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Variation of Quadriceps Angle in Professional Sports People and Non-Professional Sports People Among Young Indian Population. A Cross-Sectional Study" Ram Prakash

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ABSTRACT

Introduction: the quadriceps angle (Q-angle) is considered as a well-known parameter to evaluate knee joint problems such as patella femoral pain syndrome, dislocation of patella, anterior knee pain and other degenerative knee problems as well as biomechanics of knee joint. The sports comprising vigorous training of the quadriceps muscle during the performances and lower limb activities lead to decreasing Q-angle. This study aims to determine quadriceps angle in professional sportspeople and non-professional sportspeople.

Materials and Methods: the study was conducted on 50 subjects including 25 sportspeople from Nehru Sports Academy, Chennai, India and 25 non-professional sports people were students of Saveetha University, Chennai aged 17-25 years. Q-angle measured by Universal Goniometer on supine lying position. Result: The mean value of Quadriceps angle among active professional sports people was 12.64± 1.469 degrees as compared to 14.60± 1.414 degrees for non-professional people which was statistically significant ($p<0.001$).

Conclusion: assessment of quadriceps angle will be considered as an indicator to pin out possible clinical conditions related to knee joints.

Keywords: Quadriceps angle; Sports people; Patella femoral pain syndrome.

Introduction

The Quadriceps angle (Q-angle) is an acute angle formed by an imaginary line drawn from the anterior superior iliac spine (ASIS) to the centre of the patella (CP) and another line connecting the Centre of the patella to the tibial tuberosity (TT)[1]. The normal Q-angle for men is 13 degrees and 18 degrees for women[2]. Exceeding the Q- angle beyond 15-20 degrees might affect the extensor mechanism of the knee and patella-femoral joint with the tendency of the patella to slide laterally, anterior knee pain, patellar overload syndrome, anterior cruciate ligament injuries[3-6]. However, decreased Q-angle also correlates with clinical conditions like chondromalacia, patellar alta patellar instability and patella-femoral pain syndrome (PFPS)[7-9].

Q-angle is considered a well-known parameter to evaluate the biomechanics of the knee joint, normal alignment in the lower extremity as well as lower extremity functional[10-12]. Evaluation of the Q angle might be beneficial for orthopaedicians, and physiotherapists to predict the probable knee joint pathologies that may appear in future. Additionally, orthopaedic surgeons make use of Q-angle values for understanding and dealing with replacement arthroplasty and patellofemoral disorders as well[13].

Previous studies reported that Q-angle values were in inverse relation to the strength of quadriceps muscle and increased muscle tone[14-15]. Sports individuals employ significant repetitions of the quadriceps muscle during quadriceps strength training which are substantially associated with decreased Q-angles[16]. In addition to that the pulling effect of the quadriceps muscle and anatomical structures might influence Q-angle variations[17]. Furthermore, a study reported active participation in sports (Football) and strengthening exercises of lower limbs affect Q- angle values[18].

In this context, our study aimed to investigate whether levels of participation in sports activities influence the variation of Q -angle value between sports individuals (football players) and nonprofessional sports people as well as to find the Q - angle differences between professional sports people and non-professional sports people concerning age, height and weight.

Materials and Methods

A cross-sectional study was conducted among 50 people, sedentary (n=25) and sports (n=25) male subjects aged from 17 to 24 years old were selected by convenient sampling technique during the period from August 2013 to January 2014. The subjects

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signed an informed consent form after explaining the procedure. Nonprofessional sports people who had not been actively involved in sports activities included the students of Saveetha University, Thandalam, Chennai. Professional sports people (football players) were selected from Nehru Sports Academy Chennai, India after obtaining necessary permission from the institutional human ethical committee clearance (IHEC) of Saveetha University vide their letter no 019/07/2013/IEC/SU. The selected male subjects to whom the anterior superior iliac spine (ASIS), the centre of the patella (CP) and tibial tuberosity (TT) could be easily palpable were included in the study. The subjects with a history of fracture of lower limb bones, any knee pain and clinical evidence of meniscal injury were excluded from the study. A universal goniometer, measuring tape, weighing machine, wooden table and marker pen were used for this study during data collection.

The subjects were asked to wear shorts to show off the anatomical bony landmarks of lower limbs and made supine lying on the table with both legs non-weight bearing, straight and quadriceps muscles relaxed. The anatomical bony landmarks including the border of the patella, tibial tuberosity and anterior superior iliac spine were palpated and marked by a marker pen. The universal goniometer was used to measure the Q-angle. The centre of the patella was defined as the point of intersection of the vertical and transverse diameter of the patella and the point of maximum prominence was defined as the centre of the tibial tuberosity. Further, one line was drawn from the anterior superior iliac spine using a measuring tape revealing as the longitudinal axis of the femur and 2nd line was drawn from the tibial tuberosity to the centre of the patella. The fulcrum of the goniometer was placed on the midpoint of the patella and its stationary arm was aligned towards the anterior superior iliac spine while the movable arm was aligned towards the tibial tuberosity. The angle formed between 2 lines is noted as Q-angle (Figure. 1 &2).

