

## THE STUDY OF QUADRICEPS ANGLE WITH CORRELATION OF BODY HEIGHT IN NORTH INDIAN ADULT HUMAN POPULATION

Sumit Kumar<sup>1</sup>, DR. Sudha Srivastava<sup>2</sup>, DR. Pawan K. Mahato<sup>3\*</sup>

<sup>1</sup>PHD Scholar, Department of Anatomy, Malwanchal University, Indore, M.P

<sup>2</sup>Professor, Department of Anatomy, Malwanchal University, Indore, M.P

<sup>3\*</sup>Associate Professor, Department of Anatomy, Malwanchal University, Indore, M.P

**\*Corresponding Author:**

### Abstract

**Title-** The study of Quadriceps angle with correlation of Height in North Indian Adult Human Population.

**Objective-** The objective of the study is to establish the bilateral inconsistency in the mean Q- angle (Quadriceps angle) value in both male and female. This study is to examine the correlation between Q- angle (quadriceps angle) values and the Body height.

**Background-** Before taking the measurement, the persons were positioned such that the hips and knees were in extension, the quadriceps muscles were relaxed, and the legs and ankles were neutral. Following marking, one of the arms of the manual goniometric was placed such that the ASIS and the patellar middle point were combined, and the other arm was placed so that the tuberosity of tibia and the patellar centre were collective. The measurement value was recorded after the manual goniometry was placed.

**Subjects-** The present study was done on 500 adult subjects (300 male and 200 female) of north Indian origin.

**Methods-** The Q angle is measured with a full circle universal manual goniometry which is made of clear steel with the subject standing in the erect weight-bearing position.

**Result-** The dimension of Quadriceps angle values in males from right side (mean 13.25) and from left side (mean 13.41), the Q- angle values in females from right side (mean 16.97) and from left side (mean 16.35) ( $P < 0.0001$ ). The result shows that the Q- angle was more prominent in females than in males. The variation of Q-angle with dominant side revealed that left side of Q- angle (both males and females) was more often greater than right side.

**Conclusion and Discussion-** The Quadriceps angle value of both males and females decreases with increases in body height which shows a positive correlation with body height. Positive correlation exists between Quadriceps angle and Body height.

**Keywords-** Q- angle values, Body Height, Age and Gender.

## INTRODUCTION

Anthropometry deals with the study of human body and skeleton that is helpful in forensic science for medico legal cases. Anthropometry is also divided as social and cultural units as it deals with human and human behavior in societies. The Q-angle is defined as the acute angle formed by the vectors for combination of pull of the quadriceps femoris muscle and the patellar tendon. It can also be performed as a composite measure of pelvic position, hip rotation, Rotation of tibia, patellar and foot position. (1) The quadriceps angle (Q angle) is formed when the line connecting anterior superior iliac spine (ASIS) and midpoint of patella connecting with the line joining tibial tubercle to midpoint of patella. The reasons for high angle amongst females are enhanced pelvic width, shorter femur length, or due to a more laterally placed tibial tuberoses. (2) The greater Q- angle values are in patients with patellar pain or instability. So, females with a greater Q- angle can be considered as having a great risk to develop knee joint problems. (3) The women do have a greater Q- angle than men, may be due to their broader pelvis and shorter femur. Therefore they can be considered to have greater risk for patella femoral dysfunction. (4) Q-angle has become accepted as an important factor in assessing knee joint function and determining knee health in individuals suffering from an anterior knee pain. When it is assessed correctly, it will supply very useful information concerning the alignment of the pelvis, leg, and foot. (5) Moreover, excessive Q angle leads to more exerted of the foot, and the increase of the phonation time will cause excessive internal rotation of the tibia which will change the quadriceps mechanism and lateral tracking of the patella. (6)

## Materials and method-

The present study is present on Quadriceps angle is done on 500 adult subjects (300 male and 200 female) between the ages of 18 to 45 years of north Indian origin. The study was conducted in the department of Anatomy, Malwanchal University, Indore (Madhya Pradesh).

## Inclusion and Exclusion Criterion-

Normal and Healthy Subjects and Subjects of North Indian Origin are the Inclusion criterion. Subjects with history of trauma and affected limbs are the Exclusion criterion.

