



Original Research Article

## Relationship of Hand Anthropometry and Hand Grip Strength in Junior Basketball Boys

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Received: 01/09/2014

Revised: 27/09/2014

Accepted: 08/10/2014

### ABSTRACT

The present study was planned to collect basic data of hand anthropometry and grip strength as well as find out the association of isometric hand grip strength and various hand anthropometry in junior district level basketball players. The study was conducted on 37 district junior male basketball players of Allahabad collected from Amitabh Bachhan sports complex (Mayo-hall) Allahabad with age ranging from 10-16 years. In this cross-sectional study, the subjects were selected randomly and anthropometric measurements; viz. age, height, weight, hand width, hand length and hand span were measured for each subject by standard tools and techniques. All variables except height and weight were measured on both the sides of the body. The grip strength of both right and left hands was measured using a Jamar Grip Dynamometer at standing position with shoulder adducted and neutrally rotated and elbow straight. Result showed that hand width and hand span were greater in left hand except the hand length but it was not significant. A remarkable observation has been found out that isometric grip strength of the left / non dominant hand was higher than right/ dominant hand. May be because of hand width and hand span values were higher in left/ non dominant hand so that greater grip strength was found in the same hand than the right/ dominant hand. It may be attributed that during training as well as game both hands are widely and majorly used by the all position and in maximum techniques and tactics like left and right hand rebounding, lay ups, deflection, passing as well as fake and feints.

**Keywords:** Grip strength, hand anthropometry, basketball players, dominant and non dominant hand

### INTRODUCTION

Strength can be explained as the maximal force of the muscle (s) or muscle group. Strength may be the production of collaborative approach of our neurons and muscle cells against the resistance. Muscular strength and power are generally acknowledged as being important in all team sports and sports that are dominated by speed. [1] Strength in basketball does depend

on the athlete's position to an extent, although all basketball players need a significant amount of muscle strength. [2]

Handedness inherits genetically, but hand grip strength is affected greatly by nutritional status of an individual, [2-3] and to follow – up of patients with neuromuscular disease. [4] Hand grip strength is a general term used by strength athletes, referring to the muscular strength and force that they can

generate with their hands. The strength of a hand grip is the result of forceful flexion of all finger joints, thumbs, and wrists with the maximum voluntary force that the subject is able to exert under normal biokinetic conditions. [5-6] Strong correlations between grip strength and various anthropometric traits were reported in different researches. [6-9] The longer the finger lengths, the better the accuracy of the shot or throw in the handball and basketball game. All shots and throws are finished with the wrist and fingers. It was proposed that athletes with longer fingers and greater hand surface parameters also probably have greater grip strength. [10] Grip strength was reported to be higher in the dominant hand with right handed subjects, but no such significant differences between sides could be documented for left hander people. [11] Dopsaj confirmed that men showed significantly greater maximal hand grip force in both dominant and non-dominant hands than women. [12]

Hand grip strength plays an important role to predict the performance in various sports activities especially in Baseball game, [13] racket games, [14] and in cricket. [6] It can be projected that person with longer and greater hand measurements also probably have better grip strength. Januszewski reported that for offence and defense there is a medium need for strength and for rebounding there is a medium to high need for strength. [2] Strength in Basketball does depend on the athlete's position to an extent, although all basketball players need a significant amount of muscle strength. Koley, Singh & Kaur was to evaluate the physical characteristics of the hand, the grip strength was chosen as one of the indicators of hand functions. [7] It has been suggested that athletes with longer fingers and larger hand surfaces enjoy stronger grip power. Therefore, some researchers have examined a number of

factors and anthropometric variables that explain this issue. [15]

Handgrip strength is important in basketball as various movements rely on the continuous use of wrist and digits flexor muscles when catching, holding, shooting and throwing the ball. Therefore, the assessment of handgrip strength is used in prepubertal, adolescent and adult basketball players. [16] In fact, in case of any overhead game, extensor as well as flexor muscles of the arm and the hand have considerable influence on the success. To the best of our knowledge, the information regarding the association of isometric hand grip strength and various hand anthropometry in junior basketball players is scanty, we attempt to gain more impending into probable contribution to this. So the present study was planned in such a way to collect basic data of hand anthropometry and grip strength of junior basketball players as well as to find any prediction in both to talent identification at early level.

## **MATERIALS AND METHODS**

The study was conducted on 37 district junior male basketball players from Amitabh Bachhan sports complex (Mayohall) Allahabad with age ranging from 10-16 years. A written consent was obtained from the participants to participate in this study randomly, which conformed to the Declaration of Helsinki. The data were collected under natural environmental conditions in the evening (between 4:00 to 7:00 pm).

