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RESEARCH ARTICLE

CORRELATION OF Q ANGLE WITH NAVICULAR HEIGHT IN CRICKET PLAYERS

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Abstract

Background: Cricket is an intermittent sport, with intervals of high-intensity movements like bowling and batting alternating with long stretches of low-intensity action. The lower extremity being a biomechanical column affects the entire lower extremity kinetic chain, if any segment of the lower extremity deviates from normal. This study aimed to find a correlation of Q angle with navicular height in cricket players.
Methodology: 50 male cricket players between the ages of 18-25 years and with more than 3 years of experience were recruited. Demographic details were noted which included name, age, gender, dominance, height, weight, and years of experience, previous history of trauma, or any recent injury. The participants were assessed for Q-angle and navicular height measurement.
Results: Spearman's correlation showed a significant correlation between the Q angle and Navicular height of the dominant side (α = 0.297, p = 0.036) and left side (α = 0.382, p = 0.006). There was no significant correlation on right side (α = 0.265, a p = 0.063).
Conclusion: The study concludes that there is a significant correlation between Q angle and Navicular height of cricket players. The correlation is seen in the left and the dominant leg whereas the right leg did not show a significant correlation.

Introduction:-

Cricket is an intermittent sport, with intervals of high-intensity movements like bowling and batting alternating with long stretches of low-intensity action. Cricket's physical requirements vary depending on the competition format (e.g., T20, one-day, or multi-day cricket) and the position of the players on the field (i.e., bowler or batter). [1]Since fast bowlers must bowl more than 120 times a day at speeds greater than 140 km/h, fast bowling is regarded as the most physically demanding activity in cricket. Fast bowlers can generate ground reaction forces of 5 to 9 times their body weight, which calls for powerful quadriceps eccentrics and a robust lumbopelvic region to resist this repetitive motion. [1]

The bowling motion consists of a run-up where linear momentum is built up, converted to angular momentum throughout the bowling action, and transferred through the trunk and upper extremities to the ball. Fast bowling has historically had a set of technique characteristics that describe the ideal movement pattern for maximizing ball

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release speed. These include quicker run-up speeds, a front leg that is extended further, more trunk flexion, and a longer delay in the circumduction of the bowling arm. [2]The improvement of grip strength, rotational power, balance, and proprioception is said to improve batting performance. [1]To overcome the difficult limitations imposed by the game, skilled cricket batters develop intricate, whole-body movements. Their ultimate goal is to deliver the most powerful stroke possible to score runs. Full-body motions that coordinate the upper- and lower-body segments enable a more efficient transfer of forces to be summed up into the hitting action when considering the force with which a ball is struck.[3]

Cricket players often participate in a range of physical actions, including running, throwing, batting, bowling, catching, jumping, and diving, even though the sport is noncontact. Overuse and impact injuries are therefore frequent. Furthermore, because the 5.5-ounce hardball can swing through the air or be bowled at the batsman at speeds of up to 160 km/h, projectile injuries can still occur even with protection. The number of injuries has been steadily increasing as a result of more games being played and shorter recuperation periods in between. The most common injury in cricket records is a hamstring strain, whereas the most serious injury in young fast bowlers usually results in a spinal stress fracture that ends a season. [4]

As the Q angle represents the direction of the quadriceps muscle force vector in the frontal plane, excessive angulation is thought to predispose individuals to injuries caused by abnormal quadriceps forces acting at the knee and patellofemoral joints. A greater navicular drop would also be a predictor of a greater Q angle. Previous studies reported that excessive pronation is associated with internal rotation of the lower extremity and increased knee valgus and is therefore suggested to result in a greater Q angle. [6]

