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PREVALANCE OF FLEXIBLE FLAT FOOT IN ATHLETES

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Abstract- This study was emphasized on assessment of flexible flat foot in athletes, which may provide baseline information about a general lack of awareness among the athletes about the flat feet and its functional relationship between the biomechanics of the lower extremity and the structure of the arches of the foot which may potentially affect the optimal running, jumping, hopping, balance and co-ordination which are important for the effective physical performance and training of the athletes. [3]Due to these repetitive activities there is a risk of injuries which leads to the postural changes or postural malalignment, because of which there is improper biomechanical action of the joint, which creates stress on the joints and undue stretching of the soft tissues. **Methodology-** Permission was taken from sports academy in and around Pune. A cross-sectional study was carried out on 138 sub-elite athletes in whom there were 46 football, 46 basketball and 46 hockey players of age group 18-25 years with mean age 21.45±2.24. Sub-elite athletes having obesity, recent fractures, lower extremity injuries, professional athletes and those not willing to participate were excluded from the study. The assessment was done using outcome measures, Foot Posture Index (FPI) and Navicular Drop test. **Results-** Foot Posture Index mean value of right foot was 3.68 ± 2.07 and left foot was 3.42 ± 2.09. In Navicular Drop Test, mean value of right foot was 5.23 ± 3.53 mm and mean value of left foot was 4.97 ± 3.5 mm. **Conclusion-** The prevalence of flexible flat feet in athletes was 20%.

Keywords- Flexible Flatfoot, Athletes, Foot Posture index, Navicular Drop Test, Football players, Basketball players, Hockey players.

INTRODUCTION

Fallen arches or Flat foot is a common entity used for pes planus deformity. In normal adult population the prevalence of flexible flat foot was found to be 13.6%. Usually 20-30% of general population have an arch that simply never develops in a single foot or in both feet. It is a very common deformity in which entire sole of the foot comes in contact with the floor while standing. Flatfoot is classified into two types namely flexible and rigid depending upon the arch behaviour. The arch type which is maintained while at rest but disappears on contacting the ground is the flexible type. And when there is no arch whether sitting or standing, it is a rigid type. [1]

Flat foot may have hampered activities like running, jumping, hopping, balance and co-ordination in athletes. While, doing functional activities like walking and running, pronation and supination movements occur which are normal foot movements but excessive pronation hampers the activities like standing, running and the most important body's ability to stand, because excessive pronation dysfunction of foot leads to stress on lower leg and spine. [2]

Sub elite athletes have lesser performance characteristics in regards to key physiologic and training variables when compared with elite athletes. This might expose them for a greater risk of injuries during the sport. In sports like football, basketball and hockey there are injuries mostly involving the lower extremities with foot/ankle, hip/thigh and knee, among which few of the most commonly prevailing injuries in football include sprains and strains, fractures, while those mostly seen in basketball are foot/ankle injuries, deep thigh bruising, patellofemoral pain syndrome (PFPS), fractured knee cap and in hockey knee ligaments injuries, groin strains, MCL and ACL strain in knee joint.[3]In football the foot becomes the contact point with ground, easily adapting the changes in both weight and ground surfaces which absorbs forces while walking or running to facilitate rotational movement.[4] Because of this there is high risk of injuries in football players. In basketball sports high impact activity of jumping is the most common activities performed due to which the individuals have poor ability to control the movements in the ankle and foot complex, which might lead to poor jumping performance. [5] The present study was designed to examine the flexible flat foot by using Foot Posture Index (FPI) and Navicular Drop Test. In 2001 at Australian Podiatry Council National Conference, Redmond et al first

described the foot posture index (FPI). [6] Navicular Drop Test is an easy and reliable tool to administer used for assessing arch height. [7]

Both the outcome measures are used in various studies for assessment of foot posture and are a reliable and easy to administer tools.

The body of literature provides some evidence of a relationship between pes planus and increased lower limb motion during gait; however this was not conclusive due to heterogeneity between studies and small effect sizes. There were significantly higher foot and ankle injury incidence rates. Foot and ankle injuries are increasing in competitive professional and collegiate athletics. Many of these injuries result in considerable missed time from sports and often require surgical intervention. To develop and implement effective practice participation strategies, return-to-play protocols, and injury prevention programs, an understanding of injury trends and epidemiology is vital.

