



# Correlation of Q angle with medial longitudinal arch in young adults – an observational study

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## ABSTRACT

**OBJECTIVE OF THE STUDY:** The main objective of the study is to determine the correlation of Q angle with medial longitudinal arch in young adults.

**METHODS:** A total of 50 students were taken as samples through convenient sample technique from Malla Reddy University of age group from 18 to 25years based upon inclusive and exclusive criteria with the duration of the study being 3 months.

**RESULTS:** The result of this study helps us to correlate the relation between Q angle of bilateral legs to the medial longitudinal arch in bilateral legs in young adults. Initially, the Q angle is measured in standing and supine positions through goniometer and the medial longitudinal arch is calculated using the navicular drop method where the mean values among adults range from 3.6 to 8.1mm.

**CONCLUSION:** The findings of this study showed that there's no significant relationship was found between Q angle and navicular drop values in either leg and hence the study suggests that there is no major influence of flat foot on the alignment of the Q angle.

**KEY WORDS:** Q angle, medial longitudinal arch, navicular drop test, flat foot, biomechanics, knee alignment, young adults

## INTRODUCTION

A normal human foot contains different types of arches, which help the human being in several activities like walking, running, jumping, and many more. There are three arches present on the sole of the foot which are the medial longitudinal arch, the lateral longitudinal arch, and the anterior transverse arch. The shape of these arches is created by the metatarsals and tarsal bones, braced by tendons and ligaments of the foot. Compared to the two longitudinal arches, the medial longitudinal arch is the highest<sup>(1)</sup>.

The components that make up the medial longitudinal arch allow the foot to function effectively. The medial arch shortens until the heel lifts off the ground in the terminal stance after reaching its maximum length. <sup>(2)</sup>.

A foot anomaly known as flat foot, or pes planus, is caused by the collapse or shortening of the foot's medial longitudinal arch. In this condition, the foot tends to pronate excessively, which results in compensatory movements and other abnormalities for the leg <sup>(3)</sup>. Age, the population being studied, and the presence of additional medical issues all affect the frequency. <sup>(4)</sup>

Humans support their entire body weight on their feet, which helps to stabilize the body when their posture changes <sup>(5)</sup>.

Walking and running are greatly aided by the foot's arch, which distributes body weight proportionately and functions as a spring. They also serve as shock absorbers when the athlete is running or jumping. <sup>(6)</sup>. The calcaneus, navicular, talus, first three cuneiform bones, and first, second, and third metatarsals make up the medial longitudinal arch. <sup>(7)</sup>. Incorrect lower limb alignment brought on by modifications in foot biomechanics can have an impact on the Q angle, which is the angle at which the quadriceps muscle pulls. Excessive foot pronation caused the lower extremities to rotate internally, which can lead to knee valgus when the Q-angle increases. <sup>(8)</sup>

The Q angle, also known as the quadriceps angle, is formed by the intersection of two imaginary lines: one from the anterior superior iliac spine (ASIS) to the mid-patella when the knee is in an extension, and the other between the axial tendon and the quadriceps femoris muscle, which splits the patellar ligament in two to the tibial tubercle. The Q angle is said to vary by gender, with women's wider hips causing them to have a bigger Q angle than men. Additionally, the Q angle is said to be bilaterally asymmetric. Deformities include patellofemoral syndrome, genu valgus, patellar maltracking, and many more can result from an incorrect or elevated Q angle <sup>(9)</sup>

The study's outcome measures are the navicular drop test. The navicular drop test (NDT) gauges how much the arches change in relation to foot height. Improved intra- (ICC = 0.73-0.96) and inter-rater reliability (ICC = 0.92) have been shown for the Navicular Drop Test. Numerous writers have employed NDT in a variety of methods, and it is a widely used approach that has been demonstrated to be quite trustworthy. <sup>(10)</sup>

## NEED FOR THE STUDY

The need for this study is to check if there is any correlation between Q angle and flat foot in young adults as much other articles are done on different age group like early childhood and late childhood i.e. in elementary and secondary school students. The purpose of this study is to know if there is any correlation between Q angle and flat foot especially in adult population as many other researches concludes that there is correlation among these components in small and elderly population. The correlation between Q angle and flat foot also differs among people with different occupation or profession and in this study, we check the correlation among students.

## AIM AND OBJECTIVES

### AIM:

The aim of the study is to know the correlation of Q angle with flat foot in young adults.

