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Relationship between selected anthropometric variables and shoulder strength of throwball players

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Abstract
The present study investigates the relationship between selected anthropometric variables and shoulder strength among senior state-level male Throwball players. The primary objective was to determine whether specific morphological traits could significantly influence shoulder strength, a key performance factor in Throwball. Forty male players from Dhanbad district, Jharkhand, were randomly selected as subjects. Anthropometric measurements, including arm length, forearm length, palm length, upper arm circumference, and forearm circumference, were recorded using standardized tools. Shoulder strength was assessed through the Medicine Ball Throw Test. Pearson's correlation coefficient was employed for statistical analysis at a 0.05 level of significance. The findings revealed significant positive correlations between arm length, upper arm circumference, and forearm circumference with shoulder strength, whereas forearm length did not exhibit a significant relationship. These results suggest that selected anthropometric variables can positively influence shoulder strength and may be useful criteria for athlete selection and targeted training in Throwball. The study emphasizes the role of body structure in optimizing sports performance.

Keywords: Anthropometry, shoulder strength, throwball players, upper limb measurements, sports performance

Introduction
The purpose of this study was to examine the relationship between selected anthropometric variables and shoulder strength among Throwball players. Specifically, the study aimed to determine whether certain morphological traits, which are less influenced by training, could serve as discriminating factors in athletic performance.

The study included regular anthropometric measurements, which allowed for the computation of body proportion indices. Body fat percentage was determined using bioelectrical impedance analysis, and the Heath-Carter method was employed to assess somatotype. Additionally, measurements of back strength and grip strength in both hands were taken.

Results from previous studies indicate that players at higher competitive levels tend to have larger body sizes and greater muscularity, providing an advantage in physical confrontations. However, there were no significant differences in subcutaneous fat or total body fat percentage between groups. While muscle strength varied among teams, these differences were not statistically significant.

Throwball is a physically demanding sport characterized by frequent body contact and a combination of aerobic and anaerobic activities, including sprints, jumps, throws, and quick directional changes. Success in Throwball requires a blend of technical skills, tactical awareness, anthropometric advantages, physical performance, and proficient shooting abilities.

Previous research has documented positional differences in physiological and physical demands. For example, pivots and backcourt players exhibit higher in-game heart rates and spend more time at higher intensities compared to other positions. Additionally, anthropometric variations across positions are evident, with wing players typically having lower body mass and BMI, while pivots exhibit higher body weight and experience more physical contact.

Isokinetic dynamometry has been extensively used to assess muscle strength and identify injury risk factors in athletes, though most research has focused on female Throwball players and shoulder strength. Limited studies have examined how playing position affects isokinetic knee strength in male Throwball players.

Ball velocity is a crucial performance factor in Throwball, dependent on effective proximal-to-distal force transmission from the lower body through the trunk to the throwing arm. Although body height and weight have shown significant correlations with throwing velocity, the relationships with lower limb strength, sprint speed, and aerobic capacity remain inconclusive.

Over arm throwing is a key skill in Throwball, placing considerable stress on the shoulder complex and requiring dynamic stabilization of the glenohumeral joint. Previous studies have demonstrated that greater shoulder muscle strength correlates with increased throwing velocity.

The explosive strength deficit (ESD) is relevant to high-power sports like Throwball, where minimizing the gap between maximum strength and task-specific strength is critical for performance.

Anthropometric traits such as body mass, limb length, and arm span are potential contributors to throwing performance. However, the relationship between basic anthropometric measurements and throwing velocity remains complex and sometimes contradictory.

The present study aimed to

1. Investigate the relationship between selected anthropometric variables and shoulder strength in Throwball players.
2. Examine whether anthropometric factors such as arm length, forearm length, palm length, upper arm circumference, and forearm circumference significantly influence shoulder strength.

Methodology

Subjects

The study was conducted on 40 male senior state-level Throwball players randomly selected from the Dhanbad district, Jharkhand, in 2024. The age of the participants ranged from 18 to 2 years.

Design

The study followed a random group design to investigate the relationship between selected anthropometric variables and shoulder strength.

Variables and Measurement Tools

Variables	Measuring Tools	Unit of Measurement
Arm Length	Anthropometric Rod	Centimeters
Forearm Length	Anthropometric Rod	Centimeters
Palm Length	Anthropometric Rod	Centimeters
Upper Arm Circumference	Measuring Tape	Centimeters
Forearm Circumference	Measuring Tape	Centimeters
Shoulder Strength	Medicine Ball Throw Test	Score

Statistical Procedure

Pearson's correlation coefficient (r) was used to analyze the relationship between the variables at a 0.05 level of significance.

Findings

Table 1: Relationship between Arm Length and Shoulder Strength

	Arm Length (cm)	Shoulder Strength	"r" ratio
Mean	67	4	0.399462
Standard Deviation (SD)	9.22	0.86	

Interpretation

The correlation coefficient (r = 0.399) is greater than the tabulated value (0.304), indicating a Significant positive relationship between arm length and shoulder strength.

Table 2: Relationship between Forearm Length and Shoulder Strength

	Forearm Length(cm)	Shoulder Strength	'r' Ratio
Mean	27	4	0.193443
Standard Deviation (SD)	1.66	0.86	

Interpretation

The correlation coefficient (r = 0.193) is less than the tabulated value (0.304), indicating no significant relationship between forearm length and shoulder strength.

Table 3: Relationship between Upper Arm Circumference and Shoulder Strength

	Upper Arm Circumference (cm)	Shoulder Strength	'r' Ratio
Mean	25	4	0.355511
Standard Deviation (SD)	2.08	0.86	

Interpretation

The correlation coefficient (r = 0.356) is greater than the tabulated value (0.304), indicating a significant positive relationship between upper arm circumference and shoulder strength.

Table 4: Relationship between Forearm Circumference and Shoulder Strength

	Forearm Circumference (cm)	Shoulder Strength	'r' Ratio
Mean	21	4	0.396943
Standard Deviation (SD)	1.41	0.86	

Interpretation

The correlation coefficient (r = 0.397) is greater than the tabulated value (0.304), indicating a significant positive relationship between forearm circumference and shoulder strength.

Discussion

Sports performance is influenced by a combination of physical, psychological, psychomotor, physiological, and sociological factors. In Throwball, throwing and shooting performance are strongly related to upper limb anthropometric measurements.

The results of this study reveal that

Arm length, upper arm circumference, and forearm circumference significantly correlate with shoulder strength, suggesting these anthropometric factors can positively influence performance.

Forearm length showed no significant relationship, indicating it may not directly impact shoulder strength.

These findings align with prior research emphasizing the importance of shoulder strength and limb proportions in overhead throwing sports.

Conclusion

Based on the findings of this study:

1. Arm Length shows a significant positive influence on shoulder strength.
2. Forearm Length does not show a significant influence on shoulder strength.
3. Upper Arm Circumference significantly influences shoulder strength.
4. Forearm Circumference significantly influences shoulder strength.

Summary

This study highlights the importance of specific anthropometric factors in enhancing shoulder strength, which is crucial for Throwball performance. Coaches and physical educators should consider these morphological characteristics during athlete selection and training to optimize performance potential.

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