In this cross-sectional study, the age of the participants were obtained from the records of their respective educational institutions. The subjects were divided in such a way that "age 12", for instance, refers to the children aged 11 years and 6 months through 12 years and 5 months and 29 days. All anthropometric measurements, viz. height (cm), weight (kg), hand width (cm),

hand length (cm) and hand span (cm) were measured for each subject by standard tools and techniques. [17] All variables except height and weight were measured on both the sides of the body.

The height was recorded during inspiration using a stadiometer (Holtain Ltd., crymych, Dyfed, UK) to the nearest 0.1 cm, and weight was measured by a standard Seca mechanical weight machine to the nearest 0.1 kg with proper technique. The hand length was measured with sliding caliper from the styloid process of the radius to tip of the middle finger. Hand width was measured straight distance between the points metacarpal radiale and metacarpal ulnare the by the flat ruler. For the hand span the hand is placed palm down on a flat surface. The fingers are as far as possible. Measure possible outstretched linear distance between the outside of the thumb to the outside of the little finger with the help of flat ruler.

The grip strength of both right and left hands was measured by using the Jamar Grip Dynamometer (Samsons, Billingsbrook, Canada) at standing position with shoulder adducted and neutrally rotated and elbow straight. All of the participants were given 5 minutes of independent warm-up. Then they were instructed to squeeze the dynamometer as tightly as possible, using the musculature of the hand. No part of the individual's upper or lower arm or hand may push against any object or against any other part of the body. The force exerted was read from the dial of the dynamometer in kilograms and the data was recorded for the best one, after three successful attempts with one minute rest between trials. The reliability of all the tests has been found highly satisfactory and all the anthropometric equipment and hand grip dynamometer were calibrated before the assessment.

**Statistical Analysis**

Descriptive statistics (mean ± standard deviation) were determined for all measured variables. Pearson's correlation coefficients were used for correlation coefficient test. Data were analyzed using SPSS (Statistical Package for Social Science). A 5% level of probability was used to indicate statistical significance.

**RESULTS**

The results of the study are shown in the following tables:

Table 1 mean & SD of hand dimensions and isometric grip strength of basketball boys

Variables	Mean	Standard Deviation
Age	14.324	2.0931
Height	160.054	12.9665
Weight	48.3378	11.8812
Right Hand Width	6.79444	0.564
Left Hand Width	6.8166	0.5904
Right Hand Length	19.56486	1.6518
Left Hand Length	19.46214	1.4950
Right Hand Span	20.8973	1.8385
Left Hand Span	20.8432	1.6804
Right Hand Strength	25.8378	8.7934
Left Hand Strength	27.40541	8.8025

In table 1 mean and standard deviation of selected hand dimension of Junior District level Basket-Ball Players are mentioned. The right hand anthropometric measures were greater than left hand but it was not significant. A remarkable observation has been found out that isometric grip strength of the left hand was higher than that of the right hand.

Table 2 correlation coefficient of isometric grip strength & hand dimensions of basketball boys

Variables	Correlation with Right Hand Strength	Correlation with Left Hand Strength
Age	0.716487	0.73363
Height	0.747686	0.74132
Weight	0.646471	0.655731
Hand Width	0.676704	0.724607
Hand Length	0.746084	0.765031
Hand Span	0.638903	0.622391

\* N = 37 Value of r (35) = 0.412 < 0.05 level

Table 2 shows the correlation coefficient between the right and left hand grip strength with anthropometric measures of basketball players. It was clearly

observed from the table 2 that all variables were highly significant with grip strength of right and left hand.

Figs 1-10 also show the linear regression for the right and left hand grip strength and other anthropometric variables of basketball players. It was observed that all the variables namely age, height, weight, hand width, hand length, and hand span of right and left hand has the direct significant relationship with their respective isometric hand grip strength.