### OBJECTIVES:

- The objective of this study is to find if there is any association or correlation between Q angle with the flat foot in young adults.

- To evaluate the impact of altered or abnormal Q angle on the development of flat foot in young adults.
- To examine the effect of flat foot on postural alignment and its function in young adults.

## HYPOTHESIS

- Null hypothesis ( $H_0$ ):

There will be no significant correlation between Q angle and flat foot in young adults.

- Alternative hypothesis ( $H_1$ ):

There will be significant correlation between Q angle and flat foot in young adults.

## REVIEW OF LITERATURE

- **Mohamed et al.**[2017]conducted a study about Relationship between flat foot and Q angle in male secondary school student and concluded that if there is higher or increased Q angle then individual may have chances of having flat foot and there is no significant differences in subjects Q angle in right or left knee in both healthy students and subjects having flat foot in male secondary school students.<sup>(3)</sup>
- **Salvador et al.**,(2017) in a study titled Flat Foot in a Random Population and its Impact on Quality of Life and Functionality stated that Flat foot was associated with age, BMI and foot size. quality of life and foot function in patients with flat foot is lower than in those who do not suffer from the disorder, and that said effect remains after adjusting for age, sex and comorbidity.<sup>(4)</sup>
- **Manish Kumar et al.**(2021) conducted a study on title A Correlation Between Navicular Drop and Quadriceps Angle Amongst Normal and Overweight Middle-Aged Individuals and concluded that there is a positive significant correlation between flat foot and Q-Angle in middle aged individuals with body weight categorised as overweight, with increase in body weight, there was more navicular drop among overweight individuals leading to increase in Q-Angle.<sup>(8)</sup>
- **Dewa et al.**[2023] in a study titled The relationship between flat foot and Q-angle in elementary school students concluded that elementary students will be doing many different activities and their arches of foot maybe fluctuated and this further results in flat foot condition which results in increase in valgus shape in the knee joint, thus the degree of quadriceps angle (Q-angle) can increase and finally they concluded that there is a moderate, unidirectional, and meaningful relationship between flat foot and Q-angle in elementary school children<sup>(11)</sup>
- **Haiyang He et al.**(2023) conducted a study titled Correlation between flat foot and patellar instability in adolescents and analysis of related risk factors and in this article they flat foot, overweight, and Beighton scores are all correlated with Q angle and that patellar instability is mainly caused by structural abnormalities of knee joint such as enlargement of Q angle and finally they concluded that there is high correlation between flatfoot and patellar instability and overweight and excessive ligamental laxity are both risk factors for flatfoot and patellar instability.<sup>(12)</sup>
- **Hafsa Yasi et al.**( 2023)performed a study on certain components for article and titled it as Impact Among Body Mass Index, Q-Angle and Flat Foot in Students of University of Lahore and this study is done to find corelation among those factors .The researchers concluded that subjects with higher BMI had impact on flat foot and Q angle whereas flat foot deformity may result in increased Q angle in university students.<sup>(13)</sup>
- **Amir et al.** (2013) conducted a study on title Flat Foot Deformity, Q Angle and Knee Pain are Interrelated in Wrestlers. In this article they concluded that There is significant relationship between Q angle increasing in

dominant leg and knee pain and flat foot deformity. And hence they proved that there are positive and strong relationship between Navicular drop, Q-Angle and right (guard) knee pain. Whereas there isn't the meaningful relationship in left leg and based on kinetic chain system, flat foot deformity may result in patella lateral rotation and Q angle increasing. <sup>(14)</sup>.

