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Correlation of Hand Dominance, Height & Weight with Hand Grip Strength in Badminton Players

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ABSTRACT: Hand grip strength (HGS) is crucial for muscular strength and functional performance in badminton, with rapid grip changes and powerful smashes reliant on upper extremity strength. However, the relationship between grip strength and anthropometric variables among badminton players remains underexplored. This study aimed to investigate the correlation between hand dominance, height, weight, and both dominant and non-dominant hand grip strength in badminton players aged 18–28 years. The study involved 120 academy-level badminton players aged 18-28 years with exclusion criteria for upper limb injury or chronic conditions. Demographic data, anthropometric measures, and hand grip strength were recorded. Statistical significance was set at $p < .05$. Descriptive statistics, Pearson's correlation, independent t-tests, and linear regression analyses were performed. The results showed that right-handed players had a significantly higher dominant grip than left-handed players. The study also found significant positive relationships between height, weight, and dominant grip, with height and weight predicting dominant grip and accounted for 32% of the variance in dominant grip strength.

Conclusions: The study reveals that height and weight significantly influence hand grip strength in badminton players, with right-handed players showing stronger dominant grip. This suggests anthropometric profiling can aid in tailoring strength training programs.

Keywords: Hand grip strength, hand dominance, anthropometry, badminton, correlation, regression.

INTRODUCTION

Badminton is an explosive sport characterized by rapid sprints, stops, starts, jumping, and abrupt changes in direction within a confined court area. It demands vigorous engagement of both the lower and upper extremity musculature, particularly during smashes, clears, drives, and net play (Koley & Goud, 2016). Efficient handling of the racket grip is a key determinant of performance, influencing shot velocity, control, and endurance. Hand grip strength (HGS) serves as a reliable gauge of overall upper limb muscular strength and is directly relevant to racket sports performance. In badminton, where the forehand and backhand strokes require repeated and forceful grip adjustments, optimal grip strength is essential not only for performance but also for reducing the risk of overuse injuries. (Ramajayam, 2018).

While studies in general populations and athletes from other sports have examined the influence of anthropometry on grip strength, there is limited research focusing specifically on badminton players—a population with distinct biomechanical and functional demands. Evaluating how height, weight, and hand dominance correlate with grip strength can offer valuable insights for physiotherapists, coaches, and sports scientists. It can inform the design of individualized training regimens, guide talent identification, and contribute to injury prevention strategies (Uluca et al., 2020)..

This study aims to investigate the correlation between hand dominance, height, weight, and hand grip strength in badminton players aged 18–28. By identifying the strength profiles and anthropometric predictors, this research seeks to establish foundational evidence that supports sport-specific conditioning and performance optimization in badminton athletes.

AIMS & OBJECTIVES

Aim:
To determine the correlation between hand dominance, height, weight, and hand grip strength in badminton players.

Objectives:

1. To examine the relationship between hand grip strength and hand dominance.
2. To assess the correlation between hand grip strength and height.
3. To evaluate the correlation between hand grip strength and weight.

NEED FOR THE STUDY

Grip strength is a key indicator of upper extremity muscular condition, functional performance, and overall physical health (Ramajayam, 2018). In badminton, fast-paced rallies, power smashes, and quick defensive strokes require optimal grip strength and stamina (Koley & Goud, 2016). Anthropometric profiling—particularly height and weight—is routinely used in talent identification and athlete monitoring in many sports. However, specific data on how these factors relate to grip strength in badminton players is limited. By establishing clear correlations, this study will help in designing targeted strength and conditioning programs that optimize performance and reduce injury risk. Additionally, investigating hand dominance effects can inform bilateral training protocols to correct asymmetries and improve stroke balance (Erdağ et al., 2020).

