Original Article

A Study to Find Out the Correlation Between Grip Strength, Forearm Circumference, Forearm Length and Forearm Skinfold in Badminton Players

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Abstract

Background: A sturdy grip is formed by the powerful flexion of all the phalanges that a person can under normal biomechanical conditions. It is a functional variable which depends on age, gender and built of a person. It is also specifying overall muscles strength of a person. Grip strength is a useful guide of nutritional status. A powerful hand grip is a key component in performance of Badminton. This study is intended to find the corelation of grip strength with other anthropometric measurements of the upper limb such as forearm circumference, forearm length, and forearm skinfold for badminton players.

Method: 300 recreational badminton players were included within the age group of 18 to 38 years. Height, weight and age was documented for the participants. Grip strength was recorded using a hand-held dynamometer. Forearm length and forearm circumference was measured using a measuring tape. Forearm skin fold was measured using a skinfold calliper. Correlation was carried out for grip strength with forearm circumference, forearm length and forearm skin fold by using Pearson's correlation.

Result: Statistical Analysis was performed using SPSS 15 and the outcome was considered by keeping 0.05 level of significance. There was a highly significant correlation between grip strength, forearm circumference and forearm length. Relatively less significant was found between grip strength and forearm skin fold measurements.

Conclusion: A positive highly significant correlation was found between grip strength, forearm length and forearm circumference but there was comparatively less significant correlation observed between grip strength and forearm skinfold measurements.

Keywords: Grip strength, forearm length, forearm circumference, forearm skinfold, badminton, BMI.

1.INTRODUCTION

The hand is a complicated structure which plays a major role in motor and sensory function. The grip of hand is very important to perform our activities of daily living. A person's overall strength is determined by the strength of his grip. To have a strong grip, we need high amount of power of the muscles of hand and forearm[1]. Hand grip strength is significant in evaluating a person's capability in performing activities of daily life, playing a sport and also it sets a reference line for hand rehabilitation [2]. Hand grip strength is directly proportional to the age, gender and body type of a person. It is considered as a determining factor for bone mineral content and lean body mass at the forearm site [3]. Literature suggests that individuals with low BMI are most likely to have lower mean grip strength [4]. There are studies which has established normative data for grip strength. It shows that males have higher grip strength and the highest grip strength is found in both the genders at the fourth decade of life and then it declines gradually [5]. The hand grip strength in men is almost twice the strength of women. The decline in grip strength after fourth decade could be because of age related changes like lack of physical activity, loss of muscle bulk, reduce in the firing of actin and myosin filaments, modifications in hormonal level and also chronic diseases. There is very less impact of genetic effect on grip strength [5].

There are different types of grips. Power grip and Precision grip are the two-broad classification of hand grip. The sub types of Power grip are cylindrical grip, spherical grip, and hook grip. Precision grip is further classified into pad to pad, tip to tip, lateral precision, and lumbrical grip. We require a good neuromuscular strength and coordination to have a firm and rigid grip. In Power grip, we require a high force of the muscles of hand and forearm and in precision grip, we require fine coordination [6].

Badminton is a very popular sport. It requires rapid actions and unexpected changes of track. The movements are multidirectional and repetitive which requires good dexterity and both aerobic and anaerobic fitness[7]. In badminton, the athlete requires high concentration in running, jumping, lunging, spinning, stretching, deceleration, overhead shot making and rapid arm movements to strike the shuttlecock from different positions [8]. A badminton player requires very good strength and endurance of both upper and lower body in order to win a game. Thus, he requires a very firm grip strength

throughout the game.
In order to measure grip strength, the hand-held dynamometer is an accurate, reliable, easy to use and less expensive tool [9]. The skinfold caliper is also considered as a valid and reliable tool for measuring skinfold measurements[10].
In sport, performance variables is highly dependent on the anthropometric measurements as it is directly dependent on the performance of the athlete.
There is a scarce of literature collected in badminton players which limits this talent identification approach.
Thus, there is a strong need to find the correlation between grip strength and various anthropometric measurements of upper limb so that a definite exercise protocol can be designed for improving strength and performance of badminton players.
The aims and objectives of this study is to find the correlation of grip strength with forearm circumference, forearm length, forearm skinfold, for recreational badminton players.

2. MATERIALS AND METHODS

A detailed explanation of research and purpose of the study was given to each subject and all queries were dealt with satisfaction and informed consent was taken.