- **Anh-Dung et al.** (2010) conducted a study on title Relationships Between Lower Extremity Alignment and the Quadriceps Angle and concluded that in case of greater Q angle the abnormalities like femoral anteversion, knee valgus, and pronation of foot occurs (flat foot) <sup>(15)</sup>.
- **Karen P Cote et al.**, (2005) conducted a study on title Effects of Pronated and Supinated Foot Postures on Static and Dynamic Postural Stability and concluded that postural stability is affected by foot type under both static and dynamic conditions. The stability index was greater in pronators than in supinators, but neither group was different from those with neutral foot type. <sup>(16)</sup>.
- **Defne KAYA et al.** (2012), in a study titled Is there any relationship between Q-angle and lower extremity malalignment? Concluded that there was no relationship between the Q-angle and lower extremity malalignment. The Increased Q-angle and decreased lateral distal femoral angle (LDFA) may be associated with patellofemoral pain syndrome (PFPS) and increased Q-angle (greater than 20°) is a sign of increased lateral patellar displacement. <sup>(17)</sup>.
- **Tamer Çankay et al.**,(2020) conducted a study on title Assessment of quadriceps angle in children aged between 2 and 8 years and concluded that the Q angle decreased with age in healthy children aged between 2 and 8 years, and the value was not dependent on factors such as sex, presence of pes planus, and measurement position, and there was a low-level correlation between BMI and Q angle. The Q angle decreased depending on the increase in quadriceps muscle strength, and the fact that femoral height increase was proportionally greater compared with pelvic enlargement among the age groups in the following study. <sup>(18)</sup>.
- **Nielsen et al.** (2009) in a study titled Determination of normal values for navicular drop during walking: a new model correcting for foot length and gender and concluded that dynamic navicular drop is influenced by foot length and gender. And Measurement of the static Navicular Drop test might be the most appropriate technique for the clinical assessment of foot pronation <sup>(19)</sup>
- **Lori A et al.** (1998) conducted a study on title The Quadriceps Angle: A Review of the Literature and concluded that e Q angle is the product of many factors and Q angle excess of 15 to 20" will indicate pathologic conditions of the knee extensor mechanism or patellofemoral joint. Moreover, while women display larger mean Q angles than their male counterparts due to wider hips in women, the underlying reasons for the difference are not readily apparent nor is the assumption that Q angles are bilaterally symmetric. <sup>(20)</sup>
- **Ferro ES.**(2010) in a study titled Reliability and Validity of an Electronic Inclinometer (EI) and Standard Goniometer (SG) for Measuring the Q-angle in 2 Different Positions in a Sample of Women provided the reliability of Q angle, which are Intra-rater reliability for measuring Q-angle in the supine and standing positions using the SG was good with ICC values of .94 and .90. Inter-rater reliability for measuring Q-angle in the supine and standing positions using the SG was moderate with ICC (2,2) values of .50 and .53<sup>(21)</sup>.
- **Deng J et al.**, (2010) in a study titled Reliability and validity of the sit-to-stand navicular drop test: Do static measures of navicular height relate to the dynamic navicular motion during gait stated the reliability values and this sit-to-stand NDT demonstrates moderate reliability and is moderately effective in reflecting dynamic navicular motion during gait.
  - ✓ Intra-rater reliability: ICC = 0.68–0.78
  - ✓ Inter-rater reliability: ICC = 0.72<sup>(22)</sup>

## **MATERIALS AND METHODS:**

### **STUDY DESIGN:**

- Correlational study

### **STUDY LOCATION:**

- Malla Reddy university, SOAHS

### **STUDY DURATION:**

- 3 months.

### **STUDY POPULATION:**

- Males and females
- Young adults.

### **SAMPLING TECHNIQUE:**

- Convenience sampling type

### **SAMPLE SIZE:**

- 50 samples

### **MATERIALS:**

- Goniometer
- Ruler or scale
- Index card or paper

### **ETHICS CONSIDERATIONS:**

The Permission will be taken from the scientific research committee of Department of physiotherapy, SOAHS, MRU. ICS: SOAHS-PT/2025/107.

### **INCLUSION CRITERIA:**

- The young adults with 18-25 age group.
- Males and females.
- Subjects with voluntary participation and healthy participants.
- For bilateral foot.

## EXCLUSION CRITERIA:

- The subjects with knee, ankle and hip injuries
- Subjects with Congenital deformities
- The subjects with knee and ankle deformities
- Subjects with postural deviations, knee joint osteoarthritis, recurvatum knees, kyphosis and/or scoliosis
- past surgery of lower extremities like knee, hip and ankle
- Injury of the lower limbs or patellofemoral pain syndrome.
- Subjects using external devices like prosthesis and orthosis.
- Subjects with patellar subluxation.
- Lower back pain and sciatica.

## OUTCOME MEASURES

- **Q angle:** This angle is measured using goniometer. The Q angle is measured by drawing an imaginary line from anterior superior iliac spine to the centre of the patella and from the centre of the patella to the middle of the anterior tibial tuberosity through goniometric method, while positioning the subjects in a supine position with the knees extended and the quadriceps relaxed.

The Normal Q angle score for females is between 13-18° and in males it is in between 12-15°, and values greater than and lesser than these are considered abnormal.

