



A comparative analysis of left and right arm carrying angles in physiotherapy students

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Abstract

The carrying angle is the angle formed between the arm and forearm when the elbow is fully extended and supinated. It is an important anatomical feature that varies between individuals and may differ between the right and left upper limbs. Understanding this variation is useful for physiotherapy assessment and clinical practice.

Aim: To compare the carrying angle of the right and left arm among physiotherapy students.

Objectives

- To measure the carrying angle of the right arm.
- To measure the carrying angle of the left arm.
- To compare the carrying angle between right and left arms in male and female students.

Methodology: A comparative observational study was conducted on 100 physiotherapy students aged 19–25 years. The sample included 50 males and 50 females. The carrying angle of both right and left arms was measured using a goniometer with the elbow in full extension and forearm in supination. The collected data were analysed using mean, standard deviation, range, and paired t-test to determine the p-value.

Results: A total of 100 physiotherapy students (50 males and 50 females) participated in the study. The mean carrying angle of the right arm was higher than that of the left arm in both males and females. In males, the mean carrying angle was $7.48^\circ \pm 0.88$ on the left side and $8.78^\circ \pm 0.91$ on the right side.

In females, the mean carrying angle was $12.52^\circ \pm 1.07$ on the left side and $13.50^\circ \pm 1.02$ on the right side. Statistical analysis using the paired t-test showed a statistically significant difference between the left and right arm carrying angles in both genders ($p < 0.05$).

Conclusion: The study concluded that there is statistically significant difference between the carrying angle of the right and left arms among physiotherapy students. The findings help in understanding normal anatomical variations important for clinical assessment.

Keywords: Carrying angle, goniometer, physiotherapy students, comparison, upper limb

Introduction

Definition

The carrying angle is the angle formed between the long axis of the humerus and the long axis of the forearm when the arm is fully extended and the palm is facing forward (supinated) [3].

In normal individuals:

- The carrying angle is typically 5–15 degrees.
- It is generally greater in females ($10\text{--}15^\circ$) than in males ($5\text{--}10^\circ$) due to differences in pelvic width and body structure.

The carrying angle permits the forearm to clear the hips in swinging movements during walking and is important when carrying objects. Studies have shown that the range of motion of the elbow and carrying angle increases with age to skeletal maturity [3]. It is important to know the carrying angles of both elbows in the evaluation of deformities of distal humerus fractures.

Increased carrying angle may lead to many clinical conditions like elbow instability, pain during exercises, decreased elbow flexion. If there is an increased risk of elbow dislocations. The present study is designed to estimate the difference in the left and right arm carrying angles of adolescent males and females of physiotherapy students studying in Kopergaon.

Physiotherapy students often engage in both academic and physical activities that place varying degrees of stress on upper limbs. Repetitive movements, manual therapy training and prolonged static postures may contribute to changes or adaptations in upper limb biomechanics, including the carrying angle. Understanding these changes is essential, as abnormal angulations may predispose individuals to musculoskeletal issues, particularly in elbow and shoulder region.

Material and Methodology

- **Source of data:** A sample will be collected from the OPD of Rastrashant Janardhan Swami College of Physiotherapy
- **Study design:** An observational study.
- **Sample population:** Students Aged between 18–25 years.
- **Sampling method:** Convenience sampling.
- **Sample size:** 100
- **Participants:** 18–25 year old students.
- **Study duration:** Six Months.

Material

- Goniometer
- Pen, paper
- Marker
- Camera

Participants

A total of 100 physiotherapy students participated in this study age between 18 to 25 yrs and above were recorded using convenient sampling.

Inclusion Criteria

- Students aged 18–25 years.
- Healthy students without any upper limb deformities or injuries.
- Both male and female students included.

Exclusion Criteria

- History of fractures.
- History of surgeries.
- Congenital anomalies of the upper limb.

Outcome Measure

- Primary Outcome Measure
- Carrying Angle (in degrees) Measured using a universal goniometer.
- Position Elbow fully extended, forearm supinated.
- Measured for right and left arm.
- Recorded in degrees (°).
- Secondary Outcome Measures
- Side-wise Comparison.

Procedure

a. Participant Selection

- Participants will be selected on the basis of the inclusion and exclusion criteria.
- The participants will be explained about the procedure and consent will be taken.

b. Preparation and Positioning

- The student will be made to stand in the anatomical position with the elbow fully extended and supinated.

c. Placement of Goniometer & Measurement of Carrying Angle

- The goniometer's arm will be aligned in a straight line.
- The measurement plate of the goniometer will be positioned at the center of the right elbow joint.
- The stationary arm of the goniometer will be aligned with the axis of the right forearm.
- The movable arm of the goniometer will be positioned along the length of right arm.
- The angle will be determined using the measurement plate.
- The identical procedure will be carried out on the left arm.

d. Data Recording

- Record the angle of the carrying angle in degrees. Collect demographic data, such as age, gender and dominant arm, since these factors can influence the carrying angle.

e. Limitations and Controls

- Control for external factors that might affect measurements, such as arm position.
- Take note of any limitations in the measurement technique.

f. Analysis and interpretation

- **Data Compilation:** All collected data will be organized in a tabulated form, including participants' demographic details (age, gender, hand dominance) and measured carrying angles of both left and right arms.

Statistical Analysis

The collected data were entered into Microsoft Excel for analysis. Descriptive statistics such as mean and standard deviation were calculated for the carrying angle of the left and right upper limbs in male and female subjects.

To compare the mean carrying angle between the left and right upper limbs of the same subjects, a paired t-test was applied. To compare the mean carrying angle between male and female subjects, an unpaired (independent) t-test was used.

The level of statistical significance was set at $p < 0.05$. The data were presented in the form of tables and charts.

