Anthropometric Study of Humeral Torsion Angle in South-South and South-East Nigeria

ABSTRACT

Aims: Torsion is defined as a state of longitudinal twisting or spiraling of shaft of a long bone and can be measured as the difference between joint axis of proximal and distal ends of the bones. Angle of humeral torsion entails the reorientation of head of humerus bone relative to its shaft, the head being directed medially rather than caudally. Torsion occurs between proximal and distal extremities of the humerus, with humeral head facing postero-medially in anatomical position. Humeral torsion has an impact on shoulder function, movement, and the likelihood of injury. Irregular torsion can result in limited range of motion, discomfort, and diminished athletic performance. Gaining insight into torsion patterns can enhance rehabilitation, surgical approaches, and athletic training. Studies may also contribute to advancements in prosthetic development, surgical methods, and safety equipment. Precise evaluation of humeral torsion is vital for effective treatment and preventing injuries. The anthropometric study of angle of humeral torsion aims to understand the variation in the angle of humeral torsion among individuals and populations; however, this study focused on South-South and South East, Nigeria. The results concluded that there was no significant difference in mean values of angle of humeral torsion on right and left side bones.**Study design:**Descriptive and cross-sectional study.**Place and Duration of Study:**University of Port Harcourt, South-South, Nigeria.

Methodology: Two hundred humeri belonging to skeletons of unknown age, sex, and stature were collected from Medical Colleges of various Nigeria universities in South-South and South East, Nigeria. The torsion angles of these bones were then measured with the goniometer. Out of 200 humeri, 112 were of right side and 88 were of left side.**Results:**The result of the study showed the right torsion (φ) 73.87± 5.67 and left torsion (φ) 73.78±5.48.

Conclusion: This study presents new evidence indicating that the humeral torsion angle is symmetrical on both sides, showing no significant variation between the right and left humeri. This findings adds to the current body of knowledge by creating a normative reference range for humeral torsion, which can assist in the diagnosis and management of shoulder injuries and disorders.

Keywords: [Anthropometric study, Angle, humeral torsion,bones

1. INTRODUCTION

"The anthropometric study of the angle of humeral torsion is a branch of research that focuses on the measurement and analysis of the rotational orientation of the humerus bone in the human body. This angle, also known as the angle of humeral torsion, plays a crucial role in the biomechanics of the shoulder joint and affects the range of motion and functionality of the upper limb" (Krishnan et al, 2019).

"The angle of humeral torsion is formed by a line drawn through the center of longitudinal axis of the neck and head of humerus meeting a line drawn along the transverse axis of the condyle, when the base is viewed from above, looking straight down from above the head of the humerus; the normal angle of humeral torsion is between 20 and 40 degree"(Stedman's medical dictionary. 2006). The average angle of the humeral torsion is 67.57° with a range of variation from 38° to 98°(Shahet al. 2006).

Anthropometric study aims to understand the variation in the angle of humeral torsion among individuals and populations, as well as its implications musculoskeletal health and performance. Through precise measurements and statistical analyses, anthropometric studies provide valuable insights into the anatomical variability and functional significance of the angle of humeral torsion, thus contributing to advancements in orthopedics, sports medicine and rehabilitation practices (Fadhil & Mubarak, 2020).

Thus, the aim of this study is to ascertain and document scientifically the angle of humeral torsion of Nigerians in the South South and South Eastern region. This study also aims to observe the prevalence of humeral torsion angle in the South South and South Eastern region of Nigeria and to compare their humeral torsion angle to other races.

2. MATERIAL AND METHODS

The following materials were used as the cause of this project:

2.1 Materials:

Humerus Bone, Plasticin, Cardboard Paper, Goniometer, Osteometric Board, Meter Ruler, Compass and Protractor, Calculator, Pencil, Pin, Pen, Exercise Book, SPSS 17 software.