2.1 Study design and sample

A correlational study where 300 healthy recreational badminton players were included based on the inclusion and exclusion criteria. The data was collected from sports centers in Bangalore. A convenient sampling was done. The age limit of each player was between 18-38 years of age. Subjects who play at least 3 days a week were included. Elite Competitive players, body builders, people who are especially abled or anyone with history of upper limb deformity, fractures, musculoskeletal and neurological conditions were excluded in the study.

2.2 Outcome measures

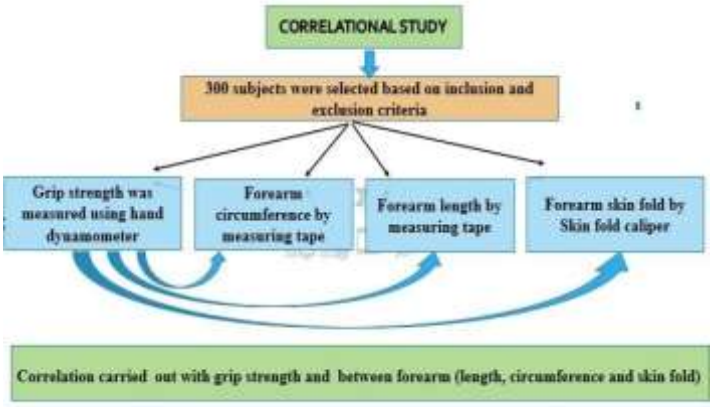
Hand Held Dynamometer: To measure the grip strength[11].
Skin fold caliper: To measure the skin fold measurement of forearm[12].
Measuring tape: To measure the circumference of forearm and forearm length[8].
Weighing scale: To measure the body weight of the subject[8].
Height measuring scale: To measure the height of the subject[8].

2.3 Procedure

Grip strength was measured with hand dynamometer. The subjects were asked to hold the dynamometer with shoulder adducted, medially rotated with elbow flexed 90 degree in a sitting position. Three readings were taken with rest period in between and mean was considered. Forearm length- It was measured using measuring tape between the olecranon process and the distal wrist crease with the wrist extended and pronated. Forearm circumference- It was measured using measuring tape along the forearm at the point of the largest circumference, with the subject holding the arm out with the palm facing upwards. Forearm skin fold- It was measured using caliper at the level of maximum circumference of the forearm in the midline of its posterior aspect.

Fig 1- Hand held dynamometer

Fig 2- Skin fold Calliper



3. RESULTS

Statistics were performed by using SPSS 15. Results were calculated by using 0.05 level of significance.
Mean of different variables were calculated $X = \sum X / N$
N = Number of subjects X = each subjects value

STANDARD DEVIATION (σ)
$S=\sqrt{\sum x^2}/N$
x = deviation of score from mean

3.1 GROUP DESCRIPTION

Total Subjects → 300
Level of Significance → 95%
$P < 0.05$ → Significant
$P > 0.05$ → Not Significant
GS → Grip Strength.
FC → Forearm Circumference.
FL →Forearm Length.
FSF → Forearm Skin folds.

4. DATA ANALYSIS

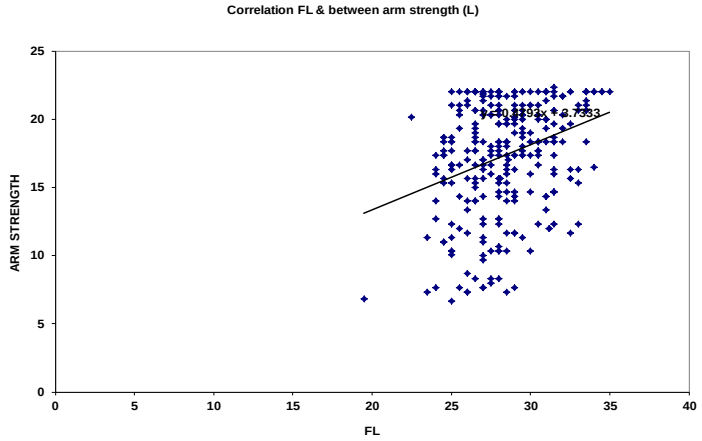
CORRELATION BETWEEN GRIP STRENGTH AND DIFFERENT VARIABLES

VARIABLES	LEFT	ARM	RIGHT	ARM
	Pearson Corelation (r)	P value	Pearson Corelation (r)	P value
FL	0.312	0.000	0.250	0.000
FC	0.435	0.000	0.519	0.000
FSF	0.039	0.501	0.053	0.364

