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Original Research Article

The Relationship between Static Posture of Lower Limb Parameter with Overuse Injury in Hip, Knee, and Ankle in Recreational Athletes in Delhi-NCR

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ABSTRACT

Athletes suffer most commonly from musculoskeletal injuries and it has increased dramatically over the last decade. Accompanying the increase in participation in sports is the increase incidence of injury in lower limb like hip, knee and ankle in both male and female athletes. The purpose of this study was to examine the static posture of lower limb parameters with overuse injury. This study is conducted with the two groups of 40 subjects i.e. Group A is Injured 20 Athletes and Group B is Non-Injured 20 Athletes. Seven variables were measured: standing pelvic position, hip position, standing sagittal knee position, standing frontal knee position, hamstring length, prone subtalar joint position, and navicular drop test. This study has been found strong relationship static posture of lower limb with pelvic position, femoral anteversion and navicular drop test. And this study also shows the low relationship with Hamstring length, standing knee extension angle and subtalar joint and normal relation with standing sagittal knee extension in lower limb with static posture in injured recreational athletes. This study concluded that the injury is affecting the biomechanics and even the relative static posture of the lower limb parameters with injured and Non-injured Athlete. We recommended the athletes to provided with targeted education regarding self-care strategies and treatment option for managing the biomechanics of the lower limb and more research be undertaken is to physical demands on the lower limb with specific games and also with specific injuries.

***Keywords**:* Static Posture, Lower Limb, Recreational Athletes, Postural Faults, Biomechanics

INTRODUCTION

"Posture is usually defined as the relative arrangement of the parts of the body. Good posture is that state of muscular and skeletal balance which protects die supporting structures of the body against injury or progressive deformity, irrespective of the attitude (erect, lying, squatting, or stooping) in which these structures are working or resting [1]. Limb posture, defined as the relative position of the limb segments, has a major effect on the cost of locomotion and the forces acting in the limb bones and muscles through its influence on the magnitude of the bending moments exerted about the joints and bones [2][3][4][5].

Sex could be a confounding factor in studies of human locomotor posture, as human males and females, who differ significantly in body size, do not differ in lower limb posture during the stance phase of walking [6][7]. Moreover, some studies have even reported that males, despite their greater body size, keep their limbs more flexed than females do at least at some joints during the stance phase of walking [8],

A sports injury is defined as any physical complaint that is sustained from a sport activity that may or may not result in time loss from sports activities or in a medical consultation. Sports injuries are further classified as traumatic or overuse injuries. A consensus statement, presented by Fuller et al. in 2006, defined traumatic injury as an "injury resulting from a specific, identifiable event", whereas an overuse injury was described as one caused by "repetitive micro trauma without a single identifiable event responsible for the injury" [9].

Musculoskeletal lower extremity injuries have led to heightened interest regarding mechanism of injury as well as biomechanical, structural, and neuromuscular differences between male and female athletes. With a growing body of research recognizing risk factors associated with injury from athletic participation, great benefit would result from the ability to identify athletes at an increased risk of injury prior to athletic participation. Athletes suffer most commonly from musculoskeletal injuries. Among the most disabling injuries in an athletic population are those involving the lumbar spine and lower extremities. Many of these injuries are attributed to muscular deficiencies such as weakness and poor endurance. Accordingly, it has been suggested that lack of trunk and hip strength may predispose athletes to low back and lower extremity injury [10].

A static posture, consisting of anterior pelvic tilt, anteverted hips, tight hamstrings, genu recurvatum, and subtalar joint pronation, may place an individual in knee hyperextension and increased internal tibial rotation during dynamic movement, putting greater stress on the pelvic muscles, knee ligaments and muscles and ankle ligaments to forceful stretch Athletes with lower extremity bio- mechanical deviations may be at greater risk of injury. Biomechanical abnormalities of the lower extremity are related to knee pathologies. This type of injury occurs due to deceleration of the lower limb, forced hyperextension of the knee, or forced tibial rotation. The injury may be an isolated tear of the ACL or a combined injury also involving secondary restraints (eg., patellofemoral pain)[11].