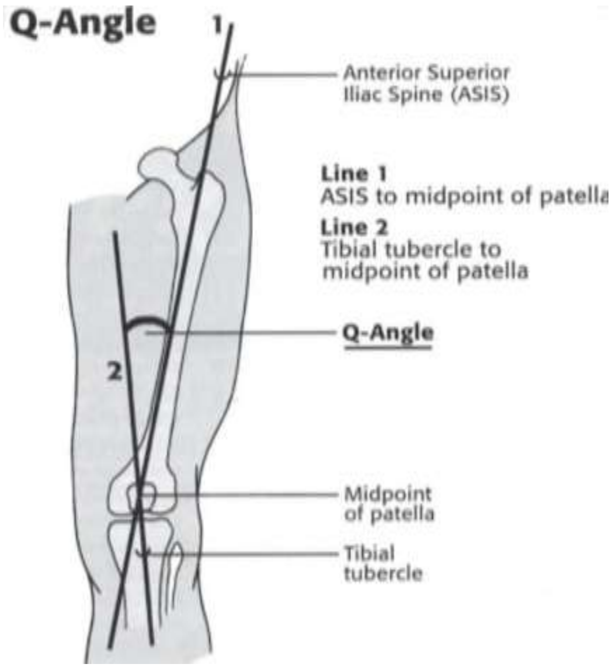
Lower extremity alignment is responsible for weight transfer to the ground. The lower extremity being a biomechanical column affects the entire lower extremity kinetic chain, if any segment of the lower extremity deviates from normal. As it has been reported by several authors, any change in QA beyond the normal range may result in a decreased medial longitudinal arch height or an abnormal dynamic response to the calcaneo-tibial joint position in which the foot is pronated or supinated. Cricket players are continuously involved in repetitive loading of the lower limb, this malalignment of the rear foot may cause tibial rotation and if it is tibial internal rotation, there may be an increase in QA. Excessive foot pronation decreases tibial external rotation which is compensated by excessive internal rotation of the femur, resulting in increased QA. Thus, this study aimed to find the correlation of Q angle with navicular height in cricket players.

Methodology:-

The ethical approval was obtained from the ethics approval committee. The study design was a cross-sectional study in which 50 participants were recruited using purposive sampling. The participants were recruited based on the inclusion and exclusion criteria. Male cricket players between the ages of 18-25 years and with more than 3 years of experience were included in the study. Individuals with any history of trauma in the lower limb in the last 3 months, history of a lower limb surgery, lower limb radiculopathy and deformity in the lower limb were excluded from the study. Informed consent was taken from the participants.Participants were ensured complete confidentiality of their information. After recruiting the participant, demographic details were noted which included name, age, gender, dominance, height, weight, years of experience, previous history of trauma, or any recent injury.The participants were assessed for Q angle and navicular height.To measure the Q angle, a line was dropped through the tibial tubercle and middle of the patella and another from the ASIS to intersect with the first line at the mid-patella. To measure the Navicular height, navicular drop test was used. The most prominent part of the navicular tuberosity was marked and its distance from the supporting surface (floor or step) was measured using a measuring tape. The data collected was analyzed through tabulation and descriptive statistics.

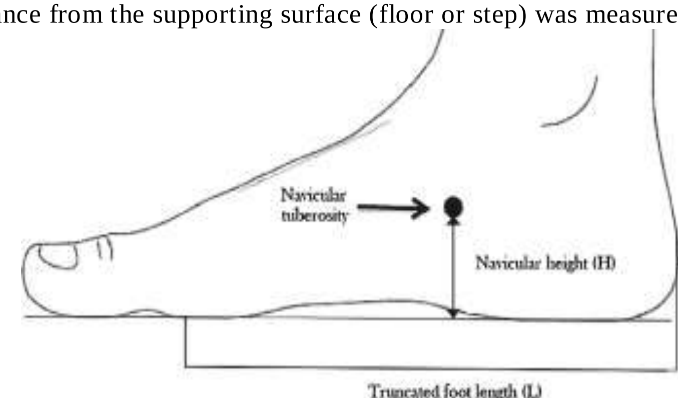
Measurement of Q-angle

Q angle was assessed using a measuring tape and a goniometer. A line was dropped through the tibial tubercle and middle of the patella and another from the ASIS to intersect with the first line at the mid-patella.