Table 1: Correlation between grip strength and different variables

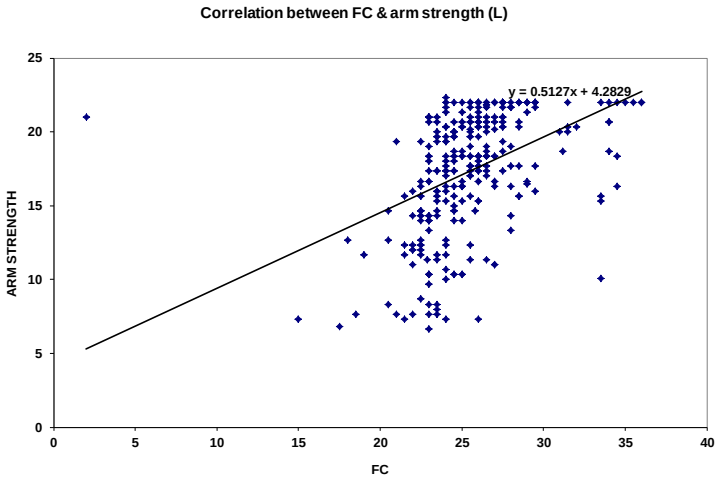
The above table denotes the values of r and p of FL for L and R which is .312, .000, .250 and .000 respectively.
The above table denotes the values of r and p of FC for L and R which is .435, .000, .519 and .000 respectively.
The above table denotes the values of r and p of FSF for L and R which is .039, .501, .053 and .364 respectively.

Graph 1: Correlation of FL and grip strength (L)



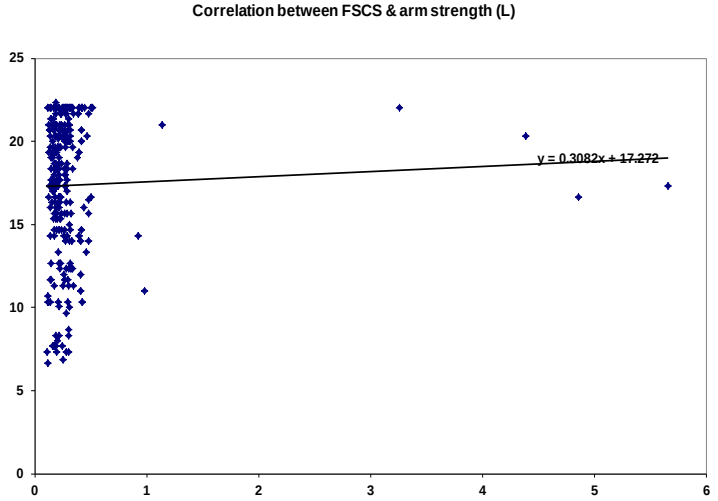
The above graph shows a positive correlation between FL and GS (L)

Graph 2: Correlation between FC and grip strength (L)



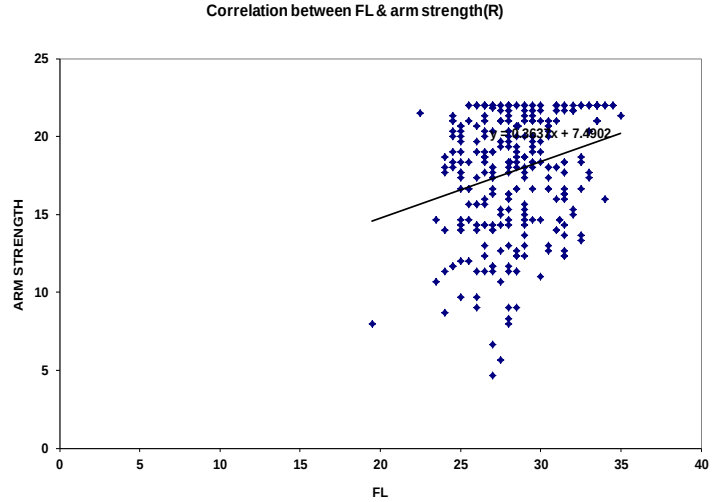
The above graph shows a positive correlation between FC and GS (L).