Fig 1: Humeri Bone

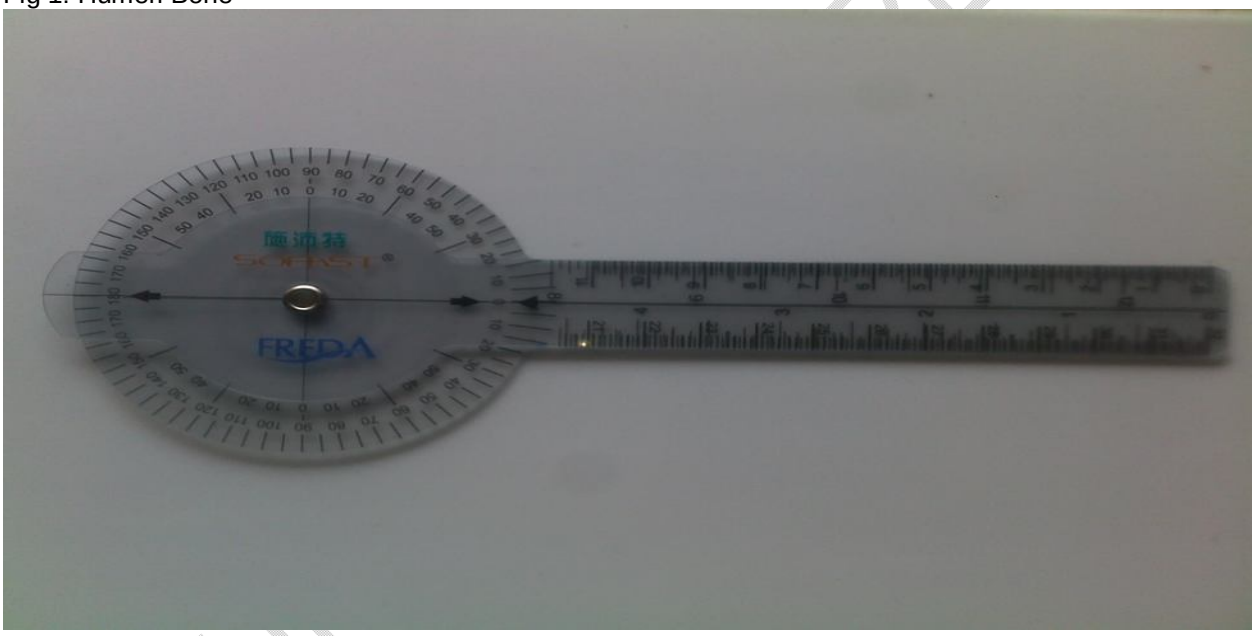

Fig 2: Goniometer

2.2 Study Areas

Two hundred humeri belonging to skeletons of unknown age, sex, and stature were collected from the medical college of the following universities: University of Port Harcourt, Rivers State, University of Nigeria, Enugu State, University of Calabar, Cross River State, University of Uyo, Akwa Ibom State, University of Benin, Edo State, Delta State University, Abraka, Ambros Ali University, Ekpoma. Edo State, Nnamdi Azikiwe University, Awka. Ananbra State, Niger Delta University, Amasoma. Bayelsa State.

2.3 Method

For this study two hundred humeri belonging to skeletons of unknown age, sex, and stature were collected from Medical Colleges of various Nigeria universities (already mentioned in Study Area above). Out of 200 humeri, 112 were of right side and 88were of left side. The mechanical axis of the head was taken as the line joining the two points namely center of the articular surface of head where transverse diameter of articular surface is maximum and at the greater tuberosity approximately between the insertions of supraspinatus and of the infraspinatus muscles. A pin was stuck with plasticin along the line of these two points. For the distal end axis, a point was marked on the anterior surface of capitulum along the center of its vertical diameter. Similarly, a second point was marked on the trochlea. A pin was stuck with plasticin along the line of these two points. The angle formed by the crossing of these two reference lines was then measured with the goniometer; this angle is called the torsion angle.

2.4 Precautions

i.A pin was fixed along the reference line employed for the upper and lower ends of humerus.

ii.A line was drawn along the fixed reference line for the upper and lower ends of humerus with a sharp pencil and meter ruler.

iii.Care was taken to ensure that the goniometer was properly placed to avoid error due to parallax

3. RESULTS AND DISCUSSION

Data of Torsion Angle

Table 1: Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Right humerus (φ)	111	34.00	50.00	84.00	73.8739	.53770	5.66507	32.093
Left humerus (φ)	87	28.00	55.00	83.00	73.7816	.58800	5.48449	30.080
Average (φ)					73.82			