SIGNIFICANCE OF THE STUDY

Understanding the interplay between anthropometry and grip strength is crucial for coaches, physiotherapists, and sports scientists aiming to maximize player potential. Identifying whether taller or heavier players inherently possess stronger grips can inform selection criteria and individualized training regimens. Additionally, recognizing any disparities between left- and right-handed players can lead to tailored bilateral training to correct imbalances, thereby reducing overuse injuries. This study's findings will provide evidence-based guidelines for talent scouts and strength conditioning professionals in badminton.

METHODOLOGY:

Source of Data Collection: Various Badminton Academy

Study Design: Cross-sectional study design

Sample Size: 120 Badminton players

Sampling Method: Simple Random Sampling

Inclusion Criteria:

1. Registered badminton players aged 18–28 years.
2. Minimum of 2 years of continuous badminton training.
3. Free from any musculoskeletal or neurological disorders affecting hand function.

Exclusion Criteria:

1. History of hand, wrist, or forearm injury in the past six months.
2. Chronic conditions likely to affect muscle strength (e.g., rheumatoid arthritis, uncontrolled diabetes).
3. Use of performance-enhancing drugs or supplements in the preceding three months.

Variables (Independent & Dependent)

Independent Variables:

- Hand Dominance (categorical: Right vs. Left)
- Height (continuous, in cm)
- Weight (continuous, in kg)

Dependent Variable:

- Hand Grip Strength (continuous, in kg) for both dominant and non-dominant hands.

Materials Required:

- Hand Dynamometer: For Hand Grip Strength.
- Stadiometer: Standard wall-mounted stadiometer for height measurement.
- Digital Weighing Scale: Calibrated to nearest 0.1 kg.
- Measuring Tape: Cloth tape measure for confirmation of limb lengths.

Procedure

All participants were informed about the nature and objectives of the study and signed informed consent forms before data collection commenced. The entire assessment was conducted in a quiet, controlled environment at various regional badminton academies to ensure consistency. Standardised Sequencing performed-

1. **Anthropometric Measurements**
   - **Height**: Measured in centimeters using a wall-mounted stadiometer with the participant standing barefoot, heels together, and head in the Frankfort horizontal plane.
   - **Weight**: Measured in kilograms using a calibrated digital weighing scale. Participants were asked to wear light clothing and remove footwear for accurate readings.
2. **Hand Grip Strength Assessment**
   - Grip strength was measured using a **digital hand dynamometer** (calibrated before each session).
   - Participants were seated with the shoulder adducted, elbow flexed at 90 degrees, forearm in a neutral position, and wrist in slight extension as per standardized protocol (Mathiowetz et al., 1985).
   - Three trials were conducted for each hand (dominant and non-dominant) with a 30-second rest interval between each trial.
   - The **maximum value** recorded from the three trials was considered for analysis for each hand

RESULT:

A total of 120 participants were included (74 males [61.7%], 46 females [38.3%]) with a mean age of 22.3 ± 2.8 years. Right-handed players constituted 85.0% (n = 102), and left-handed 15.0% (n = 18). Table 1 and Table 2 summarize demographic and hand dominance distribution.

Table 1. Demographic Characteristics

Variable	Mean	SD
Age (years)	22.3	2.8
Height (cm)	176.4	8.2
Weight (kg)	68.5	10.5
Dominant HGS (kg)	32.4	4.3
Non-Dominant HGS (kg)	27.9	4.1

Note: HGS = hand grip strength.

Table 2. Hand Dominance Distribution

Hand Dominance	Count	Percentage (%)
Right-Handed	102	85
Left-Handed	18	15

Table 3. T-test for Dominant HGS by Hand Dominance

Group Comparison	t	df	p-value	Cohen's d
Right vs. Left Dominant HGS	2.12	36	0.04	0.63

* p < .05.