Results

The present study compared the carrying angle of the left and right upper limbs among male and female subjects.

Male Subjects (n = 50)

Mean carrying angle on left side = 7.48° (SD = 0.88)

Mean carrying angle on right side = 8.78° (SD = 0.91)

An independent t-test was applied to compare the mean carrying angles between the two sides. The calculated t value = 7.29. This value is higher than the table value at $p < 0.05$, indicating a statistically significant difference between the left and right carrying angles in males.

The results show that the right side carrying angle is significantly greater than the left side in male subjects.

Female Subjects (n = 50)

Mean carrying angle on left side = 12.52° (SD = 1.07)

Mean carrying angle on right side = 13.50° (SD = 1.02)

An independent t-test was applied to compare the mean carrying angles between the two sides. The calculated t value = 4.70. This value is higher than the table value at $p < 0.05$, indicating a statistically significant difference between the left and right carrying angles in females.

The results show that the right side carrying angle is significantly greater than the left side in female subjects.

Overall Interpretation

In both males and females, the right upper limb shows a greater carrying angle than the left.

The difference is statistically significant in both groups.

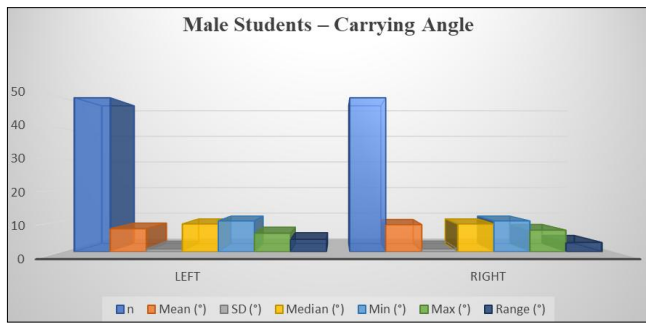
Females have a higher carrying angle compared to males on both sides.

This indicates a side dominance effect and a gender difference in carrying angle among the study population.

Data analysis chart

Table 1: Male Students – Carrying Angle

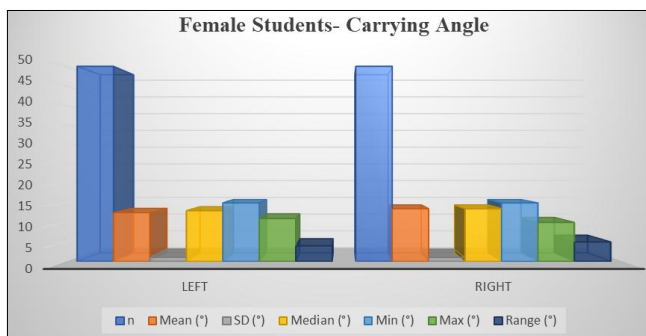
Arm	n	Mean (°)	SD (°)	Median (°)	Min (°)	Max (°)	Range (°)
Left	50	7.48	0.886175	9	10	6	4
Right	50	8.78	0.910035	9	10	7	3



Graph 1: Male Students – Carrying Angle

Table 2: Female Students – Carrying Angle

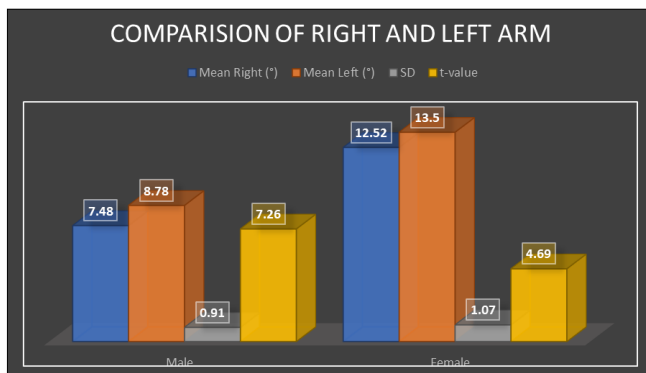
Arm	N	Mean (°)	SD (°)	Median (°)	Min (°)	Max (°)	Range (°)
Left	50	12.52	1.07362	13	15	11	4
Right	50	13.5	1.02271	13.5	15	10	5



Graph 2: Female Students – Carrying Angle

Table 3: Paired Comparison of Right and Left Arm

Gender	Mean Right (°)	Mean Left (°)	SD	t-value	p-value	Significance
Male	7.48	8.78	0.91	7.26	0.000	Statistically Significant
Female	12.52	13.5	1.07	4.69	0.000	Statistically Significant



Graph 3: Graph of Paired Comparison of Right and Left Arm

Discussion

The study found that the mean carrying angle of the right arm was higher than the left arm in both males and females, and this difference was statistically significant. This indicates that carrying angle is not symmetrical even in healthy individuals.

Females showed higher carrying angle values than males on both sides. The side-to-side variation may be due to hand dominance and habitual functional use of the upper limb, leading to adaptive alignment at the elbow joint.

These findings suggest that gender and limb dominance should be considered during clinical assessment of carrying angle.

Conclusion

This study was conducted to compare the carrying angle of the left and right upper limbs among physiotherapy students. Carrying angle was measured using a standard goniometric method in both male and female participants. The results of the study showed that the mean carrying angle of the right arm was higher than that of the left arm in both males and females. Statistical analysis using the paired t-test revealed that this difference between the two sides is statistically significant ($p < 0.05$).

It was also observed that female participants had higher carrying angle values compared to male participants. The variation in carrying angle between sides may be attributed to hand dominance and habitual functional use of the upper limb, leading to adaptive changes at the elbow joint.

Hence, the study concludes that there is a significant difference in carrying angle between the left and right arms among physiotherapy students, with the right arm showing higher values. Gender differences and hand dominance should be considered while assessing carrying angle in clinical and academic practice.

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