11.300$ and $Z = 11.500$, respectively; both $p < .001$). The Coleman Block Test (CBT) values for both left and right sides also showed statistically significant results ($Z = 2.700$, $p = .007$).

To assess reliability between left and right foot assessments, Cohen's kappa was calculated. The NDT results showed a strong agreement ($\kappa = 0.834$), with a 95% confidence interval from 0.676 to 0.992, suggesting high consistency across sides. For CBT, the agreement was moderate ($\kappa = 0.634$), with a 95% confidence interval from 0.521 to 0.747, indicating fair to good consistency between both feet.

Contingency tables further supported these findings. For NDT, 84 participants tested negative on both feet, and 12 tested positive on both sides, with only 4 individuals showing any mismatch. A Chi-Square test confirmed a statistically significant association between left and right NDT outcomes ($\chi^2 = 70.042$, df = 1, $p < .001$), reinforcing the reliability of the assessment. Similarly, for CBT, 80 participants were classified as "Not Applicable" on both sides, 13 had T.P. tightness, and 7 had valgus forefoot, with perfect alignment across left and right. The Chi-Square test again showed a highly significant association ($\chi^2 = 200.000$, df = 4, $p < .001$), indicating strong consistency in CBT categorization between the two feet.

VII. DISCUSSION

The primary objective of this study was to determine the **prevalence of pes planus (flat foot)** and **pes cavus (high arch)** deformities in recreational male soccer players and to identify which condition is more commonly present. Based on the results from the Navicular Drop Test (NDT), 13% of participants were found to have pes planus, while the remaining 87% showed normal arches. The Coleman Block Test (CBT) results indicated that 7% of participants had pes cavus, 13% showed tibialis posterior (T.P.) tightness (often associated with pronated foot posture), and 80% had no applicable deformity. These findings suggest that **pes planus is more prevalent than pes cavus** in this group of recreational male soccer players.

These results are consistent with several earlier studies. Buldt et al. (2015) reported a higher prevalence of pes planus in athletic populations, especially those engaged in high-impact, repetitive movement sports such as running and soccer. Similarly, Nigg et al. (1999) suggested that repetitive pronation during dynamic activities can lead to a flattening of the medial longitudinal arch over time, making flat feet more common among athletes. These findings support the idea that the mechanical loading experienced in soccer can contribute to the development of pes planus, particularly in athletes who may lack structured foot support or who train on hard surfaces.[43][46]

In contrast, some researchers have argued for a higher prevalence of pes cavus in athletic groups. Burns et al. (2005) and Williams and McClay (2000) observed a tendency toward cavus foot types in sports that emphasize sprinting or rapid force production, as high arches are believed to provide a more rigid lever during push-off. However, the findings of the current study differ from these claims. One explanation for this discrepancy could be that the participants in our study were **recreational players**, rather than elite athletes, and thus might not experience the same biomechanical demands that could favor cavus development.[44][47]

It is also important to consider the **multifactorial nature of foot posture**, which can be influenced by genetics, neuromuscular control, training surfaces, footwear, and load exposure (Menz et al., 2013). These factors vary significantly among individuals and between competitive and non-competitive athletic populations.[45]

Furthermore, the reliability of the present findings is reinforced by the **high level of agreement** between left and right foot assessments. Cohen's kappa for the NDT was 0.834, indicating strong agreement, while CBT showed moderate agreement with a kappa of 0.634. Chi-Square analysis also revealed statistically significant associations for both tests ($p < .001$), which supports the internal consistency of the data and the observed prevalence patterns.

In summary, the current study indicates that **pes planus is more common than pes cavus** among recreational male soccer players. This finding is in agreement with more recent studies that emphasize the role of repetitive impact and ground contact in promoting pronated foot postures. These results highlight the importance of screening athletes for foot deformities and implementing appropriate interventions, such as foot posture training or orthotic use, to minimize injury risk and enhance performance.

VIII. CONCLUSION

This study concluded that **pes planus (flat foot)** is more prevalent than **pes cavus (high arch)** among recreational male soccer players. Using the Navicular Drop Test and Coleman Block Test, 13% of participants were found to have pes planus, while only 7% had pes cavus. The tests showed strong agreement and statistical reliability. These findings highlight the importance of early screening and appropriate interventions to prevent injuries and enhance performance in soccer players.

IX. LIMITATIONS AND RECOMMENDATIONS

Limitations

- The study included only recreational male soccer players, limiting generalizability.
- Small sample size may not represent the broader athletic population.
- Only clinical tests (NDT and CBT) were used; no radiological confirmation was done.
- External factors such as footwear, surface type, and training intensity were not controlled.
- biomechanical analysis were not included.

Future Recommendations

- Include a larger and more diverse sample, including female and competitive-level athletes.
- Use radiological assessments or foot pressure analysis to enhance diagnostic accuracy.
- Consider external influencing factors like footwear type, playing surfaces, and physical load.
- Conduct longitudinal studies to track foot posture changes and related injury risks over time.

- Evaluate the effectiveness of corrective strategies such as orthotics, exercises, or footwear modifications.

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