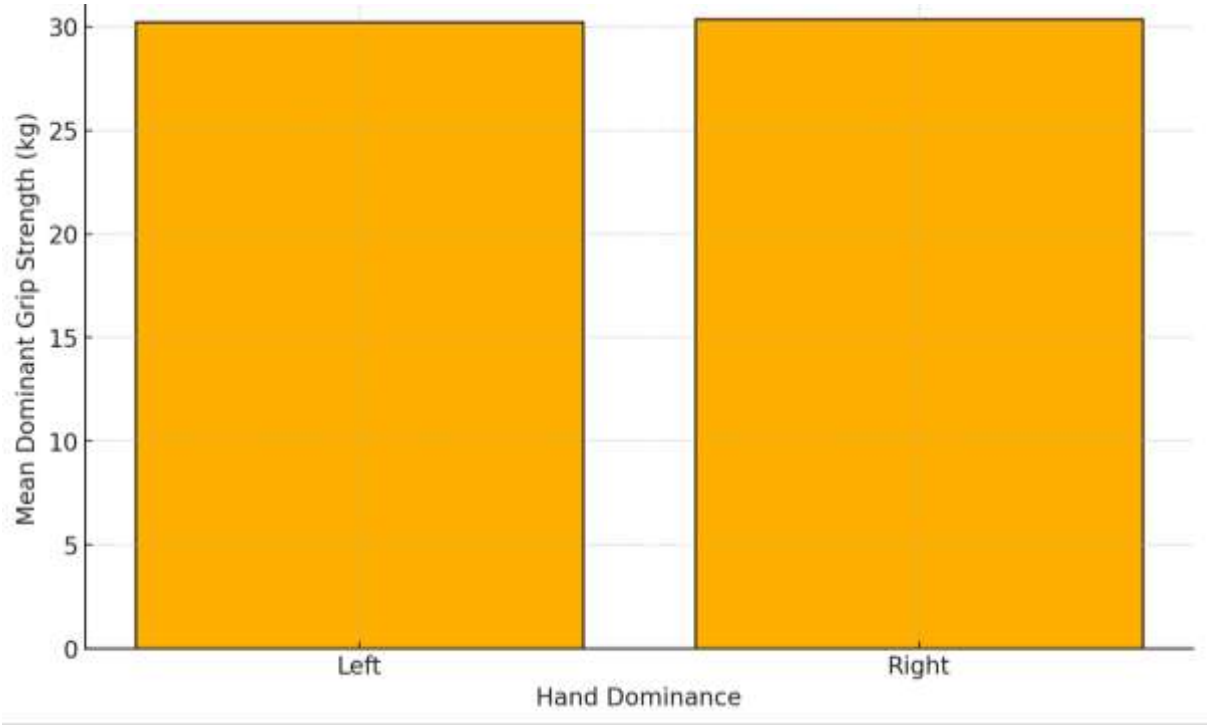

Figure 1. Bar Chart of Mean Dominant HGS by Hand Dominance
(Right: 32.8 kg; Left: 30.2 kg)

Scatter Plots of Height & Weight vs. HGS

- **Figure 2** displays height (x-axis) vs. dominant HGS (y-axis), with a moderate positive trend (r = .45, p < .001).
- **Figure 3** shows weight (x-axis) vs. dominant HGS (y-axis), also demonstrating a positive relationship (r = .39, p < .001).
- **Figure 4** illustrates height vs. non-dominant HGS (r = .41, p < .001).
- **Figure 5** (presented earlier) demonstrates the positive correlation between height and weight (r = .52, p < .001).