The physical, mental, and emotional development associated with athletic endeavors can play a great dividend in adulthood. Unfortunately, on the flipside of many athletic endeavors is the risk of injury, which can bring long term consequences. Sports injuries generally occur for two different reasons: trauma and overuse. Overuse, acute sprain, and strain injuries are the most common. An overuse injury results from excessive wear and tear on the body, especially in the areas subject to repeated activity [12].

Prevention and intervention have become focal points for researchers and clinicians. Before these types of studies can be used, the risk factors for injury must be clearly established. Many injury risk factors, both extrinsic (those outside of the body) and intrinsic (those from within the body), have been suggested. Extrinsic risk factors include level of competition, skill level, shoe type, use of ankle tape or brace, and playing surface. Intrinsic risk factors include age, sex, previous injury and inadequate rehabilitation, aerobic fitness, body size, limb dominance, flexibility, limb girth, muscle strength, imbalance and reaction time, postural stability, anatomical alignment, and foot morphology [13].

Recreational sports include all kind of physical activities, played for fun, participation, or aiming at social engagement. Recreational activities are believed to be less psychologically or physically demanding as expectancies regarding performance and commitment to the sport are lower, compared with competitive sports. Overuse plays a role in 30% to 50% of all sporting injuries and the incidence has increased over the past several decades, likely due to the increasing demands on athletes and greater participation in running and recreational sports. In elite soccer players, overuse injuries and re-injuries constituted 37% and

22% of all injuries, and athletes were most at risk of overuse injury during the preseason period [14].

Purpose of the study: The purpose of this study to find out the relationship between static posture of lower extremity with overuse injury in hip, knee and ankle and what are the biomechanical faults to cause the injury in lower Limb?

Aim and Objective:

- To check out the descriptive sources of seven parameters i.e."Pelvic position, Femoral anteversion, Hamstring length, Standing sagittal knee extension, Standing knee angle in the frontal plane, The navicular drop test, Subtalar joint neutral position" in Non-injured Athletes and Injured Athlete separately.
- To check out the significant relation between the two groups.
- To check out the correlation of both the groups in this study.

Significance: The significant relationship between Static Posture of Lower Limb parameters with Overuse Injury in – Hip, Knee and Ankle in Recreational Athletes.

MATERIAL AND METHODS

Study Design and Sampling Method:

This is the prospective Correlation Study design to find out the relationship between Static Posture of Lower Limb Parameters with Overuse Injury in Hip, Knee and Ankle in Recreational Athletes in Delhi NCR, The sample were selected from the different sources of contacts like sports ground, sports academies, college going athletes. Duration of this study was 6 to 8 months and this comprises of 40 participating athletes. According to inclusion criteria, both male and female athletes take part of this study with or without of past injury in their lower limb with the mentioned the age group between 20 to 25 years. Similarly, the exclusion criteria, athletes have no history of Upper extremity injury, suffering from any Neurological, Cardiological disease, no history of Amputated their limbs, or Para athletes.

This study is conducted with the two groups of 40 subjects i.e. Group A is Injured 20 Athletes and Group B is Non- Injured 20 Athletes. Participation in the study was voluntary and an informed consent was signed. The participating athletes were briefed about the purpose of the study and informed that their data would be safe and was guaranteed confidentiality. we were used seven variables parameter to identify the static posture of lower limb with overuse injury and these are: 1. Pelvic position, 2. Femoral anteversion, 3. Hamstring length, 4. Standing sagittal knee extension, 5. Standing knee angle in the frontal plane, 6. The navicular drop test, 7. Subtalar joint neutral position.

Method:

Pelvic position: Tilt of the pelvis was assessed by the method described by Kendall et al. The alignment of the Anterior Superior Iliac Spine and Pubic Symphysis were assessed in standing using a straight edge.