Hence, the study was proposed to evaluate prevalence of flat feet in athletes.

METHODOLOGY

The research design used for the study was observational cross-sectional study. 138 sub-elite athletes were selected from sport clubs in and around Pune of age group between 18-25 years. The sample size was calculated according to the prevalence formula for cross-sectional study using the data obtained from the pilot study. Samples were selected through convenient sampling and inclusion and exclusion criteria. Sub-elite athletes were included and obese athletes, recent fractures, lower limb injuries, professional athlete; athletes not willing to participate were excluded. Outcome measures were Foot Posture Index and Navicular Drop Test for assessing foot posture. Required permissions were taken from institutional ethical committee and various sports academies prior to the study. Aim and objectives were explained to the athletes. Written consent was taken from the athletes those who were willing to participate and were included in the study.

The players with flexible flat foot were selected for the study and were assessed by using foot posture index and navicular drop test.

The foot posture index consisted of talar head palpation, curves above and below the lateral malleoli, inversion and eversion of calcaneus, bulge in the region of talonavicular joint. To assess Foot Posture Index the patient should be in relaxed

position with double limb support. The patient should be instructed to stand still, with their arms by the side and looking straight ahead. During the assessment, it is important to ensure that the patient does not swivel to try to see down towards feet as the weight bearing stance can get affected, as this will significantly affect the Foot Posture Index. Scoring is from 0 to 5 for normal feet, +6 to +9 for pronated; +10 for highly pronated and -1 to-4 for supinated; -5 to -12 for highly supinated feet. During assessment if there is genuine doubt about how high or low to score an item we always use the more conservative score.

Navicular Drop Test was measured in sitting and standing. The subject wasasked to sit on the chair in comfortable position so that the feet are placed flat to the ground, the position of the navicular tuberosity is marked on the paper. Subject was made to stand with full weight bearing equally on both foot and again navicular tuberosity is marked on the paper and the difference should be calculated. [7] If the measurement is greater than or equal to 10mm then the feet is pronated or it is indicated as abnormal feet.

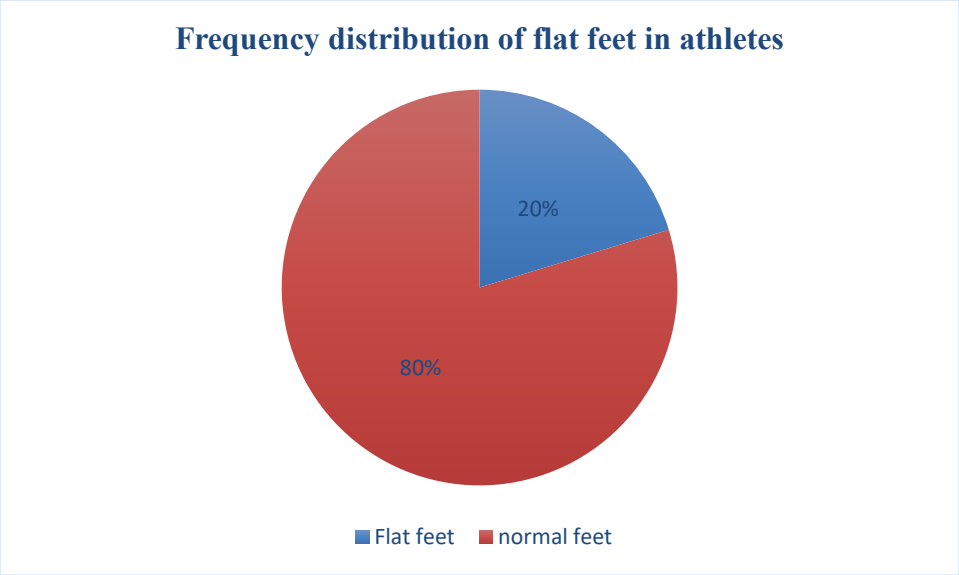
RESULTS

TABLE NO. 1

Frequency distribution of flexible flat feet in athletes

Total no. flat feet in athletes	28	20%
Normal feet	110	80%
Total number of athletes	138	100%

Graph No. 1



INTERPRETATION: Table no. 1 and graph no. 1 shows out of 138 no. of athletes 110(80%) players were normal feet and 28(20%) players were flatfeet.