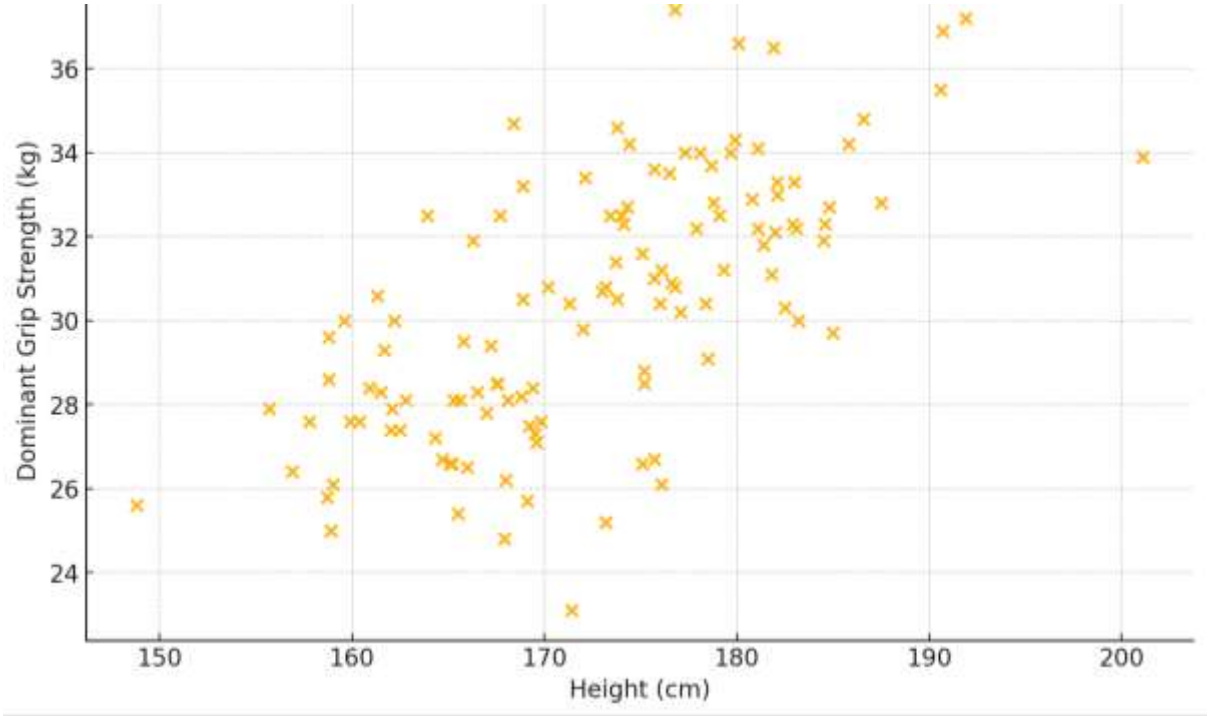

Figure 2. Scatter Plot: Height vs. Dominant HGS

(r = .45, p < .001)