Assessment of Navicular height

Navicular height was measured using the navicular drop test. The most prominent part of the navicular tuberosity was marked and its distance from the supporting surface (floor or step) was measured using a measuring tape.



Results:-

50 participants (50 male cricket players) were recruited for the study. The demographic details for these participants included age (21.46 ± 2.12 years), height (1.7354 ± 0.076 meters), weight (66.404 ± 15.37 kgs) and years of experience (9.7 ± 5.36 years).

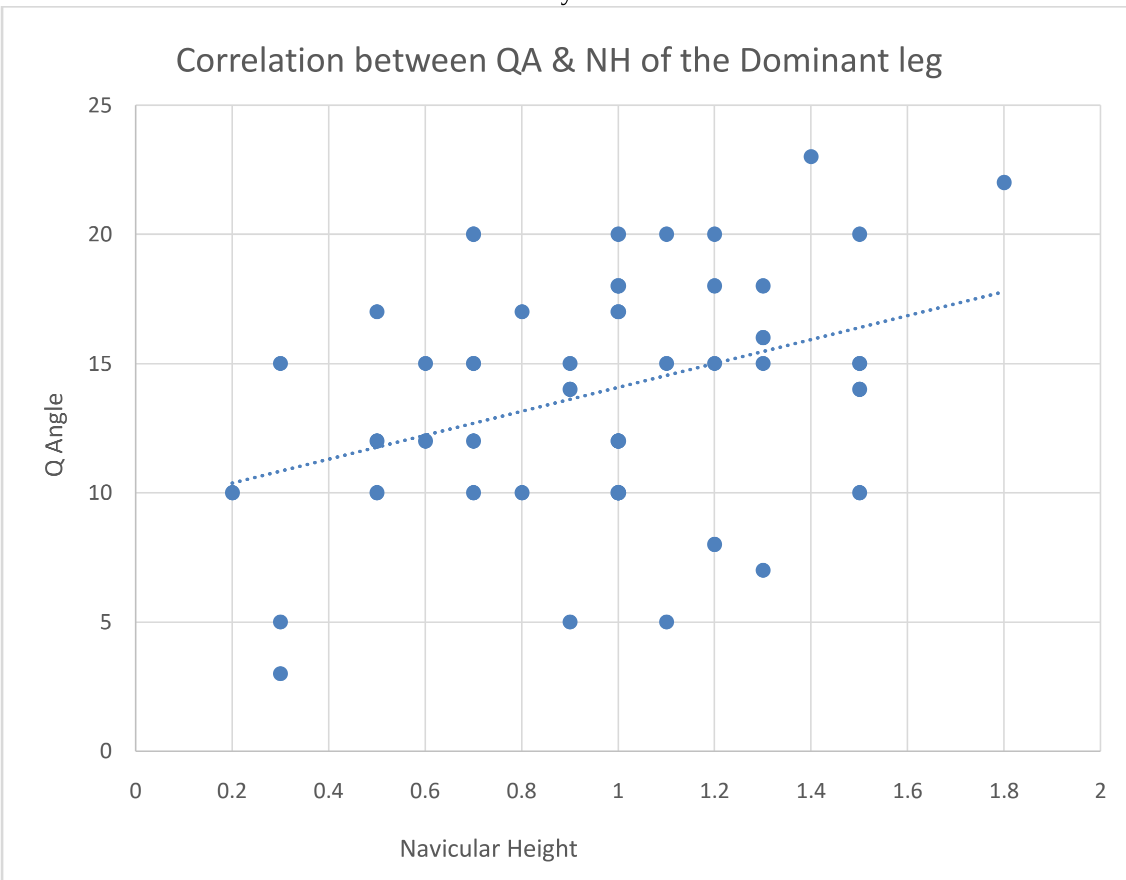
Shapiro Wilk test was performed to test the normal distribution of the data.For the Q-angle and navicular height of the right side, $p < 0.059$ and $p < 0.488$ respectively, of the left side $p < 0.055$ and $p < 0.37$ respectively, and of the dominant side $p < 0.139$ and $p < 0.375$ respectively. The test of normality showed that the data is not normally distributed. Hence, Spearman’s correlation is performed for the data.