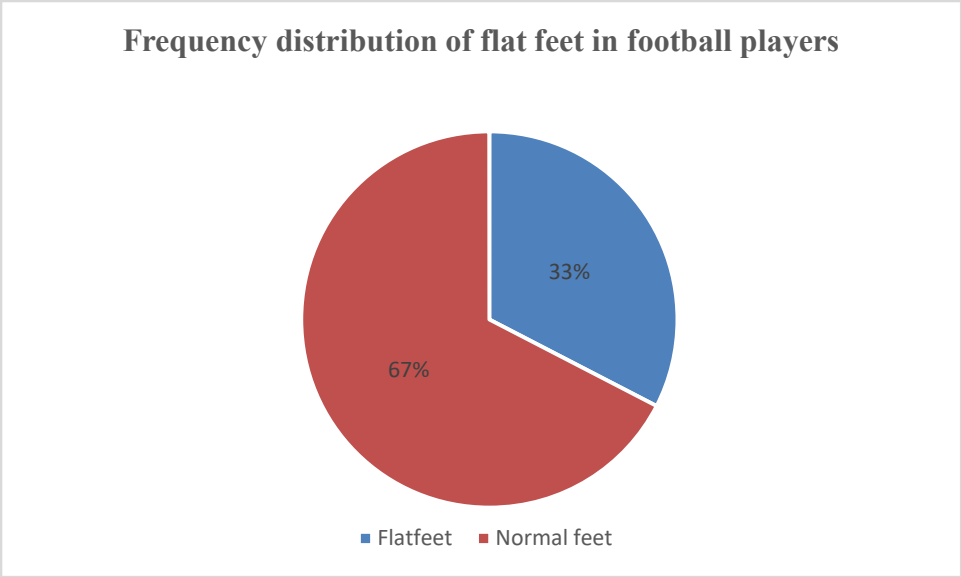
TABLE NO. 2

Frequency distribution of flexible flat feet in football players

Total no. of flat feet in football players	15	33%
Normal feet	31	67%

Total no. of flat feet in football players	46	100%

Graph no. 2



INTERPRETATION: Out of 46 no. of football players, 31(67%) players were having normal feet and 15(33%) players were having flatfeet.

TABLE NO. 3

Frequency distribution of flexible flat feet in basketball players.

Total no. of flat feet in basketball players	10	22%
Normal feet	36	78%
Total no. of basketball players	46	100%

Graph no. 3

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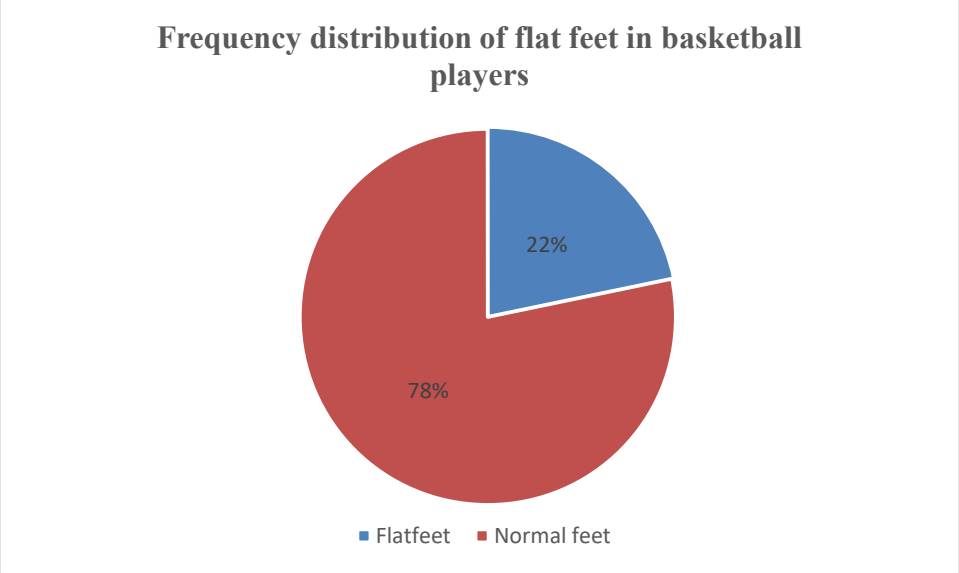