Fig 3: Chart Showing the Descriptive Statistics

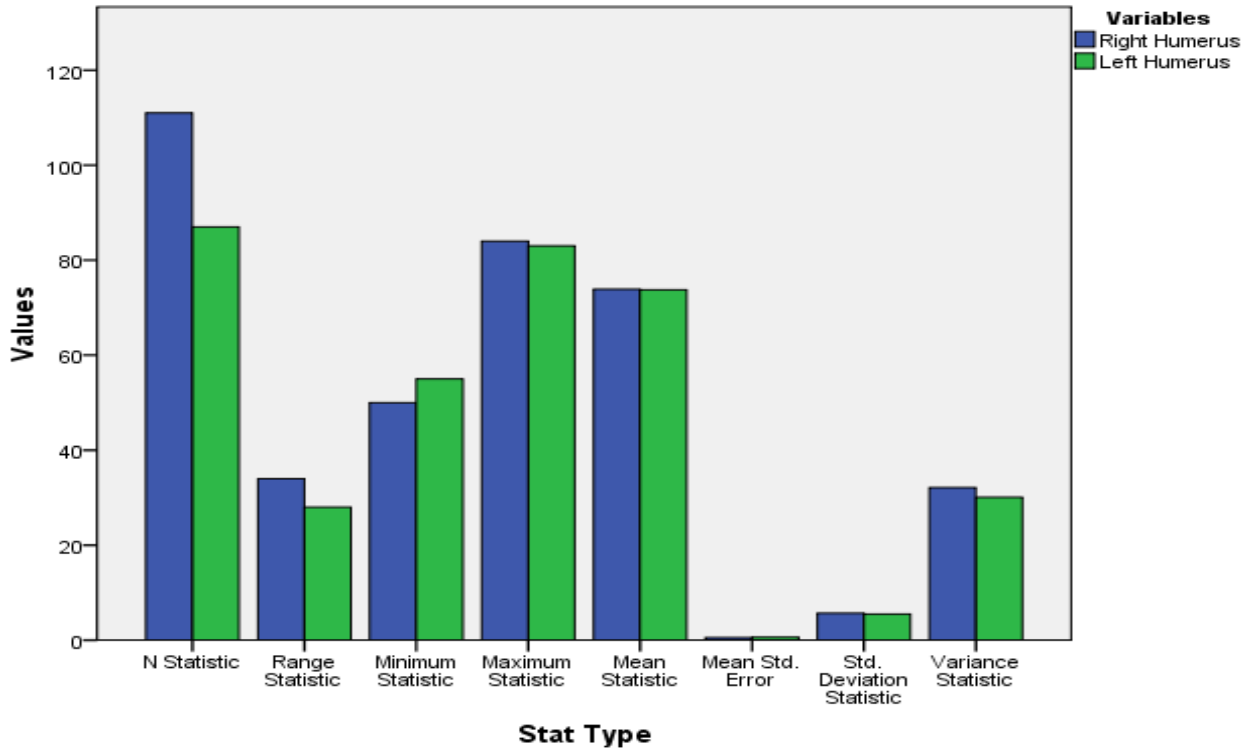

Table 2: Z-Test for Hypothesis

	Mean	variance	STD Deviation	Z-critical	Z-Value	Level of significance
Right torsion (φ)	**73.87**	**32.093**	**5.665**	**1.96**	**0.10**	**Not significant**
Left torsion (φ)	**73.78**	**30.080**	**5.484**			

Table 2 shows sample test to assess the difference in the means, variance and standard deviation between the right and left side

Torsion and rotation are two different phenomena. The angle made by the crossing of the axes of the two opposite ends, when measured obtusely includes 90-degree rotation, which the entire upper limb undergoes during its development in the embryo. In this study the mean angle reveals that there is variation on the angle of humeral torsion which is 73.83 degree**.** The range of variation in this study was 50 degrees to 84 degrees.

A comparison of torsion angle reported by different studies show that there is a considerable racial variation. Among all the investigators who have studied torsion in different races, highest average degree of torsion is found to occur in white races. It would be interesting to note that with lower degree of torsion the incidence of recurrent anterior dislocation may be less common in Nigeria but so far no clinical data is available to support this hypothesis.

Studies from Patil *et al* (2016) and Skaria & Kulkarni (2022) have found positive relationship between increased humeral torsion and recurrent anterior dislocation of shoulder (RADS), in which there was significant increase in the angle of humeral torsion in patients with RADS as compared to persons without any history of RADS or shoulder trauma. However, Larson (2007) reported no difference in torsion between normal shoulders and those with recurrent anterior dislocation of shoulder (RADS).

Furthermore, studies of individuals, whether participants in selected sports, show that humeral torsion, rather than being a static attribute that encodes only phylogenetic information, actually is developmentally dynamic in its morphological expression. Because the lateral rotators insert within the proximal epiphysis whereas most of the medial rotators act distally on the shaft, forces working in opposite directions during development normally add approximately 32º of secondary torsion (Stephan & Henneberg, 2012). The extent of this secondary (developmental) torsion depends on a variety of factors.

The clinical implications of different humeral torsion angles include higher susceptibility to recurrent anterior dislocation of the shoulder (RADS) as well as shoulder instability.Repetitive throwing players and those in overhead sports can develop adaptive changes in humeral torsion which impact their performance capabilities while also increasing their potential for injuries. Findings from studying these variations enable the creation of specialized injury prevention and treatment measures and help enhance prosthetic engineering and design.
The current study faced multiple limitations because it lacks the necessary clinical data validating its results. Also, the study results cannot apply universally because humeral torsion angles show substantial differences between different racial groups. More research studies are necessary to establish the full extent of relationships between humeral torsion and shoulder functionality in addition to athletic injury risk assessment. The study demonstrates a necessity for additional research about how humeral torsion changes adapt to professional athletic conditions. The established limitations create a need for further scientific research to better understand the medical effects of different humeral torsion patterns.

4. CONCLUSION

The result of the study showed the right torsion (φ) 73.87± 5.67 and left torsion (φ) 73.78±5.48. There was no significant difference in mean values of angle of humeral torsion on right and left side bones. From this study it has been established that torsion angle is very important for movement of upper limb, upright and posture therefore, care should be taken in other not to fracture proximal and distal part of humerus. Hence public enlightenment and awareness should be created to avoid deformity.

COMPETING INTERESTS

The authors declare that there is no competing interest in this study.

ETHICAL APPROVAL

Ethical clearance was obtained from the research ethics committee of the University of Port Harcourt before commencement of the study.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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