Table 1:- Correlation of Q Angle with Navicular Height of the Dominant Leg in Cricket Players.

			Q_angle_dominant	Navicular_ht_dominant
Spearman's rho	Q_angle_dominant	Correlation Coefficient	1.000	.297*
		Sig. (2-tailed)	.	.036
		N	50	50
	Navicular_ht_dominant	Correlation Coefficient	.297*	1.000
		Sig. (2-tailed)	.036	.

		N	50	50
*. Correlation is significant at the 0.05 level (2-tailed).				

Graph 1:- Graphical representation of correlation of Q Angle with Navicular Height of the Dominant Leg in Cricket Players.

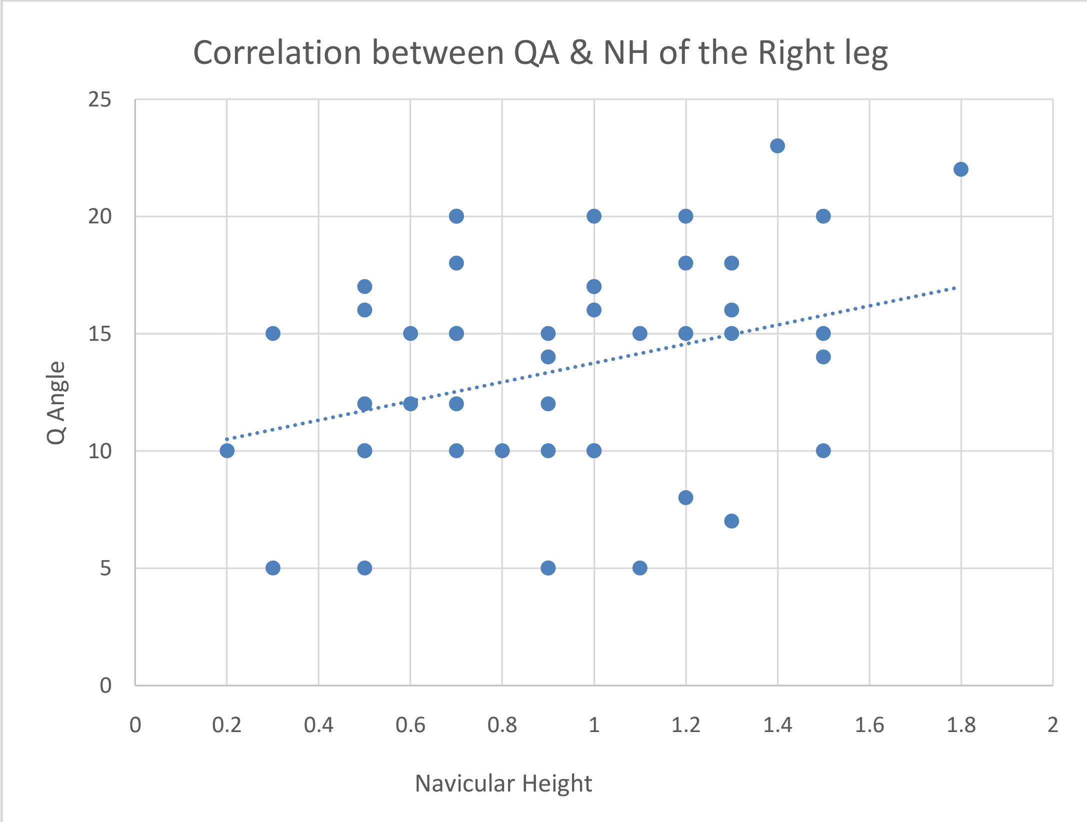


Spearman's correlation test was performed for the Q angle and Navicular height of the dominant side. There is a significant correlation between the Q angle and Navicular height of the dominant side, with a correlation coefficient of 0.297 and p-value of 0.036. (table 1, graph 1)

Table 2:- Correlation of Q-angle with Navicular Height of the Right Leg in Cricket Players.