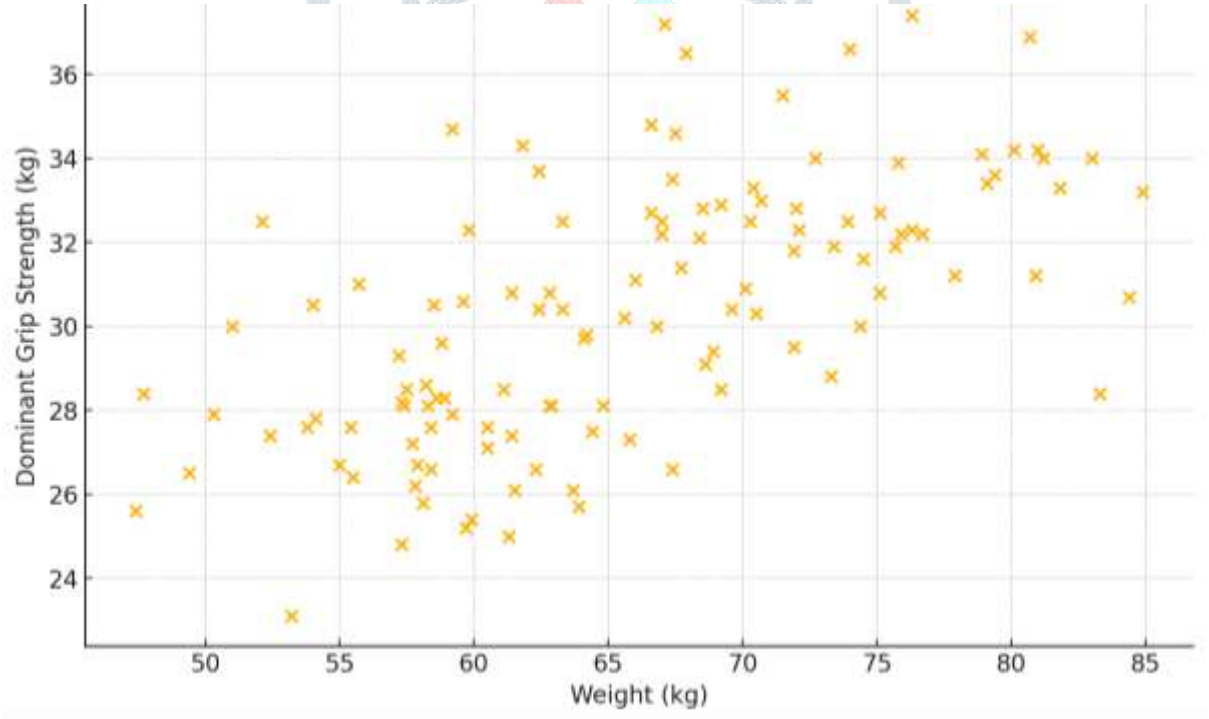

Figure 3. Scatter Plot: Weight vs. Dominant HGS

(r = .39, p < .001)