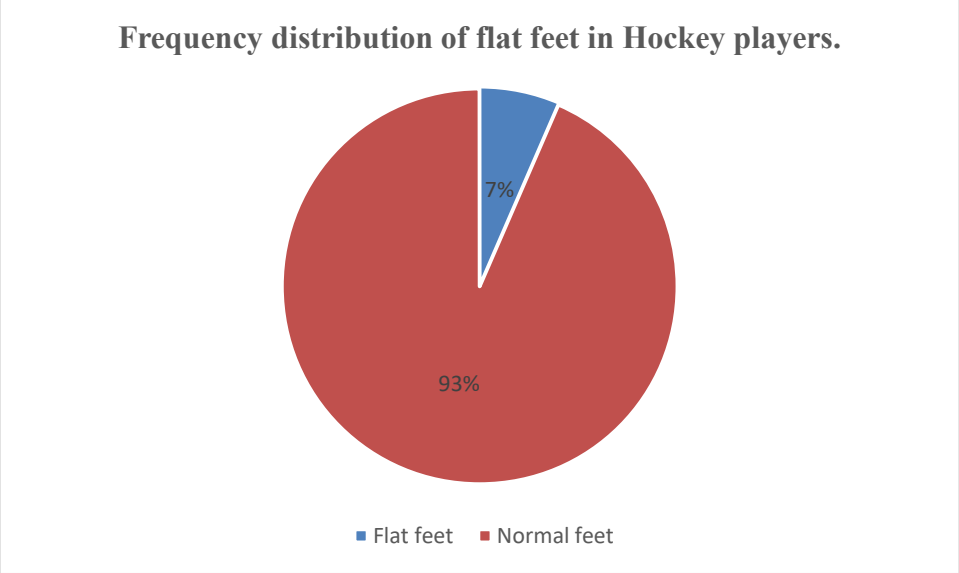
INTERPRETATION: Out of 46 no. of basketball players, 36(78%) players were having normal feet and 10(22%) players were having flatfeet.

TABLE NO. 4

Frequency distribution of flexible flat feet in hockey players

Flat feet in hockey players	3	7%
Normal feet	43	93%
Total no. of hockey players	46	100%

Graph no. 4



INTERPRETATION: Out of 46 no. of players, 43(93%) players were having normal feet and 3(7%) players were having flatfeet.

TABLE NO. 5

DESCRIPTIVE STATISTICS OF FOOT POSTURE INDEX

Foot Posture Index	Mean ± SD	Std. Error	Min.	Max.
Right	3.68 ± 2.07	0.17	0	9
Left	3.42 ± 2.09	0.17	0	9

INTERPRETATION: There was no major difference in Foot posture index mean value of right foot which was 3.68 ±2.07 when compared to mean value of left foot which was 3.42 ±2.09

TABLE NO. 6

DESCRIPTIVE STATISTICS OF NAVICULAR DROP TEST

Navicular	Mean ± SD	Std.	Min.	Max.

Drop Test		Error		
Right	5.23 ± 3.53	0.30	1	14
Left	4.97 ± 3.5	0.29	1	13

INTERPRETATION: In Navicular Drop Test, there was a slight increase in mean value of right foot which was 5.53 ±3.53 when compared to the mean value of left foot which was 4.97 ±3.5

DISCUSSION

The study was done to assess the prevalence of flexible flatfeet in athletes. Foot, ankle pain and dysfunction are common presentations to physiotherapists working in field of sports. Kinematic analysis indicates that excessive running increase in range of pronation, which cause the stretch on soft tissues surrounding foot complex. In kinetic analysis moderately, high load imposed on toes and imposition of toes on medial side is greater than lateral side of foot.[2] Flat feet or abnormal pronation will cause excessive internal rotation of lower limb during walking, running, and jumping. In sports like football and hockey requires activities like running or kicking and in basketball requires high intensity of jumping.

Certain muscles of foot and ankle either depress or support the arch, which may result in changes in sole of foot due to insufficiency of supporting muscles. For example, posterior tibial, peroneus brevis/longus, flexor hallucis longus, flexor digitorum longus and abductor pollicis longus muscles support the formation of medial longitudinal arch. Extensor hallucis longus and tibialis anterior muscles have a depressing effect on arch, whereas posterior tendon ruptures and tenosynovitis result in flat foot. [8]

The aim of our study was to evaluate the prevalence of flatfoot in athletes. The samples were taken from sports academies in and around Pune according to inclusion and exclusion criteria. The age group was between 18-25 years with mean age 21.24± 2.24 years. Both male and female players were included in this study. Permission was taken from various sports academies. The players were explained about the assessment

and written consent was taken. Overall, 138 samples were taken in this study where, 46 were football players, 46 were basketball players and 46 were hockey players.