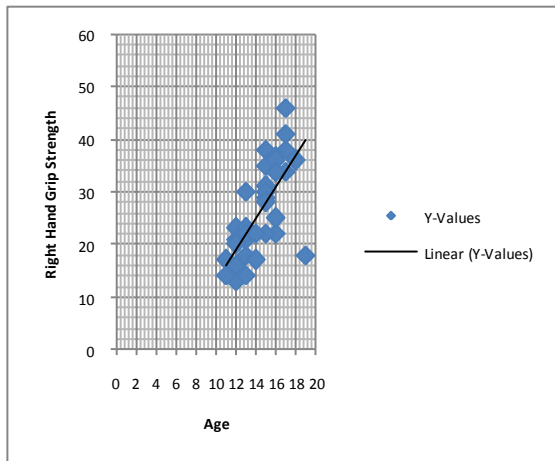


Figure 1 Scatter plot of hand grip strength (right) with age

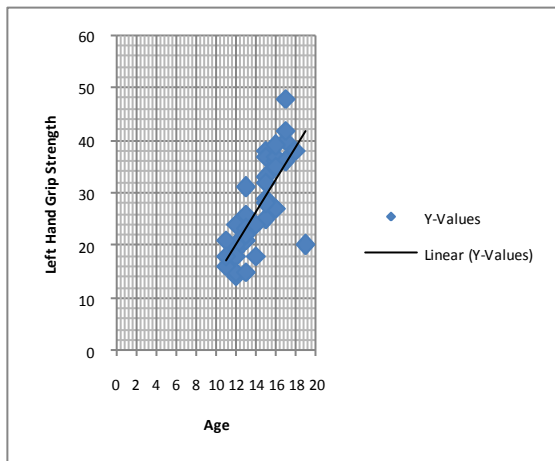


Figure 2 Scatter plot of hand grip strength (left) with age

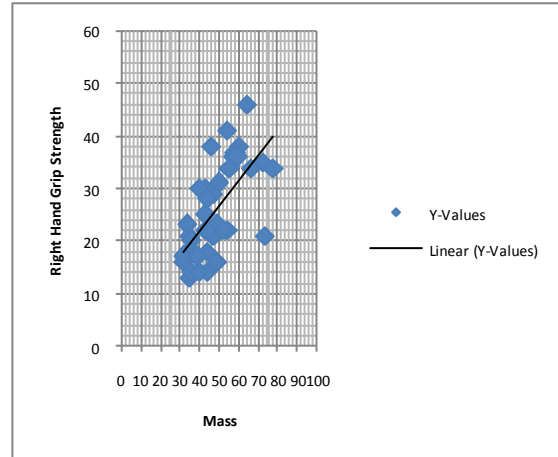


Figure 3 Scatter plot of hand grip strength (right) with mass

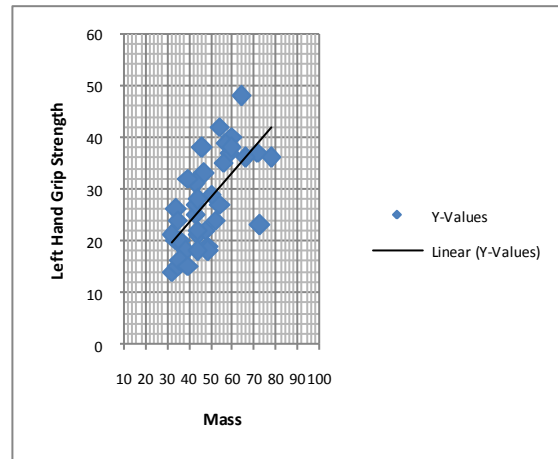


Figure 4 Scatter plot of hand grip strength (left) with mass

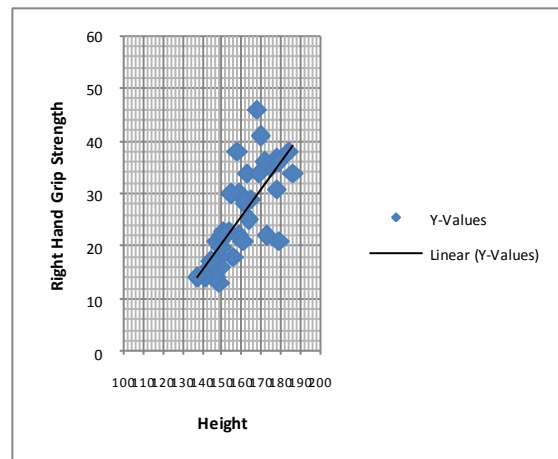


Figure 5 Scatter plot of hand grip strength (right) with height

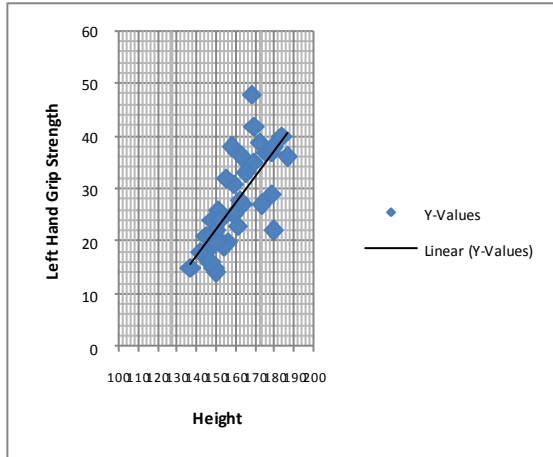


Figure 6 Scatter plot of hand grip strength (left) with height

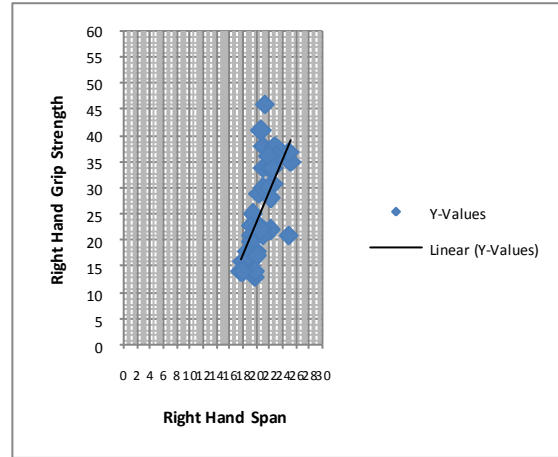