- If these two landmarks fell within the same vertical plane, the subject's pelvis were classified as Neutral;
- if the anterior superior iliac spine fell in front of the pubic symphysis, the subject's pelvis were classified as Anteriorly tilted;
- and if the anterior superior iliac spine fell behind the pubic symphysis, the subject's pelvis were classified as Posteriorly tilted

For classification purposes,

- Neutral classified as normal,
- anterior tilt classified as high,
- and posterior tilt classified as low.

Femoral Anteversion: Testing for femoral anteversion were performed with a Manual Goniometer. Subjects were placed in a prone position, with the knee flexed to 90". The greater trochanter was palpated, while

the hip was passively moved from internal and external rotation by the tester. At the point where the greater trochanter was palpated in its most lateral position, the angle of the lower leg to the vertical plane was measured.
The measurement is greater than 15" of internal rotation, the hip is designated to be Anteverted Position.

If measurement is than 8" of internal rotation in the test position then this is Retroverted position.

Hamstring length: Hamstring length was assessed, with the subject in the supine position, by measuring the angle of maximal hip flexion with the knee placed in neutral rotation (Kendall et. al.)

- If an angle between 80 and 95" was classified as Normal,
- If an angle below 80" was classified as Low and,
- If an angle greater than 95" then it is High.

Standing sagittal knee extension: Standing knee extension in the sagittal plane was measured with the subject standing in an erect posture, with the involved lower extremity placed in a position of hip extension and knee extension. We were asked to subject to shift their weight onto the involved lower extremity and to bring the knee into a maximal position of knee extension. The knee extension angle was measured using a standard range of motion technique.

- An angle between 0 and 5" of hyperextension is classified as Normal,
- An angle greater than 5" of hyperextension is classified as High.
- And an angle less than 0" is classified as Low.

Standing knee angle in the frontal plane: The relative position of the knee in the frontal plane was measured by the Q-angle method as described by Magee. Subjects were measured in the standing position with the knee fully extended and the axis of a Goniometer placed over the center of the patella. The lever arm was pointed towards the anterior superior iliac spine proximally and the tibia tubercle distally.

- values between 18 and 22" designated as Normal,
- values greater than 22" designated as High
- values below 18" as designated as Low.

The Navicular drop test: The navicular drop test was utilized as a clinical measure of pronation. We were asked to subjects to begin this test by sitting with their subtalar joint palpated in the neutral position. Palpation of subtalar was performed by palpation of the talar head on both the medial and lateral side of the joint. The height of the navicular was measured from the floor to the distal most point on the navicular bone. Then Subjects stood with the foot in a relaxed position. The navicular distance was remeasured.

- If difference value is 6 mm is considered as normal,
- Greater or equal to 9 mm is considered as high
- Values less than 6 mm is considered as low.

Subtalar joint neutral position: Subjects were placed in the prone position with the hip in neutral rotation, the knee fully extended, and the foot and ankle of the plinth. The talus was palpated on the medial side at the talonavicular joint when the foot was placed in a pronated position. The lateral aspect of the talus was palpated in the sinus tarsus when the foot was placed in supinated. The talus was palpated equally on medial and lateral sides, the foot is gently dorsiflexed until there were slight tension; this position was identified as subtalar joint neutral.

- A normal value was 0-2",
- A value of 3" were considered as High
- A value of 1" were considered as Low

Statistical Analysis: Data Analysis was performed with Microsoft Excel and JASP

(Jeffrey's Amazing statistics Program) version 0.16. Descriptive statistical test and correlation test was done between two Groups of the study i.e., Group A (Injured Recreational Athletes) & Group B (Non-Injured Recreational Athletes).

RESULT

Table No. 1: Shows the descriptive statistical Mean and S.D values for injured group (N-20)

	Age	BMI	Pelvic rot.	Femoral ant.	Hams. Length	S S K E	S K A	Ndt (in mm)	Sub talar jt.
Mean	21.6	30.11	1.35	7.03	72.335	1.9	16.8	8	1.2
S.D	1.95	4.30	0.87	1.39	6.17	1.88	2.54	2.20	1.10

With the reference of table no. 8.1

The mean value of age in injured Athlete is 21.6 (approx. 22 year). with the BMI of 30.11. The seven variables are having mean value as – Pelvic Rotation shows 1.35 which means Anterior Rotation as it is considered the value for anterior rotation equal to 1, Neutral position considered as zero (0) and Posterior Rotation considered as (2) during statistical analysis. Second measure is Femoral Anteversion showing the mean value of 7.03^{o} (degree). Hamstring Length is showing 72.335 mean value Standing Sagittal Knee Extension is showing the mean value of 1.9 Similarly Standing knee Extension Angle of 16.8, with the mean value of Navicular Drop Test as 8 mm and the last seventh one is Subtalar Joint neutral position reveal the mean value of 1.