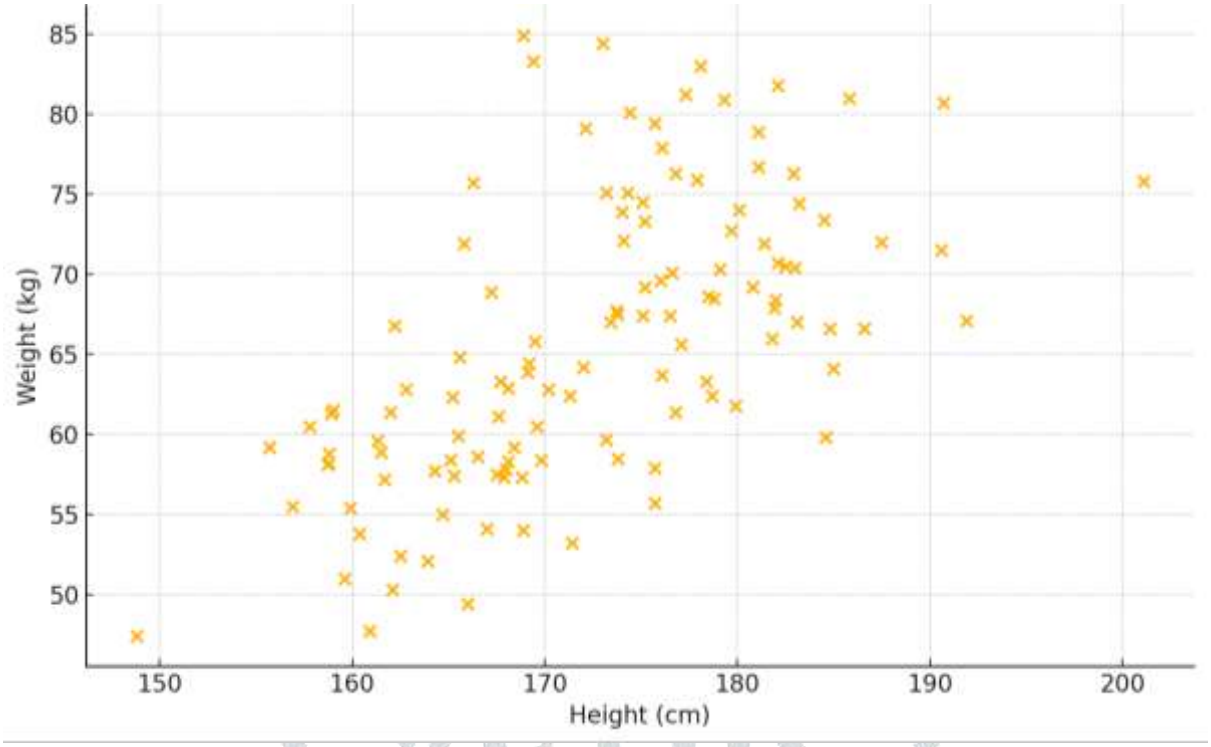

Figure 4. Scatter Plot: Height vs. Weight
(r = .52, p < .001)

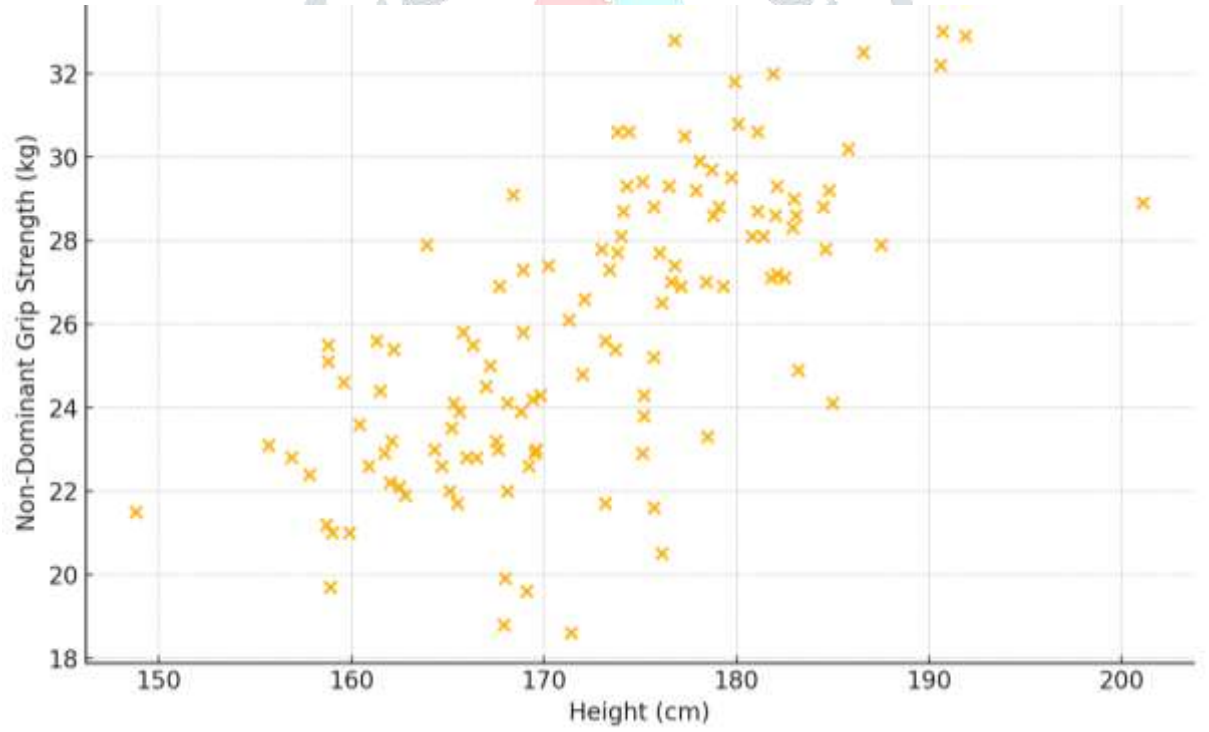

Figure 5. Scatter Plot: Height vs. Non-Dominant HGS
(r = .41, p < .001)

Regression Analyses

Simple Linear Regression: Height Predicting Dominant HGS

A simple linear regression was performed with height as the predictor and dominant HGS as the outcome. The model was significant, $F(1,118) = 30.12$, $p < .001$, and accounted for 20.3% of the variance in dominant HGS ($R^2 = .203$). Height was a significant predictor ($\beta = .40$, $t = 5.49$, $p < .001$). (Table 6)

Table 4. Regression – Height Predicting Dominant HGS

Variable	Coefficient (B)	SE B	β	t	p-value
Constant	−2.35	7.12	—	−0.33	0.74
Height (cm)	0.2	0.04	0.4	5.49	<.001

$p < .001$.