- **Navicular drop test:** this is done to assess the flat foot in individuals. The subjects are made to sit in chair with bare feet unweighted on the ground and the examiner holds an index card on the floor and mark the point of navicular drop and the subjects are again made to stand up and the position of navicular tuberosity is measured and then the examiner measures the distance between both the points. In previous studies, mean values among healthy adults range from 3.6 to 8.1 mm.

## DATA COLLECTION:

- A sample of participants were recruited from Malla Reddy university, by using a preliminary assessment to include the subjects in the study according to inclusion criteria. The subjects were explained about the purpose of the study, its aims, its objectives and outcomes. Subjects are clearly explained the possibilities of withdrawing from the study whenever they want. The study was done between January-march of 2025. The sample comprises of 50 young adults.

## PROCEDURE

Taking permission from the institutional scientific committee to collect the samples for the research study. The collection of samples begins Conveniently and by giving the consent form for voluntary participation. If the person meets the inclusion criteria, then they are invited to participate in the study.

### Q ANGLE:

This is measured in supine and standing position. Initially the participant is asked to lie in supine position and the angle is measured and the same process continues in standing position.

The Q angle is measured by drawing an imaginary line from anterior superior iliac spine to the centre of the patella and from the centre of the patella to the middle of the anterior tibial tuberosity through goniometric method and noting down the values of Q angle

The Normal Q angle score for females is between 13-18° and in males it is in between 12-15°, and values greater than and lesser than these are considered abnormal.

### NAVICULAR DROP TEST:

Next, we have to check the decrease of medial longitudinal arch which is flat foot through navicular drop test. Initially with a marker the navicular drop is marked on bilateral foot. The subjects are made to sit in chair with bare feet unweighted on the ground and the navicular tuberosity is palpated and then examiner holds an index card on the floor and mark the point of navicular tuberosity in sitting position.

the same process is done in standing position which is the subjects are again made to stand up and the position of navicular tuberosity is palpated and using index card the point is again measured and then the examiner measures the distance between both the points. In previous studies, mean values among healthy adults range from 3.6 to 8.1 mm.

After measuring both the contributing factors, the values are sorted down and analysed.

### **PICTURES**



NAVICULAR TUBEROSITY POINT



NAVICULAR DROP MEASUREMENT



Q ANGLE MEASUREMENT IN  
STANDING POSITION

### DATA ANALYSIS:

Appropriate statistical tests were used. Continuous variables are expressed as Means and Standard deviation while discrete variables are expressed as frequencies and percentages during descriptive analysis. The statistical analysis done using SPSS software, Pearson's correlation is used to correlate the variables.

P value is needed to find out the correlation of Q angle with medial longitudinal arch in young adults. The P value of 0.05 is used as the cut off for the significance. If the P value is  $<0.05$  we will be able to reject the null hypothesis and show that there is a significant correlation of Q angle to the medial longitudinal arch in young adults.

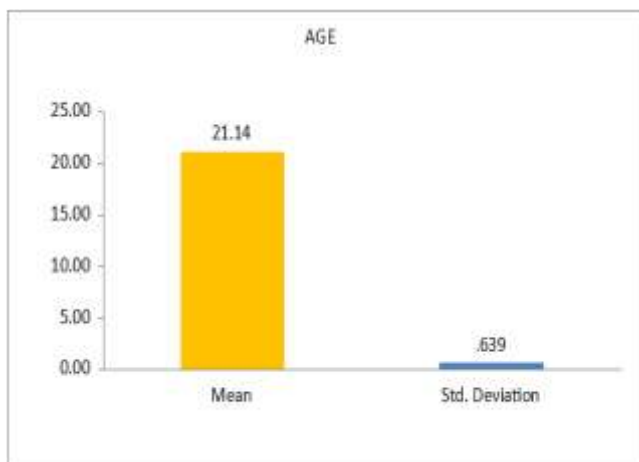
### RESULTS:

#### • AGE:

TABLE 1 AGE FREQUENCY

N	MEAN	MEDIQN	MODE	STD.DEVIATION	P value
50	21.14	21.00	21	.639	.000

The descriptive statistics of the sample (N = 50) indicate a consistent and normally distributed set of values, with a mean Q angle of 21.14, a median of 21.00, and a mode of 21. The low standard deviation (0.639) reflects limited variability among the observations. The p-value of 0.000 signifies that the mean is statistically significant, likely differing from a hypothesized population mean, suggesting that the observed values are not due to random chance.