Figure 9 Scatter plot of hand grip strength (right) with hand span (right)

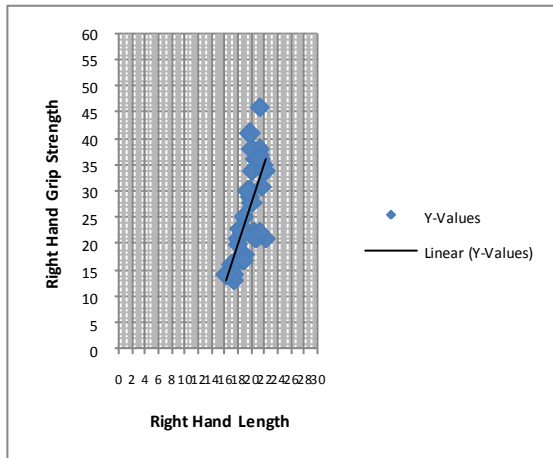


Figure 7 Scatter plot of hand grip strength (right) with hand length (right)

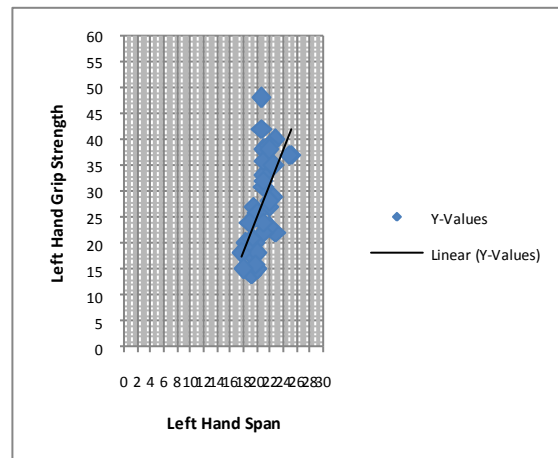


Figure 10 Scatter plot of hand grip strength (left) with hand span (left)

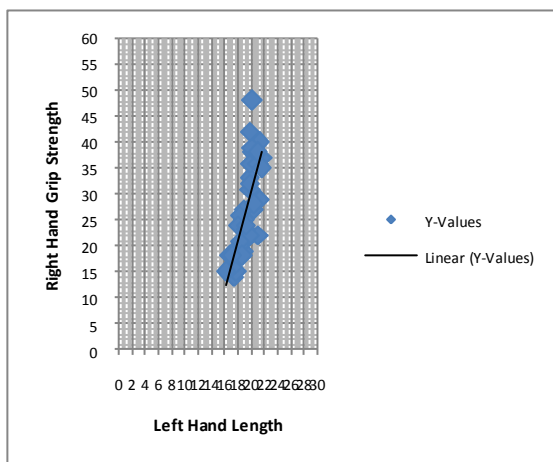


Figure 8 Scatter plot of hand grip strength (left) with hand length (left)

## DISCUSSION

In this study we found that the left hand dimensions (width & span) were greater than right hand except hand length but it was not significant. Meanwhile when we compared the mean of hand grip strength of right and left hand, it was significantly higher in left hand.