Graph 3: Correlation between FSF and grip strength (L)



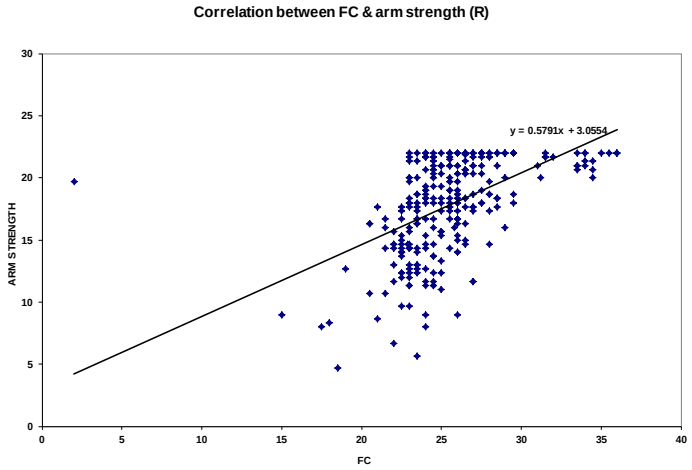
The above graph shows a positive correlation between FSF and GS (L).

Graph 4: Correlation between FL and grip strength (R)



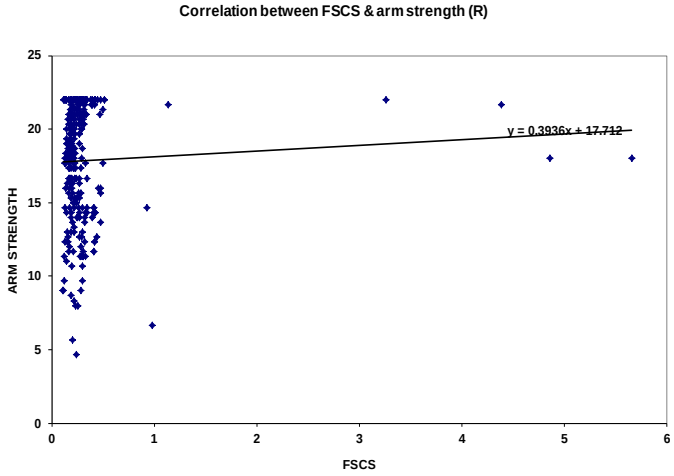
The above graph shows a positive correlation between FL and GS(R)

Graph 5: Correlation between FC and grip strength (R)



The above graph shows a positive correlation between FC and GS(R)

Graph 6: Correlation between FSF and grip strength (R)



The above graph shows a positive correlation between FSF and GS(R)

After the statistical analysis it is found that there is a highly significant corelation between grip strength, forearm circumference and forearm length. Relatively less significant was found between grip strength and forearm skin fold measurements.

5. DISCUSSIONS

In this study a correlation between grip strength and forearm circumference, forearm length and forearm skin fold has been found out.

The selected sample represents a group of young and middle-aged adults of both the sexes. In the present study it was found out that Grip strength is strongly correlated to forearm circumference and length and relatively less correlation with forearm skin fold. This could be because the population selected didn't have a standard rule of BMI in the inclusion criteria as BMI is directly related to fat mass of the body which positively correlates to skin fold measurement[13].

R.E. Anakwe et al 2007, hand grip strength was constantly greater for men than women. Contra-lateral grip strength predicted maximum grip strength for both men and women. They even demonstrated relationship between hand grip strength and forearm circumference measurements for the 58 right hand dominant males with a grip strength discrepancy greater than 10% of the forearm circumference, whereas in our study that sex discrepancy is lacking and correlation of differences of sex with hand grip strength and forearm circumference is not measured [6].

In previous studies loss of grip strength after an injury is measured but in this study we have compared the correlation of hand grip strength with forearm circumference, forearm length and forearm skin fold according to age, sex, weight, height and BMI.

H.M. Molenaar et al, hand grip strength, hand dominance, gender, height and weight of children (4-12) was measured. The study concluded that grip strength increased with age for both boys and girls as well as for both the hands. For the whole group dominant hand produced higher grip strength than the non dominant hand and boys were stronger than girls. Whereas in our study we have not taken individuals under the age of 18, so as a result we cannot predict about the growth diagrams for grip strength[14].