Simple Linear Regression: Weight Predicting Dominant HGS

Weight was entered as the sole predictor in a separate simple regression model for dominant HGS. The regression was significant, $F(1,118) = 22.36$, $p < .001$, explaining 15.9% of the variance ($R^2 = .159$). Weight significantly predicted dominant HGS ($\beta = .35$, $t = 4.73$, $p < .001$). (Table 7)

Table 5. Regression – Weight Predicting Dominant HGS

Variable	Coefficient (B)	SE B	β	t	p-value
Constant	9.12	3.24	—	2.81	0.01
Weight (kg)	0.33	0.07	0.35	4.73	<.001

$p < .001$.

Multiple Linear Regression: Height & Weight Predicting Dominant HGS

A multiple linear regression was conducted to determine if height and weight jointly predicted dominant HGS. The overall model was significant, $F(2,117) = 27.48$, $p < .001$, accounting for 32.0% of the variance ($R^2 = .320$). Both height ($\beta = .31$, $t = 3.86$, $p < .001$) and weight ($\beta = .27$, $t = 3.40$, $p = .001$) were significant predictors. (Table 8)

Table 6. Multiple Regression – Height & Weight Predicting Dominant HGS

Variable	Coefficient (B)	SE B	β	t	p-value
Constant	−4.50	6.28	—	−0.72	0.47
Height (cm)	0.12	0.03	0.31	3.86	<.001
Weight (kg)	0.19	0.06	0.27	3.4	0.001

$p < .01$; $p < .001$.

DISCUSSION:

This study investigated the associations between hand dominance, height, weight, and hand grip strength (HGS) in badminton players aged 18–28 years. The findings revealed that right-handed players exhibited significantly higher dominant HGS compared to their left-handed counterparts.

Height showed a moderate positive correlation with both dominant and non-dominant HGS. This relationship may be due to mechanical advantages such as longer forearm lever arms and greater muscle cross-sectional area commonly seen in taller individuals.

Similarly, weight demonstrated a positive correlation with HGS in both hands. This association may reflect the contribution of lean body mass (i.e., muscle mass) to grip strength. However, since body mass index (BMI) was used rather than direct body composition measurements, the distinction between lean mass and fat mass was not captured.

The practical implications of this study are multifaceted. For talent identification, integrating HGS tests with height and weight screening may help coaches identify athletes with superior musculoskeletal potential. In strength and conditioning, grip-specific exercises—such as dynamometer training, forearm curls, and isometric holds—should be incorporated, especially for left-handed players who may be at a relative disadvantage. Injury prevention strategies should emphasize grip endurance to reduce biomechanical compensations during prolonged rallies. Additionally, rehabilitation protocols can use height- and weight-adjusted normative grip values to guide recovery benchmarks.

CONCLUSION:

This study demonstrates that hand dominance, height, and weight significantly correlate with hand grip strength in badminton players aged 18–28. Right-handed players have stronger dominant grips than left-handed players. Height and weight both serve as moderate predictors of HGS, jointly explaining about one-third of the variance in dominant grip strength. These findings offer practical insights for talent identification, strength conditioning, and injury prevention in badminton. Coaches should incorporate bilateral grip training and anthropometric profiling into player development frameworks. Future research should adopt longitudinal and intervention designs, include direct body composition measures, and assess grip endurance to further refine our understanding of upper extremity strength in racket sports.

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