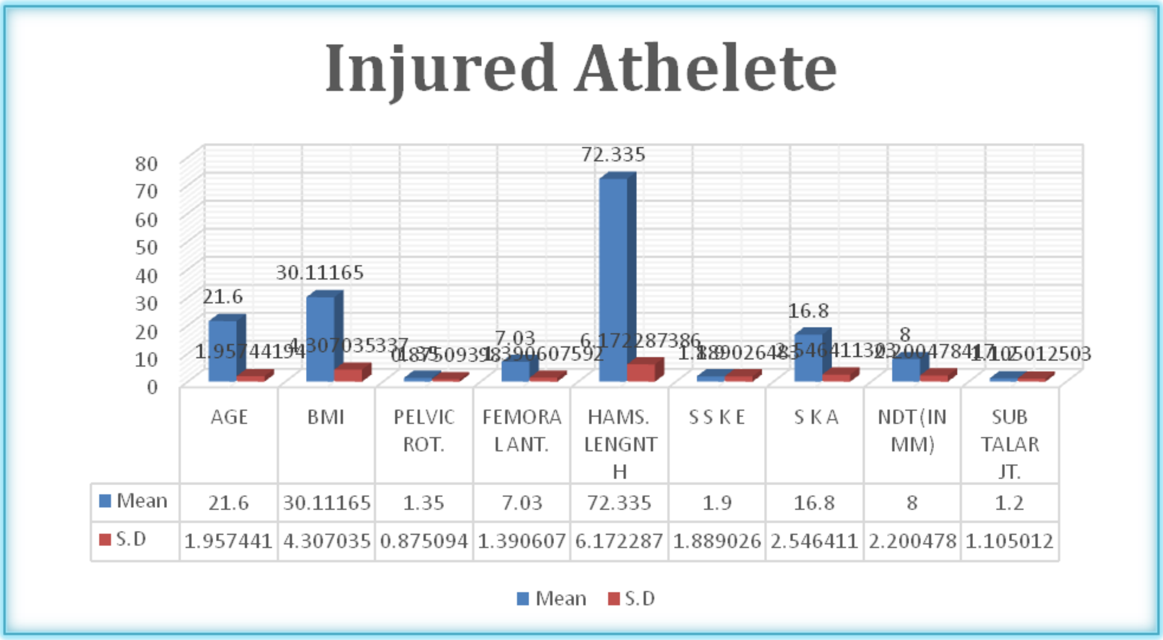


Table No. 2: Shows the descriptive statistical Mean and S.D values for Non-injured group (N-20)

	Age	BMI	Pelvic rot.	Femoral ant.	Hams. Length	S S K E	S K A	NDT (IN mm)	Sub talar jt.
Mean	22.25	27.63	1.1	13.8	84.8	4.2	23.8	6.75	2.25
S.D	2.09	8.51	0.64	2.94	3.05	1.19	3.48	1.40	0.85

However, with the reference of the Table no. 2 The mean value of Age in Non-Injured Athletes is 22.25 years (approx. 22 yrs.). With the BMI of 27.25. The seven variables are having mean value as-

Pelvic Rotation shows 1.1, which means that Non- Injured Athletes is showing Anterior Pelvic Rotation. The Second Variables is Femoral Anteversion which is showing the mean value of 13.8 (approx. 14) degree. Hamstring Length is represented the mean value of 84.8, Standing Sagittal Knee Extension is showing the mean value of 4.2, similarly the Standing Knee