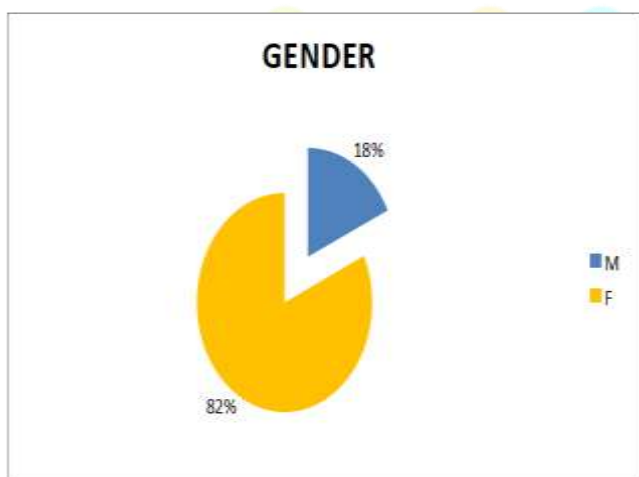
GRAPH 1: GRAPH INDICATING AGE

• GENDER

TABLE 2 GENDER DISTRIBUTION

		Frequency	Percent
Valid	M	9	18.0
	F	41	82.0
	Total	50	100.0

The bar graph displaying the frequency of gender among the participants. It shows a higher proportion of females (82%) compared to males (18%) in the sample with predominance of females, with 41 out of 50 participants (82%) and only 9 (18%) being male. This indicates that the study sample is heavily skewed toward female participants, which may influence the generalizability of the findings to the broader population.



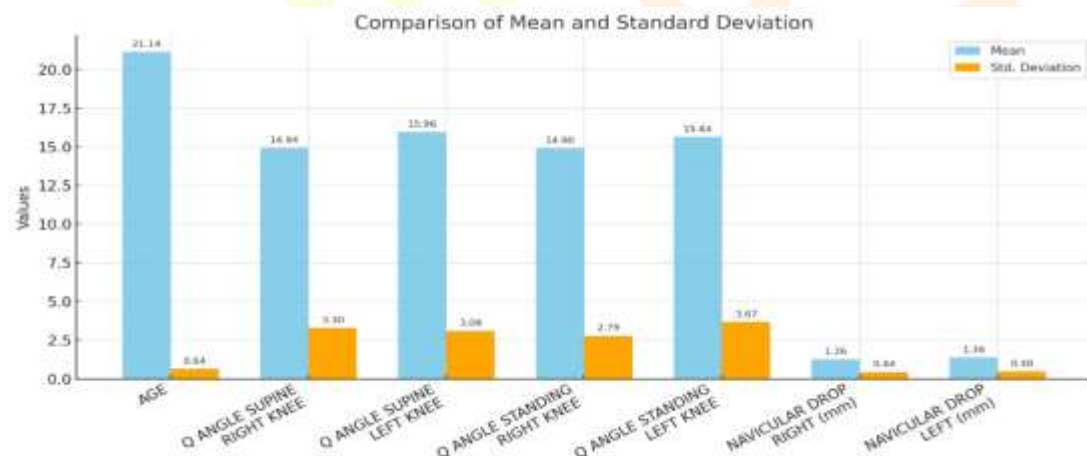
GRAPH 2 GRAPH SHOWING FREQUENCY OF GENDER

• **DEMOGRAPHIC DATA AND OUTCOME MEASURES**

*TABLE 3 Demographic Data and Baseline Characteristics*

Variable	Sample Size	Mean	SD	P-value
Age	50	21.14	0.639	.000
Q Angle Supine Right Knee	50	14.94	3.304	.000
Q Angle Supine Left Knee	50	15.96	3.090	.024
Q Angle Standing Right Knee	50	14.90	2.787	.200
Q Angle Standing Left Knee	50	15.64	3.669	.015
Left navicular drop test	50	1.36	.485	.000
Right navicular drop test	50	1.26	.443	.000

The above table gives information about mean, standard deviation and significant value of all the variables in this study which are age, Q angle in both supine and standing positions of bilateral foot and navicular drop test for bilateral arches of all the samples.