			Q_angle_rt	Navicular_ht_rt
Spearman's rho	Q_angle_rt	Correlation Coefficient	1.000	.265
		Sig. (2-tailed)	.	.063
		N	50	50
	Navicular_ht_rt	Correlation Coefficient	.265	1.000
		Sig. (2-tailed)	.063	.
		N	50	50

Graph 2:- Graphical representation of correlation of Q-angle with Navicular Height of the Right Leg in Cricket Players.

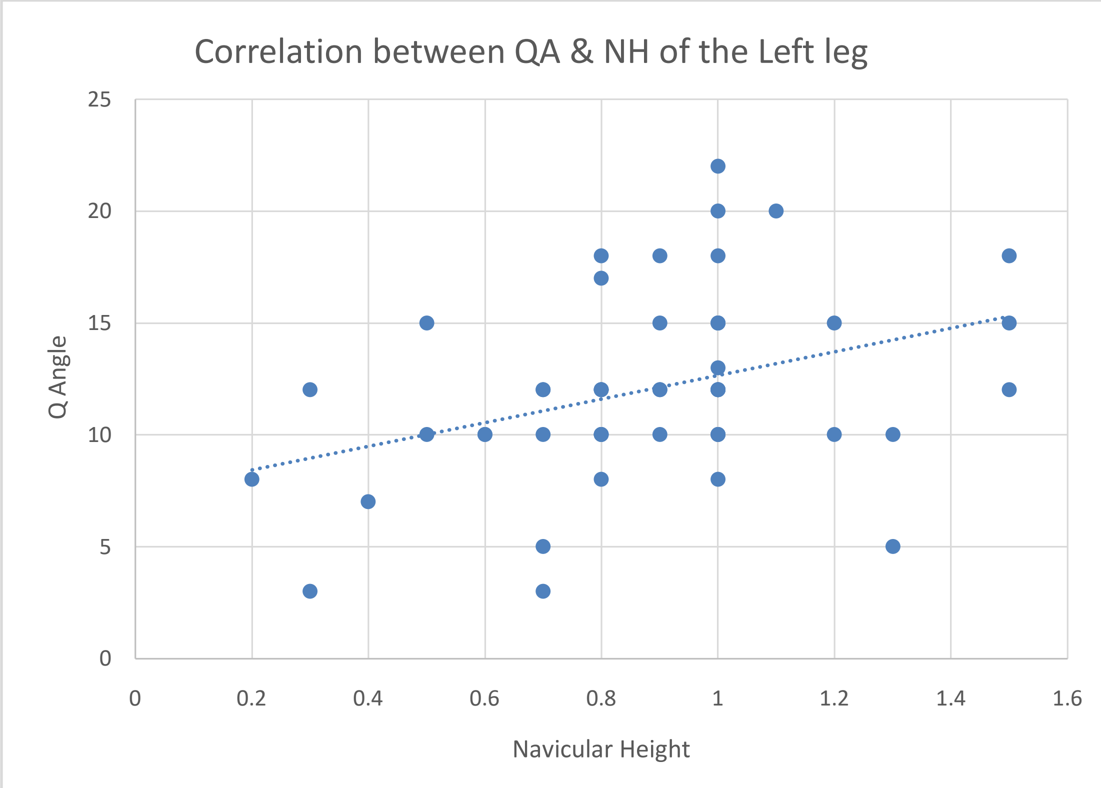


Spearman's correlation test was performed for the Q angle and Navicular height of the right side. There is no significant correlation between the Q angle and Navicular height of the right side, with a correlation coefficient of 0.265 and a p-value of 0.063 (table 2, graph 2).