Extension Angle in the femoral plane showing the mean value of 23.8, with the mean value of Navicular Drop Test as 6.75 mm and the last seventh one Subtalar Joint Neutral Position is measured with the mean value of 2.25

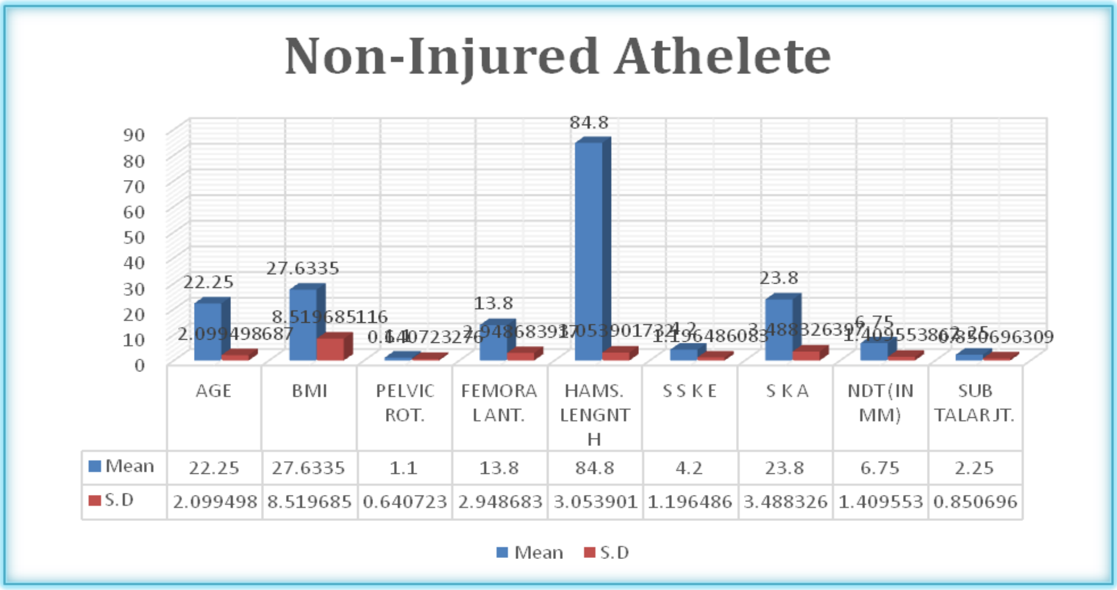


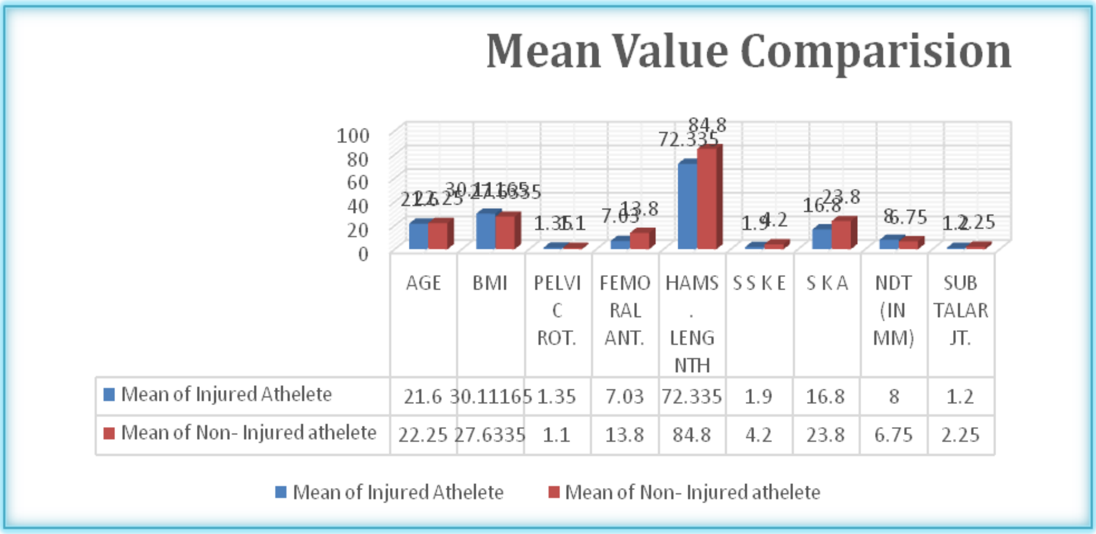
Table No. 3: Shows the descriptive statistical Mean and S.D values for both injured and non-injured athletes group