*GRAPH 3 GRAPH SHOWING MEAN AND Std. DEVIATIONS*

• **CORRELATION AMONG FACTORS**

*TABLE 4 spearman's correlations*

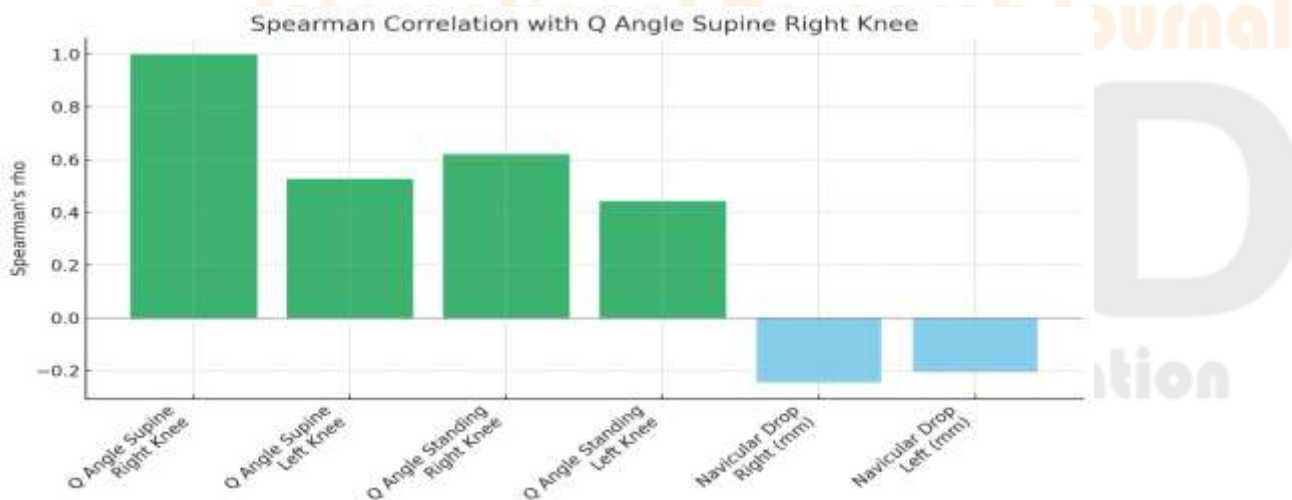
	Q ANGLE SUPINE RIGHT KNEE	Q ANGLE SUPINE LEFT KNEE	Q ANGLE STANDING RIGHT KNEE	Q ANGLE STANDING LEFT KNEE	NAVICULAR DROP TEST (in mm) RIGHT	NAVICULAR DROP TEST (in mm) LEFT
Spearman's Correlation rho	1.000	.527**	.619**	.442**	-.244	-.207
Q ANGLE SUPINE RIGHT KNEE		.000	.000	.001	.088	.150
Q ANGLE SUPINE LEFT KNEE			.000	.000	.453	.968
Q ANGLE STANDING RIGHT KNEE					.109	.006
Q ANGLE STANDING LEFT KNEE					.453	.968
NAVICULAR DROP TEST (in mm) RIGHT						.150
NAVICULAR DROP TEST (in mm) LEFT						
N	50	50	50	50	50	50

Q	ANGLE	.619**	.511**	1.000	.600**	-.123	-.124
Correlation	STANDING Coefficient						
RIGHT	Sig. (2-	.000	.000		.000	.397	.392
KNEE	tailed)						
N		50	50	50	50	50	50
Q	ANGLE	.442**	.607**	.600**	1.000	-.043	-.026
Correlation	STANDING Coefficient						
LEFT KNEE	Sig. (2-	.001	.000	.000		.767	.857
	tailed)						
N		50	50	50	50	50	50
NAVICULA	Correlation R	.244	-.109	-.123	-.043	1.000	.505**
Coefficient	DROP						
TEST(in	Sig. (2-	.088	.453	.397	.767		.000
mm) RIGHT	tailed)						
N		50	50	50	50	50	50
NAVICULA	Correlation R	.207	.006	-.124	-.026	.505**	1.000
Coefficient	DROP						
TEST(in	Sig. (2-	.150	.968	.392	.857	.000	
mm) LEFT	tailed)						
N		50	50	50	50	50	50

\*\* Correlation is significant at the 0.01 level (2-tailed).

The Spearman correlation analysis reveals significant positive relationships among Q angle measurements taken in different positions and on both knees. The Q angle in supine right knee shows a moderate to strong positive correlation with the supine left knee ( $r = 0.527$ ), standing right knee ( $r = 0.619$ ), and standing left knee ( $r = 0.442$ ), all statistically significant at the 0.01 level, indicating consistency in Q angle measurements across positions and limbs. Similarly, the Q angle in the standing left knee is also significantly correlated with the other Q angle measurements (ranging from 0.442 to 0.607).