Statistical analysis

All the statistical analysis was done with the help of SPSS-15 software. The data were evaluated by an independent t–test at the level of significance (p<0.001). The data were presented as Mean ± standard deviation and standard error of the mean (SEM) as in Table 1. The correlation- coefficient of the left and right leg Q-angle were also evaluated.

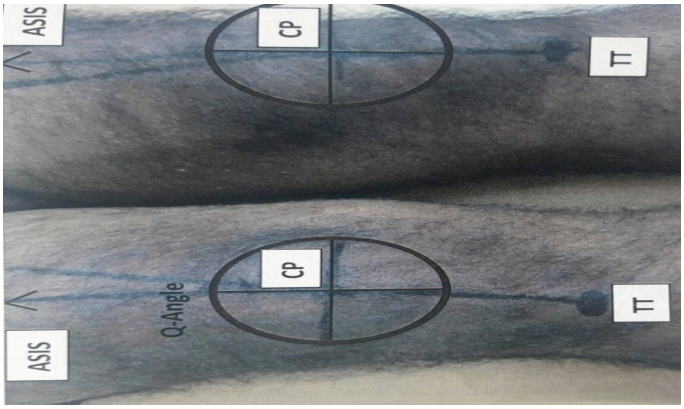

Figure 1. Illustrates bony landmarks ASIS, CP and TT to measure Q-angle in non-professional sports people.

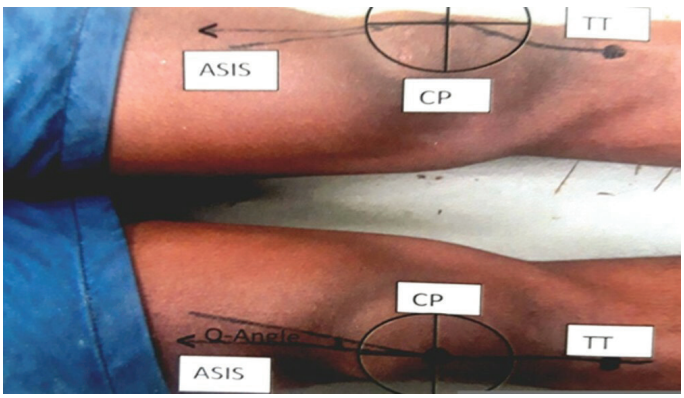

Figure 2. Illustrates bony landmarks ASIS, CP and TT to measure Q-angle in non-professional sports people.

Results

In the present study, the Q angle of professional sports individuals and non-professional sports people and the anthropometric variables (Age, height and weight) were also measured for (N= 50) subjects. Table 1 illustrates the mean Q-angle, age, height and weight for professional sports and non-professional sports people. The mean age and height of professional sports people were 18.72±1.14 years, and 171.68±5.56

Table 1. Mean±SD, t-values and p-values of different parameters including Q-angle of sports (n=25) and sedentary (n-25) peoples.

Parameters	Professional Sports Peoples		Non-professional sports Peoples		t-values	p-values
	Mean±SD	Standard error of the mean	Mean±SD	Standard error of the mean		
Age (yrs)	18.72±1.14	0.227	19.76±1.30	0.26	3,011	<0.005
Height (cm)	171.68±5.56	1.112	164.0±5.19	1.04	4.524	<0.001
Weight (kg)	63.56±4.48	0.896	62.16±2.63	0.53	1.340	0.184
Rt Q-angle (0o)	12.64±1.47	0.294	14.60±1.41	0.29	4.007	<0.001
Lt Q- angle(0o)	11.88±1.39	0.279	14.40±1.35	0.27	6.484	<0.001

cm as compared to non-professional sports people the mean age, height and were 19.76±1.30 years, 164.0±5.19 cm were significantly different. Figure 3 represents the mean value of right Q-angle among active sports people (12.64±1.47) as compared to non-professional people (14.60±1.41), which was statistically significant at ($p<0.001$). Figure 4 illustrates the mean value of left Q-angle among active professional sports people (11.88±1.39) compared to non-professional people (14.40±1.39) was also statistically significant.