Grip strength has long been assumed as an analyst of overall body strength, but there is not much information available. Pieterse et al 2002 also conveyed that malnutrition defined by low BMI and less arm muscle area, appeared as a significant determinant of impaired hand grip strength[15].

6. LIMITATION AND FUTURE SCOPE

Age group was limited from 18 to 38 years only. Unequal number of male and female subjects. Subjects with a standard BMI must have been included. To conduct a study for formulating a protocol for improving the anthropometric measurements which in turn would improve the grip strength and also may improve performance in the sport for badminton players

7. CONCLUSION

A positive highly significant correlation was found between grip strength, forearm length and forearm circumference but there was comparatively less significant correlation observed between grip strength and forearm skinfold measurements.

8. ACKNOWLEDGEMENT

The authors are thankful to all the participants of the study. We convey our sincere thanks to the badminton academies for giving the opportunity to collect the data.

9. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research study

REFERENCES

1. Shyamal Koley, Navdeep Kaur, J.S.Sandhu. A study on hand grip strength in female labourers of Jalandhar, Punjab, India. J Life Sci, 1(1): 57-62 (2009).
2. Juilette M Boadella, P Paul Kuijer, Judith K Slutter, Monique H Frings Dresen. Effect of self selected handgrip position on maximal handgrip strength. Arch Phys Med Rehab Vol 86, February 2005.
3. Meenal Gandhi, Shyamal Koley, J.S.Sandhu. Association between anthropometric characterstics and physical strength in school going children of Amritsar. Anthropologist, 12(1): 35-39 (2010).
4. Nicola M Massy-Westropp, Tiffany K gill, Anne W Taylor, Richard W Bohannon, Catherine L Hill. Hand grip strength: Age and gender stratified normative data in a population based study. BMC Research notes 2011, 4:127.
5. Bernard Jeune, Axel Skytthe, Amandine Cournil, Valnetina Greco, Jutta Gampe, Maurizio Berardelli, Karen Andersen Ranberg, Giuseppe Passarino, Giovanna DeBenedictis, Jean Marie Robine. Handgrip strength among Nonagenarians and Centenarians in three European countries. Journal of Gerontology, Medical Sciences 2006, volume 61 A, No.7 707-712.
6. R.E.Anakwe, J.S.Huntley, J.E.Mceachan. Grip strength and forearm circumference in a healthy population. Journal of Hand Surgery (European Volume ,2007) 32E:2:203-209.
7. Guilas AA, Lagman RAL, Liao LAS, Mamaril GP, Rueca JRQ, Tapire KM, 2006. Incidence of chronic lower extremity musculoskeletal injuries among badminton players participating in UAAP. Philippine Journal of Allied Health Sciences. 1(1): 18-26.
8. Kuntze, G., Mansfield, N., & Sellers, W. (2010). A biomechanical analysis on common lunge tasks in badminton.
9. Lan Le-Ngoc and Jessica Janssen, Validity and Reliability of a Hand-Held Dynamometer for Dynamic Muscle Strength Assessment, https://www.researchgate.net/publication, July 2012
10. Patria Hume &Michael Marfell-Jones, The importance of accurate site location for skinfold measurement. Journal of sports science. Pages 1333-1340 | Accepted 28 Apr 2008, Published online: 13 Oct 2008.
11. Anneli Peolsson, Rune Hedlund, Brigitta Oberg. Intra and Inter- tester reliability and references values for hand strength. J Rehab Med 2001:33 36-41.
12. Andrew P Haines, John D Imeson, Thomas W Meade. Skin fold thickness and cardiovascular risk factors. American Journal of Epidemiology vol 126, No. 1.
13. Peter T Katzmarzyk, William H Dietz, Relation of body mass index and skinfold thicknesses to cardiovascular disease risk factors in children: the Bogalusa Heart Study. American journal of nutrition 2009 Jul; 90(1): 210–216.
14. H.M.Molenaar, Ruud W Selles, J Michiel Zuidam, Sten P Willemsen, Henk J Stam, Steven E.R. Hovius. Growth diagrams for grip strength in children. Clin Orthop Relat Res (2010) 468:217-223.
15. S.Pieterse, M Manandhar, S Ismail. The association between nutritional status and handgrip strength in older Rwandan refugees. European Journal of Clinical Nutrition (2002) 56,933-939.