Table 3:- Correlation of Q Angle with Navicular Height of the Left Leg in Cricket Players.

			Q_angle_lt	Navicular_ht_lt
Spearman's rho	Q_angle_lt	Correlation Coefficient	1.000	.382**
		Sig. (2-tailed)	.	.006
		N	50	50
	Navicular_ht_lt	Correlation Coefficient	.382**	1.000
		Sig. (2-tailed)	.006	.
		N	50	50
**. Correlation is significant at the 0.01 level (2-tailed).				

Graph 3:- Graphical representation of correlation of Q Angle with Navicular Height of the Left Leg in Cricket Players.



Spearman's correlation test was performed for the Q angle and Navicular height of the left side. There is a significant correlation between the Q angle and Navicular height of the left side, with a correlation coefficient of 0.382 and a p-value of 0.006 (table 3, graph 3).

Discussion:-

This study aimed to find whether there is a correlation between quadriceps angle with navicular height in cricket players. The present study reported that there was a significant correlation between the Q Angle and Navicular height of the dominant side (p-value = 0.036), and of the left side (p-value = 0.006). This shows that Q Angle has a correlation with Navicular height which could be due to various causes.

The patellar medial displacement and lateral displacement of tibial tuberosity can lead to rotational change caused by foot pronation. Lower QA values have been linked to the possibility of a supinated foot position. Following heel contact and continuing into the end of the foot flat, the subtalar joint goes into pronation in a normal gait. It starts to move in the direction of supination during the push-off phase, turning the foot into a stiff lever arm for propulsion. The subtalar joint in individuals with pronated feet is unable to transition into supination during the push-off phase and is insufficient to complete the push-off during gait. Because of the coupling action between inversion/eversion and tibial rotation via the subtalar joint, an excessively pronated foot is typically accompanied by an excessive or prolonged tibial rotation and greater QA. [5]

Similar results were reported by a study done by Ata Elvan et al which stated that navicular height was the most significant contributor to quadriceps angle aligning the foot posture into supination or pronation that could alter plantar pressure distribution. Their results also indicated that the load increased under the lateral aspect of the forefoot was associated with decreased quadriceps angle. In contrast, the load was found to be higher under the medial aspect of the forefoot with a larger quadriceps angle.[5]

When QA is lower and there are no symptoms, the strain on the medial compartment of the knee joint increases. To lessen this adduction moment, a loading line may be positioned laterally in the supinated foot. In contrast, a larger

QA may be able to decrease the adduction moment at the knee joint caused by the medially situated loading line in the pronated foot. [5]

Several mechanisms are known that are responsible for the creation of skeletal disorders based on the kinetic chain system these are: 1) Distal portions of the damaged or dysfunctional component are used to make up for the disruption in function. This can lead to an interference pattern from an incorrect distribution of weight and pressure, which can result in more damage, 2) Muscle imbalance around the joint can result from an injury to one area of the body, and this can cause further dysfunctions, 3) Scar tissue and adhesions caused by previous injuries can also be other causes in creation disorder in the kinetic chain, and 4) Inappropriate movement patterns can cause misalignment and musculoskeletal diseases. Examples of these patterns include walking, extension and knee flexion, hip abduction extension, curling up, and more. The activation patterns of the neurological and muscular motor units are impacted by improper movement patterns, which might result in further issues (dysfunction). [10,11]

Similar outcomes were published by NiharRanjanMohanty et al, who concluded reported that, femoral anteversion, tibial torsion, and navicular drop have a significant impact on the magnitude of Q-angle. [7]