	AGE	BMI	Pelvic rot.	Femoral ant.	Hams. Length	S S K E	S K A	NDT (in mm)	Sub Talar Jt.
Injured Athletes	21.6	30.11	1.35	7.03	72.33	1.9	16.8	8	1.2
Non- Injured Athletes	22.2	27.63	1.1	13.8	84.8	4.2	23.8	6.75	2.25

Similarly, with the reference of Table No.3 is presenting the mean value of each aspect in both injured and Non-injured Athletes. The age is showing 21.6 years and 22.2 years respectively. The BMI is showing 30.11 and 27.63 respectively.

Now, with the same reference the pelvic rotation is showing as 1.35 and 1.1 respectively. Second is femoral Anteversion is showing 7.03 and 13.8 respectively.

Third is Hamstring Length as 72.33 and 84.8 respectively. The Sagittal Knee Extension is showing the mean value of 1.9 and 4.2 respectively. Similarly, the Standing Knee Angle in the Frontal Plane is presenting as 16.8 and 23.8 respectively with the Navicular Drop Test values of 8mm and 6.75mm respectively and the last seventh Subtalar Joint Neutral Position of 1.2 and 2.25 respectively.



Finally, the study is showing the values of variance of 519.0108211.,
The Pearson Correlation value is 0.988884349.
T-Test Value is -1.80453667.
P-Value in two is 0.10879.
This study is also showing the Positive Correlation

DISCUSSION

Injuries to the athlete have escalated with increasing participation is competitive sports. The inter-collegiate players are significantly more likely to have an injury. Reason for this increase in injuries range is to increase speed and aggressiveness of play. The present study is taking the seven measures for checking the effectiveness of seven biomechanical measures between injured athletes and non-injured athletes.

The age in both the groups i.e., Injured Athletes Group and Non- Injured Athletes is same approximately i.e., 22 - 25years. But on the view through BMI, presenting that injured Athletes are another category. Whereas Non-Injured Athletes are coming under the overweight category of BMI range. On the follow up of the seven measures – the Pelvic Rotation is showing that in both groups i.e., Injured and Non-Injured Athletes having Anterior Rotation of Pelvic. The second measure Femoral Anteversion is showing that Injured Athletes has below 8^{o} of Internal Rotation that measure the Femoral Anteversion is in Retroverted position, however in Non-Injured Athletes having the value nearest to 15^{o} Internal Rotation. Now the third measure is Hamstring Length in Injured Athlete is showing Low Length of Hamstring, as compare with Non-Injured Athletes are having Normal range of Hamstring Length. The fourth measure is Standing Sagittal Knee Extension is showing that the both groups have lying in the normal range with difference of 2.3 value. The fifth measure is Standing Knee Angle in Frontal Plane is showing that injured athletes are having low range and Non- Injured Athletes are having high range of standing knee angle in frontal plane. The sixth measure i.e. Navicular Drop Test is presenting that the injured athletes are having High Navicular drop as compare to non-injured athletes which are having the normal range. However the last measure is Subtalar Joint Neutral Position, which is presenting as low in the injured athletes and normal in the non-injured athletes.

There have never been any earlier reports of ultrasound assessments of AV angles in a healthy sample of adults. Most previous investigations using biplanar radiographic methods have concluded that the average AV angle in normal subjects is between 10 degrees and 15 degrees, but somewhat higher values. Thus, our results correspond well with those of radiographic studies. As a result, our findings are consistent with those of radiographic investigations. Female patients had a larger average AV angle than male respondents, which is consistent with radiographic investigations. The lower limit of the normal range was - 2' in the males and the upper limit was 33" in the females. As a result, we believe that AV angles outside of the 0"-30" range should be regarded anomalous[14].