If we compare our study with the similar international study conducted by Cagatay, Pinar and Sibel (2008) [18] on school basketball players with (9-18) years of age we found that the previous group possessed higher values in right hand width ( $7.78 \pm 0.81$ ) to ( $6.79 \pm 0.564$ ), left hand width

(7.68±0.77) to (6.81±0.59), whereas later group possesses superior values in right hand length (19.56±1.65) to (17.28±1.77), left hand length (19.46±1.49) to (17.38±1.81), right hand grip strength (25.84 ± 8.79) to (23.07±10.32) and left hand grip strength (27.41±8.80) to (22.09±9.83). In our study superior values of right and left hand grip strength could be due to the significant superior difference in hand lengths as various studies conducted earlier stated the same. [5-7, 9, 18]

In this study all the anthropometric variables were significantly related to the isometric grip strength. Similar results were found in various studies conducted earlier. Right and left hand grip strength was positively correlated with weight, height and body surface area (Chatterjee & Chowdhuri, 1991). [8] Koley & Yadav (2009), Koley, Singh & Kaur (2010), [6-7] conducted various studies on relationship of anthropometric variables and hand grip strength among players of different games namely basketball, softball, and cricket and found that the anthropometric variables have the significant relationship with the grip strength. [7] Cagatay et al (2008) [18] found that in basketball volleyball and handball players' anthropometric variables and hand shape and size have the significant relationship with the grip strength. Passing, dribbling and shooting are the fundamentals of basketball, which requires adequate strength of the entire upper extremity. [7] Foo (2007) reported that hand grip strength reflects overall physical strength of an athlete. Hand grip strength was reported to have strong positive correlations with all the arm anthropometric characteristics (except arm fat area), showing functional efficacy of arm length, arm area, and arm muscle area to generate adequate strength. [19] Koley, Singh, & Kaur (2010) stated that hand length has the significant effect on the grip strength. [7]

More interactions between athletes occur while rebounding. The athlete must jump towards the hoop; have enough strength to rip the ball out of another athlete's hands, and land with complete control of the basketball. This requires more strength because the athlete must account for the weight of the basketball and for the force applied by the opponent. [2] Fingers are the smallest, lightest parts of the motor apparatus, and, therefore, they represent the parts most easily deflected by force from the ball, but at the same time, finger control is especially important for the accuracy of different shots, both in handball and basketball. Thus, it is especially necessary to measure finger length and perimeters of the hand for practical reasons. [10] So, it may be concluded that arm anthropometric information would have immense academic value in the identification of sport talents in overhead games such as basketball.

For the grip strength there is a common rule that the dominant hand possesses significantly higher values of grip. [9,11,12] When comparisons were made between dominant right and left hand groups and non-dominant right and left hand groups, both in males and females, statistically no significant differences were noted in any case. [5]

## CONCLUSION

The study was limited to district level male players only and their training age and performance level were also not much significant. So it concluded that hand anthropometric measures (hand width and hand span) and hand grip strength have higher values in left / non dominant hand of the participants but both hand grip strength was significantly correlated with age, height, weight, hand length, hand width and hand span. It was also documented that all anthropometric measures and grip strength were highly significant correlated in both



hand with slightly greater correlation coefficient in left/ non dominant hand. There is the lack of support studies for this fact and the outcome may be due various reasons such as low sample size, variation in height ( $160.05 \pm 12.96$ ).

This contradictory outcome from previous studies was noticed in this study as the value of the grip strengths of the dominant hand was significantly lower than value of the non dominant hand. Because of hand width and hand span values were higher in left/ non dominant hand so that greater grip strength was found in the same hand than the right/ dominant hand. It may be attributed that during training as well as game both hands are widely and majorly used by the all position and in maximum techniques and tactics like left and right hand rebounding, lay ups, deflection, passing as well as fake and feints.

### **Practical Application**

The data presented in the present study carry immense practical applicability and should be useful in future investigation on player selection, talent identification in basketball and training program development. During training, all techniques may be based on the use of both hands with proper fake and feints. This study may be helpful to know the nutritional status of an individual as well as follow – up of rehabilitation program of the athletes.

### **ACKNOWLEDGEMENT**

The authors would like to thanks all the participants of the study and Ms Pratibha Chauhan (Basketball Coach, Mayo Hall, Allahabad) and Mr Jitendra Kumar Singh who cooperate in the study.

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How to cite this article: Chahal A, Kumar B. Relationship of hand anthropometry and hand grip strength in junior basketball boys. *Int J Health Sci Res.* 2014;4(11):166-173.

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