## Materials and Method-

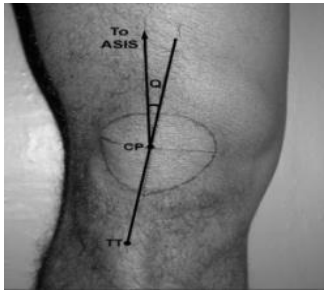
The present study was present on 500 adult subjects (300 male and 200 female) between the ages of 18 to 45 years of north Indian origin. The study was conducted in the department of Anatomy, Malwanchal University, Indore (Madhya Pradesh). The Q angle is measured with a full circle universal manual Goniometry which is made of clear steel with the subject standing in the erect weight-bearing position. The anterior superior iliac spine (ASIS), the midpoint of the patella, and the tibial tuberosity are replaced and firm. The hinge of the Goniometer is located at the midpoint the patella, the goniometer arms are adjusted to become positioned to the line joining the ASIS and the line joining the tibial tuberosity, than the small angle on the goniometer is read as the Q angle. Both sides are measured for each individual, and the mean values of the Q - angle are calculated. (Fig-1) Height is done by Stadiometer and the subject standing in anatomical position, on their heels together, buttocks, shoulder and head touched the walls of Stadiometer. The subjects are taken a deep breath and hold it. The head of stadiometer was placed on their head and wall to decide maximum height then told to extent out and to step away from the wall. Measurement is taken from vertex to the heel. (Fig-2)

For the purpose of study, the total number of subjects has been divided into five groups according to the age:

- Group I - 18 to 24 years
- Group II - 25 to 29 years
- Group III – 30 to 34 years
- Group I V - 35 to 39 years
- Group V - 40 to 45 year

## Result-

Age group (18 to 24) the Measurement of Quadriceps angle values in males from right side (mean 13.25) and from left side (mean 13.41) , the Q- angle values in females from right side (mean 16.97) and from left side (mean 16.35). Age group (25-29) the Q- angle values in males from right side (mean 13.25) and from left side (mean 13.37), the Q- angle values in females from right side (mean 15.87) and from left side (16.0). Age group (30-34) the Q- angle values in males from right side (mean 13.21) and from left side (mean 13.23), the Q- angle values in females from right side (mean 16.15) and from left side (mean 15.85). Age group (35-39) the Q- angle values in males from right side (mean 12.88) and from left side (mean 13.40), the Q- angle values in females from right side (mean 15.45) and from left side (mean 15.72). Age group (40-45) the Q- angle values in males from right side (mean 13.26) and from left side (mean 15.94), the Q- angle values in females from right side (mean 13.43) and from left side (mean 16.07). The Q- angle values in both side was significantly ( $P < 0.0001$ ) greater in females than in males. The result shows that the Q- angle was more prominent in females than in males. The variation of Q-angle with dominant side revealed that left side of Q- angle (both males and females) was more often greater than right side. (1)



**Fig-1 Q- angle Measurement.**



**Fig-2 Measurement of Body Height**

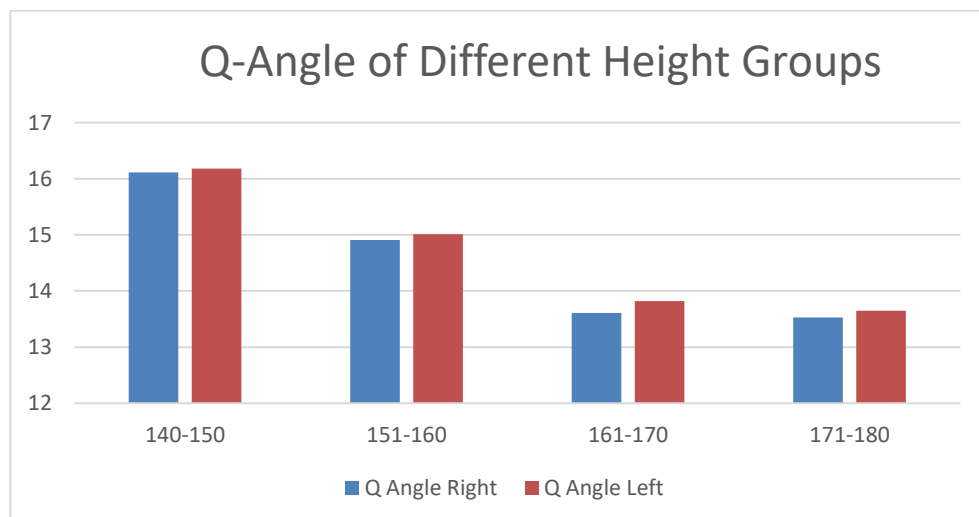
**Table-1 Measurement of Quadriceps angle ob both Male and Female**