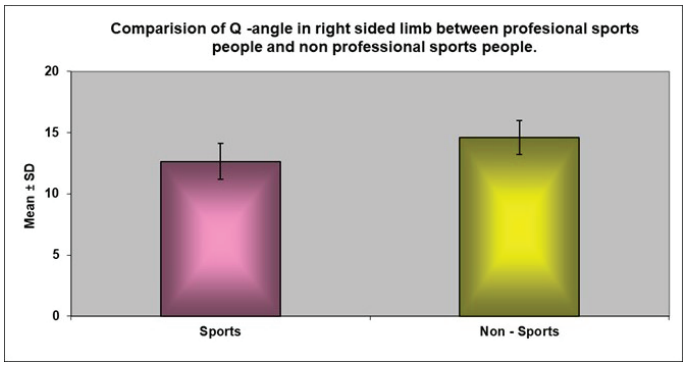

Figure 3. The bar chart depicts the comparison of Q -angle in the right-sided limb between professional sports and non-professional sports people.

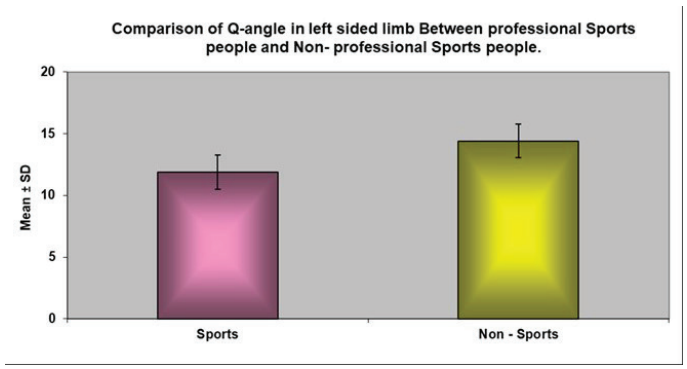

Figure 4. The bar chart depicts the comparison of Q -angle in the left -sided limb between professional sports and non-professional sports people.

Table 2 shows the correlation coefficient of the right and left Q-angle of professional sports and nonprofessional sports people.

Table 2. Correlation-Coefficient(r) and p-values between right and left Q-angle in degrees of professional sports and non-professional sports people.

Subjects	Correlation-Coefficient (r)	p-values
Sports people (n=25)	0.690	0.01
Sedentary peoples (n=25)	0.675	0.01
All (n=50)	0.779	0.01

The level of significance for the correlation coefficient is $p<0.05$

Discussion

In the present study, the variation of Q-angle values were evaluated in professional sports people (Football players) and non-professional sports groups concerning bilateral asymmetry of the limbs, height age and weight. The present study also noted the Q-angle values in professional sports individuals were significantly decreased than non - professional sports people due to massive indulgence in quadriceps strength training during lower extremity performance. In our study, we found the decreasing trends of Q angle in right limbs ((12.64±1.47) and left-sided (11.88±1.39) in professional football players to non-professional football players the determined Q angle values were (14.60±1.41) were in parallel with the results of Elena Escamilla-Martínez and the associates evaluated lower Q angle in professional and non-professional football players[19] as well as similar to the results displayed by Braz and Carvalho who had reported lower Q angle values in professional versus non-professional football players[20]. Previous studies also uncovered sports individuals undergoing vigorous training of quadriceps muscles and excessive contractile state of muscle quadriceps lead to decreasing Q angle i.e. 12 degrees in the right limb and 10 degrees in the left limbs[21-22]. Similarly, Danes mandi determined the average Q angle value for the sports persons 11.46 + 1.46[23]. Concerning bilateral variation of mean Q-angle between the right and left lower limb previous studies also advocated the left Q-angles are lesser than the right Q-angle due to dominant sides being used which was closely associated with our results[24-26] Previous studies found the Q angle values did not vary significantly with the weight of the study population. Sra A. *et al* (2008) also reported no noticeable association between the Q angle and weight which also correlated with our findings[27].

A previous study reported Q angle values were inverse-proportional to the height and length of the lower limb[28]. However, recent works of literature also advocated a remarkable association between the Q-angle and height[29]. Jaiyesimi AO *et al.* pointed out that the change in the Q-angle values substantially linked with the height of the individual rather than the placement of bony landmarks i.e. since male participants tend to have a greater height than females, Q-angle in males is lower in comparison to females[30].

Conclusion

Evaluation of the Q angle is substantially important for professional sports individuals who are involved in competitive sports and physical activities and non-professional sports people. Since increasing and decreasing the Q-angle influence the possible clinical conditions. Overuse and vigorous training for the knee joints during performances might be possible causes for decreasing Q angle which further induces clinical conditions such as

patella femoral pain syndrome, anterior knee pain and chondromalacia patella. Hence, encouragement and awareness are significant to carry out periodic screening of the susceptible population as well as different correctional exercises that can be started as a precaution to prevent future disorders. Periodic checkups of the Q angle will be vital in quantifying the effective strategies for treatment and modifying it if necessary.

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