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BILATERAL CORRELATION OF Q-ANGLE WITH SELECTED LOWER EXTREMITY BIOMECHANICAL ALIGNMENT VARIABLES IN STATE LEVEL FEMALE BASKET-BALL PLAYERS

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Abstract:
The endeavour of this study was to find out the effects of various lower extremity biomechanical alignment variables on Q-angles bilaterally in state level female basket-ball players. Fifty, State level female basket-ball players from various sports clubs of Odisha, between the age group of 18-27 years (Mean ± SD: age 22.25±2.97yrs, height 156.10±5.68cm, weight 53.64±6.71, BMI 22.01±2.46kg/m2) volunteered to participate in the study. Seven anthropometric variables, i.e. height, weight, Body Mass Index (BMI), total leg length bilaterally and lower leg length bilaterally were measured. Bilateral six lower extremity alignment variables, i.e. tibiofemoral angle, femur anteversion, Q-angle, genu recurvatum, tibial torsion, navicular drop were measured on each subject following standard techniques. Statistical analyses of data were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0. The level of significance was set at 0.05. Significant positive correlation of right Q-angle was seen with right tibiofemoral angle, right femoral anteversion, right genu recurvatum and right navicular drop. Whereas, significant positive correlation of left Q-angle was observed with left tibiofemoral angle, left femoral anteversion, left tibial torsion and left navicular drop.

Keywords: basket-ball, Q-angle, anthropometry, femoral anteversion, tibiofemoral angle, tibial torsion, genu recurvatum

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1. Introduction

An athlete or sportsman is a person who competes in one or more sports that involve physical strength, speed and endurance. Lower extremity is more used during various sports and is more prone to injury. The anatomy of the lower extremity itself is complicated. It consists of hip joint, knee joint complex, ankle joint, subtalar joint and other small joints of foot. Lower extremity malalignment determined as a risk factor for acute and chronic lower extremity injuries, including patellofemoral syndrome [1], anterior cruciate ligament injuries [2-5], medial tibial stress syndrome, stress fractures, and plantar fasciitis [6].

Females have a higher risk of lower extremity malalignment due to different anatomical alignments, lower pain thresholds, and lower physical tolerance than males [7-9]. Earlier researches stated that females are at increased risk of abnormal anterior pelvic tilt, femoral antetorsion, Q-angle, tibiofemoral malalignment, and genu recurvatum [7,9].

In the adult population, sex differences have been identified in the structures of the hips and knees, with females having greater anterior pelvic tilt [7,10], femoral anteversion [7,11,12], tibiofemoral angle [7,13], quadriceps angle [7,11,13,14] and genu recurvatum [7,15]. Conversely, no sex differences have been observed in measures of tibial torsion [7,16] and foot pronation as measured by navicular drop [7,10,15] and rearfoot angle [7,17].

There are few investigations that have examined anatomical and postural characteristics during maturational years to determine when the sex differences that have been observed in adults begin to emerge. Reports examining individual intratest anatomical factors indicate that joint laxity [18], hip anteversion [19], tibiofemoral angle [20-22], genu recurvaum [21], and foot pronation [23], progressively decrease, and tibia and femur lengths [24], and tibial torsion [25] progressively increase with age in both male and female adolescents. Of the limited studies that have examined sex differences during maturation, males surpass females in tibia and femur lengths by age 13 [24], and at about the same age there is evidence that hip anteversion [19] and tibiofemoral angles [22] may decrease in males while values in females remain similar.

Among all the lower extremity alignment variables, the Q-angle has been frequently studied, which is defined as the angle formed by a line from the anterior superior iliac spine to the patella center and a line from the patella center to the tibial tuberosity [26]. Q-angle is a composite measure of pelvic position, hip rotation, tibial torsion, patella position and foot position [27,28]. The Q-angle shows an inverse relationship with quadriceps strength, as the smallest the angle the greater the force produced by the quadriceps, which assumes that individuals with above normal Q-angle have lower quadriceps strength and are more subject to diseases of the patellofemoral joint [29].

The value of Q-angle varies according to the patient's gender, the state of contraction of the quadriceps and the position adopted by the patient, standing or lying

down [30]. The Q-angle can be measured reliably [31,32], and it provides a reasonable estimate of the quadriceps muscles' angle of pull on the patella in the frontal plane [33]. Q-angles that vary from 15-20◦ are often referred to as excessive [34,35]. When the Q-angle exceeds 15-20 degrees it is thought to contribute to knee extensor mechanism dysfunction and patellofemoral pain by increasing the tendency for lateral patella malposition [36].

Although the Q-angle has been suggested as risk factors for injuries [1,37], retrospective risk factors studies [2,4] have failed to confirm this relationship. The reason for these inconsistent finding, may be in part due to the multiple anatomical factors that may influence the magnitude of the Q-angle, which may differentially impact how the Q-angle relates to dynamic knee function. Determining the anatomical factors that have the potential to impact the magnitude of the Q-angle may allow clinicians and researchers to better determine its role in dynamic motion and risk of knee injury.