The outcome measures were used i.e. Foot Posture index and Navicular Drop Test.[6,7] In this study we designed to evaluate the flat foot in different sports of athletes which included football, basketball and hockey. Our study was to determine the prevalence of flat foot in athletes. Our overall analysis as seen in table 1, graph 1 of the prevalence of flat feet in athletes were about 28 players (20%) out of 138 players. We also have specifically analysed for different sports, i.e. in football players, shows prevalence of flat feet was 15 (33%) out of 46 players as seen in table 2 and graph 2. Also, in basketball players, prevalence of flat feet was 10 (22%) out of 46 players as seen in table 3 and graph 3 and in hockey players, there was less prevalence of flat feet about 3 (7%) out of 46 players as seen in table 4 and graph 4. Stress fracture of femur, tibia, metatarsals and different parts of lower extremities are the causative factor for pes planus, but no such relation was found between pes planus and prevalence of lower extremity injury in athletes.[8]

Flexible flat foot is characterized by the appearance of the flatfeet only during weight bearing activities such as walking, running and jumping. The gait patterns of the patients with flatfeet are characterized by pronation and abduction of the forefoot, and medial rotation of the talus due to eversion of calcaneus. Factors related to the pain development and injuries due to flatfeet include acute stress, joint instability, lack of strength, muscle fatigue, and stress due to loading times. Especially during walking or running, there is possibility that the invertor/evertor and abduction/adduction movements which are highly related to foot motion of lower extremity could cause excessive pain or injury to the joint. [9]

Walking, running, jumping and kicking the ball are most common activities performed in the selected sports. Walking or running is characterized as a closed kinetic-chain motion of lower limb therefore; foot motion has an effect on the movement of lower limb joint. Especially important element of gait mechanism is rearfoot motion, so during normal gait the first body part contact to the ground is foot and in addition external forces transferring from the ground to the lower limb. This rearfoot motion occurs between the talus and calcaneus bone, where the eversion and inversion of calcaneus are involved in the pronation and supination of foot during walking and running. Therefore, excessive inversion and eversion can reduce the stability of ankle joint, and these motions may affect the ankle joint movements. [9]

Jumping is one of the most common activities performed in basketball players as there is less ankle plantarflexion at the instant of take-off in flat-footed group compared to the normal-arched group during countermovement jump take-off. The gastrocnemius/soleus has to stretch and maximise the ankle power significantly. Due to this mechanism flat footed individuals require greater effort to maintain similar level of performance with normal – arched counterparts and this leads to flat footed individuals may tire out faster which resulting in inferior jump performance soon in the game. During countermovement joint take-off kinetic analysis shows that flat-footed players jump with significantly less hip joint power than normal arched players it would seems that reduction in hip joint power amongst the flat-footed players cause the lack of difference in the jump distance as compared to the normal arched group. So, the differences in biomechanics of lower extremity indicate that flat footed individuals have to work harder than normal arched. These flat-footed individuals have to achieve same performance and may experience fatigue earlier than the normal arched groups. [10]

In hockey players, compared to football and basketball players as there was a smaller number of flatfeet were investigated. In the study of football and basketball players it was investigated that comparison of flatfoot are similar than hockey players. The hockey players, particularly use the supporting shoes and protecting foot-sole. [11] Less number of players were having certain changes in some areas of foot but no damage or deformity was seen in large number of players.

As foot and overall body mechanics are closely related, it is essential that players should be aware of the foot postures even though they are hassle-free at the moment and preventive rehabilitation should be encouraged for athletes having flexible flatfeet in the long run.

In our study we discussed prevalence in different sports separately as well, as each sport, demands different level of lower extremity involvement and hence the exposures for risk of injury might be different.

CONCLUSION

The study shows that the prevalence of flat foot in athletes was 20%. Also, in individual analysis prevalence of flat foot in football players was 15 (33%) out of 46 players. In basketball players, prevalence of flat feet was 10 (22%) out of 46 players

and in Hockey players, there was less incidence of flat feet about 3 (7%) out of 46 players.

CONFLICT OF INTEREST: NIL

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