Age Group	N (%)	Mean $\pm$ S.D (Right)	Mean $\pm$ S.D (Left)	P- Value
18-24	Total- 100%	14.58 $\pm$ 2.12	14.59 $\pm$ 1.93	<0.0001
	Male- 60%	13.25 $\pm$ 1.10	13.41 $\pm$ 1.18	
	Female- 40%	16.57 $\pm$ 1.68	16.35 $\pm$ 1.44	
25-29	Total- 100%	14.32 $\pm$ 1.63	14.45 $\pm$ 1.66	<0.0001
	Male- 60%	13.25 $\pm$ 0.83	13.37 $\pm$ 0.66	
	Female- 40%	15.87 $\pm$ 1.22	16 $\pm$ 1.45	
30-34	Total- 100%	14.39 $\pm$ 1.69	14.40 $\pm$ 1.81	<0.0001
	Male- 60%	13.21 $\pm$ 0.83	13.23 $\pm$ 1.03	
	Female- 40%	16.15 $\pm$ 0.98	16.15 $\pm$ 1.23	
35-39	Total- 100%	13.91 $\pm$ 1.61	14.33 $\pm$ 1.53	<0.0001
	Male- 60%	12.88 $\pm$ 0.79	13.40 $\pm$ 0.91	
	Female- 40%	15.45 $\pm$ 0.80	15.72 $\pm$ 1.61	
40-45	Total- 100%	14.32 $\pm$ 1.61	14.47 $\pm$ 1.69	<0.0001
	Male- 60%	13.26 $\pm$ 0.74	13.43 $\pm$ 0.86	
	Female- 40%	15.94 $\pm$ 1.17	16.07 $\pm$ 1.38	

Measurement of Quadriceps angle values of both males and females from right side (mean 16.10) and from left side (mean 16.18) according to body height range (140-150). Q-angle values of both males and females from right side (mean 14.90) and from left side (mean 15.0) according to body height range (151-160). Q-angle values of both males and females from right side (mean 13.61) and from left side (mean 13.82) according to body height range (161-170). Q-angle values of both males and females from right side (mean 13.53) and from left side (mean 13.65) according to body height range (171-180). The Quadriceps angle value of both males and females decreases with increases in body height which shows a positive correlation with body height. (2)

**Table-2 Correlation of Quadriceps Angle with body height of both Male and Female**

Body Height(Range)	(N)	Right(Mean $\pm$ S.D)	Left(Mean $\pm$ S.D)
140-150	74	16.10 $\pm$ 1.49	16.18 $\pm$ 1.33
151-160	128	14.90 $\pm$ 1.73	15 $\pm$ 1.81
161-170	221	13.61 $\pm$ 1.36	13.82 $\pm$ 1.37
171-180	78	13.53 $\pm$ 1.18	13.65 $\pm$ 1.31



**Fig-2 Comparison of Q- angles from body Height Measurement.**

## Discussion-

Maharjan R. et al (2013) - Conducted their study on Q- angle measurement on 1200 volunteers, the mean and standard values of q- angle was  $13.89 \pm 1.74$  in males from right side and  $13.76 \pm 1.66$  from left side,  $13.94 \pm 1.74$  in females from right side and  $13.90 \pm 1.61$  from left side and p value was  $>0.05$ . The study shows that mean values of females was higher than males. Chaudhary M. et al (2019) – Concluded their study on Q- angle on 100 subjects, the mean and standard values of q- angle was  $15.60 \pm 4.56$  in males from right side and  $14.04 \pm 4.25$  from left side,  $16.80 \pm 4.23$  in females from right side and  $16.20 \pm 4.20$  from left side and p value was 0.080 in male and 0.482 in female. The study revealed that mean values of females was higher than males. Allouh MZ. et al (2019) - Performed their study on Q- angle on 500 subjects from 19 to 25 years. The mean and standard value of q- angle was  $17.35 \pm 0.225$  in females and  $14.1 \pm 0.21$  in males,  $16.7 \pm 0.43$  in the right side and  $16.4 \pm 0.12$  in the left side and p value was  $<0.01$ . The study shows that Q- angle was female more often greater than male and Q- angle value was greater in right side than left side. Supriya A. et al (2018) - Conducted their study on Q- angle on 100 volunteers. The mean and standard value of Q- angle was  $12.45 \pm 1.22$  in males from right side,  $11.77 \pm 0.92$  from left side,  $17.64 \pm 1.87$  in females from right side,  $16.46 \pm 1.71$  from left side and p value of both males and females was  $<0.001$ . The result of the study was q- angle values greater in females than males. **In the present study**, the mean and standard value of Q- angle are  $13.25 \pm 1.10$  in males from right side,  $13.41 \pm 1.18$  from left side and q- angle value are  $16.57 \pm 1.68$  in females from right side,  $16.35 \pm 1.44$  from left side. The study found that mean q- angle of females is greater than males.

## Regression formulae for estimating the Quadriceps angle of a subject using

Male	$Y = 13.812 + 0.0095x \quad R^2 = 0.0028$
Female	$Y^1 = 23.914 + 0.0557x^1 \quad R^2 = 0.0504$

Where x and  $x^1$  is the Body height of male and female

Where y and  $y^1$  is the quadriceps value of male and female

## Conclusion-

Positive correlation exists between Quadriceps angle and Body height. The result shows that the Q- angle was more prominent in females than in males. The variation of Q-angle with dominant side revealed that left side of Q- angle (both males and females) was more often greater than right side.

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