Previous authors have warned against the use of clinical hip rotation as an indicator of rotational deformity. Our research came to similar conclusions, as the relationship between hip rotation and AV angle was shown to be minor. Our results did not support the experience that external rotation seemed to be a somewhat better indicator than internal rotation. The pattern and amplitude of hip rotation in our investigation are consistent with findings as regards the male group, whereas internal rotation, as well as external rotation, was somewhat smaller in the females in our study. This was probably due to a higher mean age of the subjects [15].

This is the first systematic study on the subject that we are aware of. Our aim was to improve the understanding of the relationship between type of sport and biomechanical Injuries in re creational Athletes. The individuals included in this study were more often adolescents the articles included did not allow us to distinguish between these two groups. Whilst the reporting styles of the reviewed articles made it impossible to compare exact incidence rates, relative differences in occurrence could be studied in relation to the proportion of injuries as a percentage of total exposure hours, injury site, and diagnosis. This is the first systematic study and meta-analysis of prospective research regarding posture and its relationship to lower limb overuse injury development. Findings showed that a posture was a risk factor for the development of both recreational injuries and pain. However, associated effect sizes were small, indicating this relationship is weak and only a part of the multifactorial etiology [16][17][18].

This has been the subject of much research, with differing conclusions drawn regarding any association; seemingly depending upon the static measure implemented. Static measures of navicular height are not strongly correlated with dynamic navicular motion and although the Femoral Anteversion has been shown to correlate with dynamic measures of foot function, the strength of this correlation has varied from weak to strong.

The result is suggesting that there is a strong association between the injured and biomechanical factors changes in injured athletes, while comparing the Non-injured Athletes. Biomechanical of the body is playing important role in prevention of injury and after injury too. In athletes, which shows that is athlete biomechanics of the lower limb would be disturbed for sure after injury.

Furthermore, the level of knowledge among those charged with defining the injury varied, ranging from medical specialists to the afflicted person. Depending on the definition and site of injury, it can be expected that self-reported problems might be less accurate than those obtained through a medical examination. The definition is important when comparing estimates between studies, because, as pointed out by Bahr, self-reported pain will result in higher estimates than pain with a con- sequence in terms of medical attention or time-loss. An additional challenge was that not all diagnoses and injury sites were explicitly documented in each paper. In sum, this area of research would benefit from a well-reasoned consensus approach to the various relevant definitions, making it possible to compare findings between studies.

Future Research:

- Future research should include a larger number of subjects in this study with a specific sport to further analyze correlation between static posture of lower limb with overuse injury in lower limb.
- Future research should include the static posture of upper extremity with overuse injury to analyze the correlation between them.
- Future research should be taken between Posture and Biomechanics faults in body after overuse injury in Athletes.

Limitations:

- This study contains limitations that should be considered when reviewing the findings.
- First, a small number of subjects (n=20) i.e., Injured Athletes Group and (n= 20) i.e., Non- injured Group. Correlations between tasks from the Lower Extremity. Correlations between tasks from the static posture of lower limb and overuse injury in lower limb were trending towards significance. However, these findings may have had greater significance if there was a larger sample size.
- Second, in this study not a specific sport subjects have been taken.

- Third, because of COVID guidelines there is shortage of time to take the subjects.

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CONCLUSION

The study is the good to specifically investigate the relationship between static posture of lower limb parameters with overuse injury in Recreational Athletes. This study concluded that the injury is affecting the biomechanics and even the relative static posture of the lower limb parameters with injured and Non-injured Athlete. We recommended the athletes to provided with targeted education regarding self-care strategies and treatment option for managing the biomechanics of the lower limb and more research be undertaken is to physical demands on the lower limb with specific games and also with specific injuries.

Ethical Clearance: As per the Ref. No. IAMR/22/4055 Institute of Applied Medicine and Research given the ethical Clearance for the research. There is no funding and conflict to interest.

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