An excessive unwinding of the osteoligamentous plate results in a pronated foot. The entire leg experiences excessive internal rotation if the foot biomechanically operates in a pronated position all the time. Internal rotatory stress, or a position of excessive internal rotation of the leg, might result in two potential complications surrounding the knee: excessive angulation of the patellar tendon and excessive pressure on the lateral patellar facet. Amir Letafatkar et al also reported similar results in their study. They reported that there was a positive and strong relationship between Navicular drop, Q-Angle, and knee pain. [8]

To achieve knee extension during midstance, the tibia must externally rotate relative to the femur to ensure adequate motion for the screw-home mechanism. The femur internally rotates on the tibia to make up for the absence of tibial external rotation caused by abnormal pronation, giving the tibia the necessary rotation for extension. Subtalar joint pronation causes the lower extremities to rotate internally, which increases the Q angle and the lateral component of the quadriceps vector.[12]

The foot's pronation facilitates energy storage, shock absorption, terrain adaptation, and preservation of balance. On the contrary, supination is a more active movement that demands the swing leg's velocity and concentric muscle activity in addition to arthrokinematic mechanisms that urge the foot toward osseous stability and predominantly concentric muscle activity for propulsion. If the timing, degree of pronation and supination, or strength of the relevant muscles alter, the coordinated alignment of the bones becomes inefficient and cannot deliver stability on demand. [8]

Hence, our study findings are in agreement with the above studies and conclusively reports that there is a correlation between Q Angle and Navicular height.

Conclusion:-

The study concludes that there is a significant correlation between Q angle and Navicular height of cricket players. The correlation is seen in the left and the dominant leg whereas the right leg did not show a significant correlation.

Limitation

Considering the heterogeneity and expanse of the community, the sample size was small and hence not truly representative of the community selected.

References:-

1. Anthony Weldon, Neil D. Clarke, Lee Pote, Chris Bishop. 2020 December. Physical profiling of international cricket players: an investigation between bowlers and batters.
2. P.J. Felton, S. McCaig& M.A. King. 2023 April. Cricket fast bowling: The relationship between range of motion and key performance and injury technique characteristics.
3. Sarpeshkar, V., Mann, D.L. 2011. Biomechanics and visual-motor control: how it has, is, and will be used to reveal the secrets of hitting a cricket ball.
4. Dinshaw N. Pardiwala, Nandan N. Rao, Ankit V. Varshney. 2017 October. Injuries in Cricket.

5. Ata Elvan,Ibrahim EnginSimsek, Mehmet AlphanCakiroglu, and SalihAngin. 2019 January. Correlation of quadriceps angle with plantar pressure distribution, navicular height and calcaneo-tibial angle.
6. Anh-Dung Nguyen, Michelle C. Boling, Beverly Levine, Sandra J. Shultz. 2010 June. Relationship between lower extremity alignment and quadriceps angle.
7. NiharRanjanMohanty, ShyamalKoley. 2018 November. A Study on Lower Extremity Malalignment and Its Correlation to Q-Angle in State Level Athletes of Odisha.
8. Amir Letafatkar, ShahrzadZandi, Majid Khodayi, JafarBelaliVashmesara. 2013 January. Flat Foot Deformity, Q Angle and Knee Pain are Interrelated in Wrestlers.
9. Hassan Daneshmandia, FarzanehSakib, SarehShahheidaric, AbolfazlKhoori. 2011 June. Lower extremity Malalignment and its linear relation with Q angle in female athletes.
10. Phillip Page, Clare C. Frank, Robert Lardner. 2009 December. Assessment and treatment of muscle imbalances; Janda approach. Human Kinetics.
11. Carolyn Richardson, Paul Hodges, Julie Hides. 2004 August. Therapeutic Exercise for Lumbopelvic Stabilization: A Motor Control Approach for the Treatment and Prevention of Low Back Pain.
12. Christopher M. Powers, Robert Maffucci, Sean Hampton. 1995 October. Rearfoot Posture in Subjects with Patellofemoral Pain.