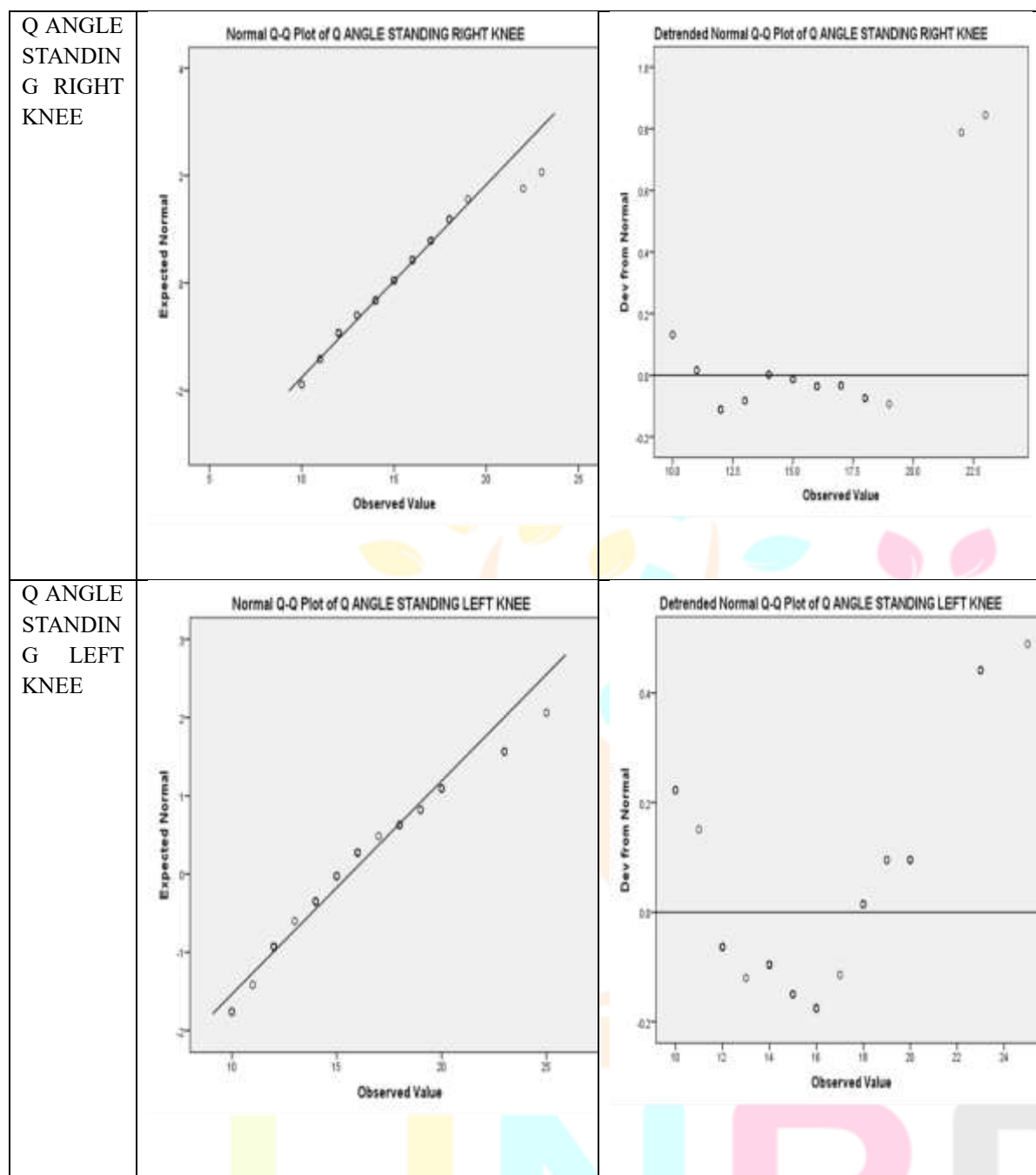
However, correlations between Q angles and Navicular Drop Test (NDT) values are negative and weak, with no significant associations, suggesting that foot pronation (as measured by navicular drop) does not have a meaningful relationship with Q angle. The only strong and significant correlation involving navicular drop is between the right and left navicular drop test values themselves ( $r = 0.505$ ,  $p < 0.01$ ), reflecting bilateral symmetry in foot posture.



