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**Research article**

# Normal Q-Angle Values in Asymptomatic Young Adults in Abha, Aseer Region, Kingdom of Saudi Arabia

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**ABSTRACT:** Q-angle is considered an important factor in the development of a variety of soft tissue conditions. An abnormal high or low Q-angle has been

repeatedly cited as predisposing to anterior knee pain syndrome common among young active individuals. The objective of this study is to assess the normal Q-angle values in asymptomatic young adults in Abha, Aseer region, Kingdom of Saudi Arabia. The methodology adopted for this study, One hundred (100) male subjects, age range (18-25) years participated in the study. The Q-angle of the subjects was measured in the supine lying position with quadriceps relaxed, with knees extended by using a universal goniometer. The results showed the average Mean Q angle and S.D for 100 subjects who participated in the study was  $13 \pm 2.16$ . This study also assessed the correlation between Age and Q angle. The study concluded that the normal Q-angle values vary between different ethnic groups. Therefore, it is recommended that Q-angle assessment should be an essential component of the physiotherapy management of knee joint pathology

**KEYWORDS:** Q angle; Asymptomatic young male adults; Gender

## INTRODUCTION

Quadriceps (Q) angle is an important indicator of biomechanical function in the lower extremity. This measurement reflects the effect of the quadriceps mechanism on the knee<sup>1</sup>. Q-angle was initially described by Brattstorm<sup>2</sup>. Measuring the Q-angle provides useful information regarding the alignment of knee in frontal plane and its possible underlying pathology<sup>3</sup>. The angle formed by the resultant force of the quadriceps femoris muscle on the base of the patella and the line of pull of patellar ligament on apex of the patella is called the Q angle.

Q-angle is one of the few measures of patellofemoral joint mechanics available in the clinical situation not requiring sophisticated radiographic equipment<sup>4</sup>. Traditionally, the Q-angle has been measured with subjects in supine lying position, with quadriceps relaxed and knees

in extension with universal goniometer<sup>5</sup>. Measurement of Q angle in supine with quadriceps relaxed is the most commonly used method as it is easy to perform and is reliable.

Women have been found to have larger Q-angle than men and often affected by patellofemoral problems. This is possibly due to increased pelvic width, shorter femur length or femoral neck anteversion<sup>8</sup>. Q-angle is considered an important factor in the development of a variety of soft tissue conditions. An abnormal high or low Q-angle has been repeatedly cited as predisposing to anterior knee pain syndrome common among young active individuals<sup>9</sup>. Q angle of 20 degrees or more is considered to be abnormal, creating excessive lateral forces on patella that may predispose patella to pathologic changes<sup>11</sup>.

Although an excessively large Q angle is usually an indicator of some structural malalignments, an apparently normal Q angle is not necessarily consistent with the absence of problems. Insall et al. suggested that increased Q-angle is an indicative of pathological lateral forces to act on the patella<sup>12</sup>. If women do have greater Q angles than men, women could be greater risk than men for developing patellofemoral joint problems. Normal Q angle in males is 13 degrees and in females is 18 degrees. An angle above 14 degrees indicates a tendency toward less patellar stability and an angle above 18 degrees is often associated with patellar tracking dysfunction, subluxating patella, increased femoral anteversion or increased lateral tibial torsion<sup>13</sup>. Normal values of Q - angle in men vary in between 10-13 degrees and 14-17 degrees in women. Bade B Omolou et al. established a baseline reference value for normal Q-angles among asymptomatic Nigerian adults and concluded that Mean Q-angle values were  $10.7^{\circ} \pm 2.2^{\circ}$  in supine position and  $12.3^{\circ} \pm 2.2^{\circ}$  in standing position in Nigerian male population. Moreover it has been accepted that Physical variability exists between different human races and therefore we cannot assume the same Q-angle values in all<sup>14</sup>. Therefore this study is mainly intended to establish a baseline reference value for normal Q-angles among asymptomatic young adults in Abha, Kingdom of Saudi Arabia.

#### MATERIALS AND METHODS

The subjects selected for the study were normal healthy asymptomatic college students from King Khalid University, College of Applied Medical Sciences, Abha, Saudi Arabia of age 18-25 years of age. The procedure was explained to all the

subjects who then signed an informed consent form. Ethical clearance for the study was obtained from the University. A total of 100 male subjects were selected for this study. The sample included healthy male subjects without any history of pathological conditions of lower extremities, spine, any history of surgery of knee and elite level sports persons. All the measurements were taken only once by a single investigator.