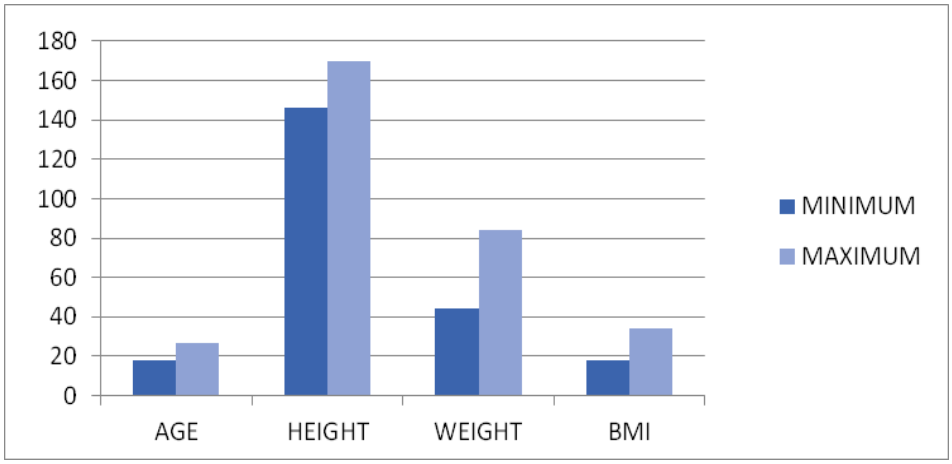
2. Material and Methods

2.1 Subjects

Fifty, State level female basket-ball players of Odisha between the age group of 18-27 years (Mean ± SD: age 22.25±2.97yrs, height 156.10±5.68cm, weight 53.64±6.71, BMI 22.01±2.46kg/m^2) volunteered to participate in the study.

Table 1: Descriptive Statistics of the state level female basket-ball players at baseline

Variable	N	Minimum	Maximum	Mean	SD
Age (Years)	50	18	27	22.25	2.97
Height (cm)	50	146.00	170.00	156.10	5.68
Weight (kg)	50	44.00	84.00	53.64	6.71
BMI (kg/m^2)	50	18.20	34.08	22.01	2.46



2.2 Methodology

This study is designed as a retrospective cross-sectional study. Seven anthropometric variables, viz. height, weight, BMI, right total leg length, left total leg length, right lower

leg length and left lower leg length were measured by standard techniques [38]. Right and left standing Q-angles were measured with a universal goniometer [39]. Bilateral (both right and left) tibiofemoral angle [40], femoral anteversion by Craig's test [41], genu recurvatum [7] and tibial torsion [42] were measured with a universal goniometer. Bilateral navicular drop was measured by a straight edge ruler [43].

2.3 Statistical Analysis

Statistical analyses of data were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics (mean ± SD) were calculated for both directly measured and derived variables. Karl Pearson's correlation coefficients were calculated to understand the dimension of relationship of both right and left Q-angles as dependent variables with set of right and left lower extremity variables respectively. The level of significance was set at $p< 0.05$.

3. Results

Table 2: Descriptive Statistics of the right anthropometric and right lower extremity biomechanical variables of state level female basket-ball players

Variables	N	Minimum	Maximum	Mean	SD
Right total leg length (cm)	50	74.00	92.00	82.2400	4.12340
Right lower leg length (cm)	50	32.00	42.00	38.4000	1.96915
Right tibiofemoral angle (degree)	50	6.00	14.00	9.7200	1.81872
Right femoral anteversion (degree)	50	14.00	32.00	23.2600	3.27520
Right Q angle (degree)	50	18.00	25.00	21.5600	1.71619
Right genu recurvatum (degree)	50	4.00	14.00	8.8200	2.30075
Right tibial torsion (degree)	50	16.00	24.00	19.4000	1.84059
Right navicular drop (cm)	50	.60	1.20	.8640	.15618

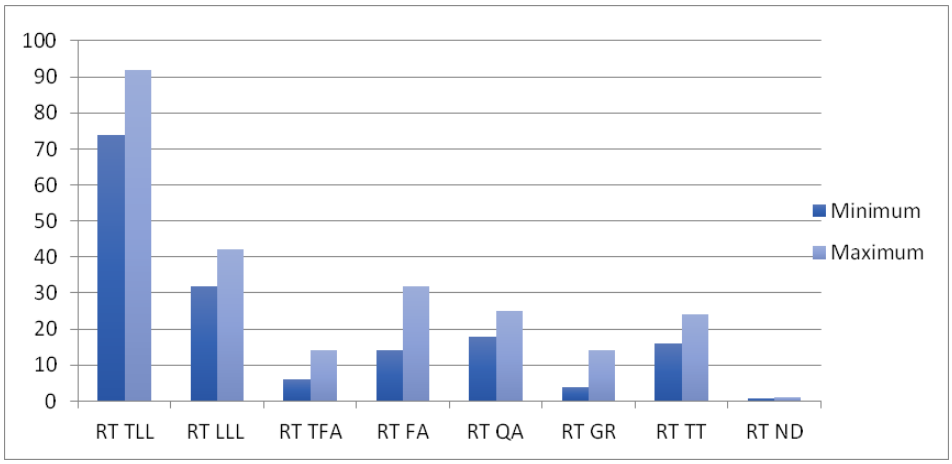


Table 3: Descriptive Statistics of the left anthropometric and left lower extremity biomechanical variables of state level female basket-ball players