GRAPH 4 CORRELATIONS OF Q ANGLE TO NAVICULAR DROP TEST

<p>AGE</p>		
<p>Q ANGLE SUPINE RIGHT KNEE</p>		
<p>Q ANGLE SUPINE LEFT KNEE</p>		

Research Through Innovation



GRAPH 4 GRAPHS INDICATING NORMAL AND DETRENDED PLOTS OF AGE AND Q ANGLES IN DIFFERENT POSITIONS.

## DISCUSSION

The sample size of 50 students are taken and assessed. In order to determine the link between Q angle values in supine and standing postures, this study will examine the association between Q angle and the navicular drop test. It also looked at the potential significance of the relationship between changes in Q angle and navicular drop, a measure of foot posture. the values of Q angle are  $14.90^{\circ}$  to  $15.96^{\circ}$  on average for all postures, which is consistent with normative data for young adults. The Q angle was marginally higher in standing than in supine postures and somewhat larger in the left knee than the right, according to descriptive data.

In the majority of Q angle measurements, age did not show a statistically significant association. In the supine left knee, however, a modest but statistically significant negative correlation between age and Q angle was discovered ( $\rho = -0.289$ ,  $p = 0.042$ ), suggesting a little decrease in Q angle on that side as age increases. This discovery, while not very noticeable, could be the result of muscle impacts on joint alignment or age-related changes in lower limb biomechanics, even in a young group.

Q angles tested across both limbs and postures showed substantial positive associations. The Q angle of the right knees in the supine and standing positions showed the highest correlation ( $r = 0.640$ ,  $p = 0.000$ ), suggesting that patellofemoral alignment was consistent throughout testing postures. Significant relationships between the right and left sides as well as between the supine and standing measurements were also found, indicating that alignment is influenced by systemic or anatomical factors rather than just posture-specific differences.

When Q angle values were compared between those with positive and negative navicular drop (right foot), independent samples t-tests revealed no statistically significant differences in standing ( $p = 0.158$ ) or supine ( $p = 0.170$ ) postures.

Overall, the results indicate that Q angle is a fairly constant anatomical measure across sides and postures, although aging may have a little impact. Furthermore, the absence of correlation with navicular drop gives the possibility that, in young, healthy people, foot position by itself is not a reliable indicator of Q angle fluctuation.

A.M.DOWLING in his study titled Relationship between flatfoot and q angle in male secondary school students proved that there is no statistically significant differences in the participant's quadriceps-angle between the right and left knee in normal healthy male secondary school students and students suffering from flat foot and in the present study There is a slight difference in Q angle between right and left knees without any involvement of navicular drop but the Q angle is consistently higher in the left knee ( $\approx 1^\circ$  difference) both in supine and standing compared to left and navicular drop does not significantly influence the measures of the Q angle.<sup>(3)</sup>

Nguyen in the study titled Relationships between lower extremity alignment and the quadriceps angle suggested that females have greater Q angles compared with their male and it was thought that the greater Q angle in females was a result of females having a wider pelvis compared with males; however, this has been well disputed and according to our study there is a statistically significant difference in Q angles between males and females in all measured positions with females likely having higher Q angles.<sup>(15)</sup>

## CONCLUSION

This study aimed to assess the correlation between Q angle and the medial longitudinal arch (flat foot) in young adults using the navicular drop test. The findings showed that Q angle values were consistent across different positions and limbs, with a slight increase on the left side. While Q angles were significantly correlated with each other, no statistically significant relationship was found between Q angle and navicular drop values on either side. This suggests that in healthy young adults, flat foot (as indicated by navicular drop) does not have a major influence on the alignment of the quadriceps angle.

## STUDY IMPLICATIONS

- To understand the correlation between Q angle and medial longitudinal arches in young adults.
- To explore how medial longitudinal arches affects the biomechanics and posture in young adults.
- To assess the impact of abnormal Q angle on the development of medial longitudinal arches in young adults.
- To guide future research on improving the health in young adults.

## LIMITATION

- The sample size was relatively small ( $N = 50$ ), limiting the generalizability of the findings.
- Only young adults aged 18–25 years were included
- Navicular drop was measured in a static manner, which may not reflect dynamic foot function during walking or sports.
- The correlation was not done separately by gender, though Q angle is known to vary between males and females.

## FUTURE SCOPE OF INTREST

The present study helps in future for many various purposes as the correlation among flat foot and Q angle is significantly negative which means that flat foot is not directly affects Q angle.

The wide-angle among females may create an impact on q angle. The variation among Q angle in different positions varies.

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