#### MEASUREMENT PROCEDURE OF Q ANGLE

Subjects who met the inclusion criteria were assessed for Q angle. A goniometric measurement method which has been described by Jha and Raza was implemented for this study<sup>19</sup>. For measurement of Q angle , subjects were placed in supine position with knee and hip in extension, squaring the pelvis, quadriceps muscle relaxed and feet in neutral position .In this position , mark the Anterior superior iliac spine ( ASIS ), center of patella and tibial tuberosity. First draw a line from the anterior superior iliac spine (ASIS) to center of the patella with a felt- tipped pen (Fig. 1). Then a line was drawn from the center of patella totibial tuberosity (Fig. 1). The angle formed by intersection of these two lines will be measured. The center axis of long arm goniometer was placed over center of patella, the upper arm was pointed towards ASIS and the lower arm was placed along patellar tendon to the tibial tuberosity and Q angle was measured and documented (Fig. 2). Measurements were taken on right leg of all individuals by the same investigator.



Figure 1. Line drawn from ASIS to center of patella and from tibial tuberosity to center of patella.

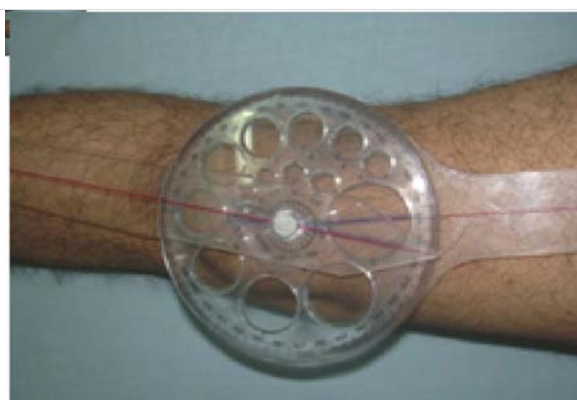


Figure 2. Measurement of Q angle by using a goniometer where both the lines intersect.

## RESULTS

Data analyzed by using the SPSS and Mean, Standard deviation of the Q-angle was determined. Correlation between age and Q angle was calculated by Pearson correlation coefficient.

Normal Q-angle values and ranges were established by calculating the mean and standard deviation. The Descriptive Statistics of Groups for Age shown in Table 1.

Table 1. Descriptive statistics of groups for age.

Age ( years )	Total No. of subjects	Mean Q angle and S.D
18-19	18	12.22± 1.43
20-21	32	12.96 ± 1.19
22-23	27	12.59 ± 1.49
24-25	23	13.13 ± 1.17
<b>Total sample</b>	<b>100</b>	-

The average Mean Q angle and S.D for 100 subjects who participated in the study was  $13 \pm 2.16$ . Correlation between Age and Q angle was calculated by Pearson correlation coefficient and the value was 0.99 which shows a very good correlation

## DISCUSSION

This study established that the average Q-angle for the asymptomatic young adults in Abha, Asser region, Saudi Arabia which was  $13 \pm 2.16$ . It is difficult to compare the results of this study with previous Nigerian studies on Q-angle, because most of them reported one value only<sup>9</sup>. There are also differences in methodologies, in that they all measured the Q-angle using the flexiometer, while this study used the goniometer, which is more popular among medical practitioners.

Here, it is important to note that individuals with abnormally high or low Q angles may suffer from patellofemoral maladies as it is an important indicator of biomechanical function in the lower extremity. But these individuals may remain asymptomatic though the factors causing abnormal Q angle have always been present and the condition may not yet have manifested itself because the muscle control is adequate<sup>10</sup>.

The increase of Q angle values has been shown to increase patellofemoral contact pressures<sup>15</sup>, and even the quadriceps muscle also play a key role in Q angle. The quadriceps muscle protects the knee by providing the dynamic stability in support of the static stabilization. Biomechanically it withstands the stress generated during activity, which is a determining factor in its performance. Since the bony surfaces are irregular and the axis of the motion does not pass through fixed points in the knee joint, the joint geometry and the support of the quadriceps muscle mainly control

the motion between the joint surfaces which also plays a key role in proper tracking of patella<sup>16</sup>. A significant association between Q angle and quadriceps strength has been stated<sup>17</sup>.

In this study it must be noted that measurement of Q angle was made by asking the individuals to lie in supine position, the feet in neutral rotation and the quadriceps relaxed. This was done to enable accurate results when compared to other positions<sup>18</sup>.

## CONCLUSION

The present study showed normal baseline reference value of Q angle values in asymptomatic young adults. These findings are important because they provide objective evidence that Q-angle measurement will be considered as an important tool in the knee assessment and plan of physical therapy treatment. Therefore Q-angle is also a suitable clinical measure which can be used to assess the patellofemoral pain syndrome and other patellar instabilities.

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