Variables	N	Minimum	Maximum	Mean	SD
Left total leg length (cm)	50	74.00	92.00	82.2400	4.12340
Left lower leg length (cm)	50	32.00	42.00	38.4000	1.96915
Left tibiofemoral angle (degree)	50	6.00	12.00	8.7600	1.77925
Left femoral anteversion (degree)	50	16.00	28.00	21.7800	2.76487
Left Q angle (degree)	50	17.00	25.00	20.6200	1.82824
Left genu recurvatum (degree)	50	5.00	12.00	8.1200	2.00652
Left tibial torsion (degree)	50	14.00	24.00	18.3200	2.41965
Left navicular drop (cm)	50	.50	1.20	.8120	.16616

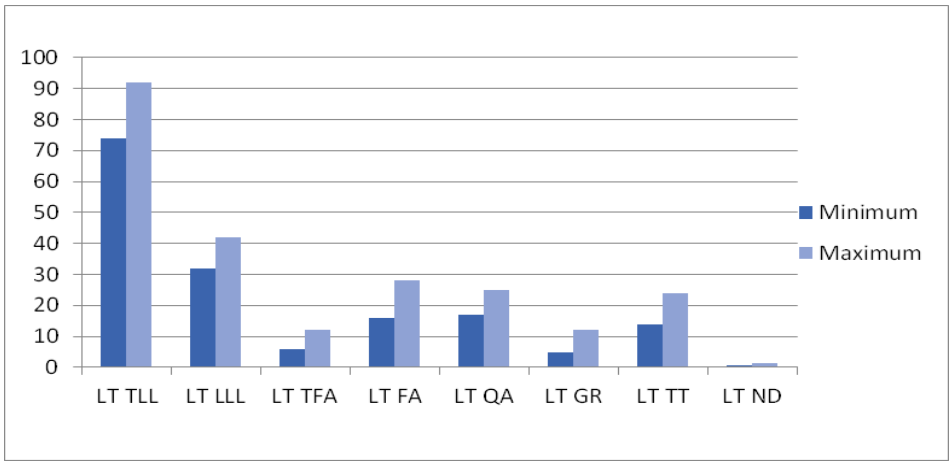


Table 4: Correlation coefficient of right Q-angle with right lower extremity biomechanical variables of state level female basket-ball players

Variables	State level female basket-ball players (n=50)	
	r value	p value
Right tibiofemoral angle (degree)	0.430	**<0.002**
Right femoral anteversion (degree)	0.573	**<0.001**
Right genu recurvatum (degree)	0.584	**<0.001**
Right tibial torsion (degree)	0.186	0.196
Right navicular drop (cm)	0.435	**<0.002**

Table 4 showed the correlation coefficient of right Q-angle with other right lower extremity biomechanical variables of state level female basket-ball players. In the players, significant positive correlation was seen in right tibiofemoral angle, right femoral anteversion, right genu recurvatum and right navicular drop.

Table 5: Correlation coefficient of left Q-angle with left lower extremity biomechanical variables of state level female basket-ball players

Variables	State level female basket-ball players (n=50)	
	r value	p value
Left tibiofemoral angle (degree)	0.461	**<0.001**
Left femoral anteversion (degree)	0.338	**<0.016**
Left genu recurvatum (degree)	0.263	0.065
Left tibial torsion (degree)	0.434	**<0.002**
Left navicular drop (cm)	0.398	**<0.004**

Table 5 showed the correlation coefficient of left Q-angle with other left lower extremity biomechanical variables of state level female basket-ball players. In the players, significant positive correlation were seen in left tibiofemoral angle, left femoral anteversion, left tibial torsion and left navicular drop.

4. Discussion and Conclusion

In basket-ball players, lower extremity plays an important role in performance. Thus identifying the biomechanical factors that influence Q-angle, excessive stress and potential injury is of considerable importance. The results of this study would be implicated for preseason screening as well as clinical diagnosis and treatment of athletes or patients. A wide range of corrective exercise programs would be started as preventive measures in case of any malalignment persisting before and can be modified, which would prevent future injuries.

- The findings of our study indicated that in state level female basket-ball players, significant positive correlation ($p<0.01$) of right Q-angle was noted with right tibiofemoral angle, right femoral anteversion, right genu recurvatum and right navicular drop. Whereas, significant positive correlation ($p<0.01$) of left Q-angle was noted with left tibiofemoral angle, left tibial torsion and left navicular drop.
- Significant positive correlation ($p<0.05$) of left Q-angle was noted with left femoral anteverion.

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