CORRELATION OF PERCENTAGE OF BODY FAT, HAND GRIP STRENGTH IN FOOTBALL AND CRICKET PLAYERS: A CROSS-SECTIONAL STUDY

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Abstracts:

Background: Hand grip strength (HGS) and percentage of body fat has been an indicator for determining strength. **Aims and Objectives:** The purpose of the study was to found out for comparison of percentage of body fat in cricket and football player. We also have done a correlation of HGS with percentage of body fat in cricket and football players**. Material and Methods**: Total 30 healthy cricket and football players (15-25 years), from district sports academy, regularly practicing from last 3 years at university level and who do not have any abnormality of the upper arm or any neurological problem, history of fracture of hand were included. Percentage of body fat determined by harpendence caliper by standard method. Measurement of HGS with the help of Sahen's hand grip digital dynamometer was done. Mean of three reading was taken as final reading. Unpaired test was applied for the comparison between cricketers and football players for the variables of percentage of body fat. Pearson correlation coefficient established a correlation of percentage of body fat with HGS. **Results:** It was also found that statistically there was a highly significant difference observed in percentage of body fat between cricket and football players and there was negative correlation observed between HGS with percentage of body fat in cricket and football players. **Conclusion:** Proper training for maintaining percentage of body fat and HGS will increase in HGS. It will further lead to better strength and performance in cricket and football activities.

Key Words:

Anthropometry; Dynamometry; Harpendence Caliper; Handgrip Strength; Percentage of Body Fat

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Introduction:

A sport is a worldwide phenomenon. Amongst sports, cricket & football are more popular as it is a great fun and people of all ages can enjoy it. Many studies have shown that specific anthropometric characteristics are significantly associated with success in sports.[1] Therefore, understanding the body composition of top-level athletes and then competitive weights for the athletes, has been done for decades and is considered an essential part of the total management process.[2] Scientists all over the world are looking for a standard formula that can improve the performance of elite players and discover talents as efficiently as possible.[3] Since each sport has its own specific demands, every athlete should have specific anthropometrical characteristics and body composition figures for his or her own sports discipline. Anthropometric dimensions like body fat percentage and hand grip strength play an important role in cricket and football. Many scientists have done a research on anthropometric parameters of cricket players and hand grip strength in them.[4,5]Hand grip strength has been an indicator for determining strength since 1880. It is referred as the muscular strength and force that they can generate with their hands. It is the result of forceful flexion of all finger joints, thumbs, wrists with maximum voluntary force that the subject can exert under normal bio kinetic conditions[6,7] There are 35 muscles involved in movement of the forearm and hand, with many of these involved in gripping activities. During gripping activities, muscles of the flexor mechanism in the hand and forearm create grip strength while the extensors of the forearm stabilize the wrist.[8] According to German Sports Scientist Weinick J[9] the characteristic structure of the hand is related to its function as a grasping tool. Grasping ability is made possible by the fact that the thumb can be opposed to the fingers. The fingers and the thumb act as a versatile pair of

pliers. They need the palm of the hand as a flat base, on which the object grasped can be held. Extensor digitorum increases the joint compression and enhances the joint stability. Percentage of body fat, hand grip strength of both dominant and nondominant hand is different in cricket and football. By doing comparison of these parameters we can evaluate demand of each sport. We can plan training programmes for improvement of these parameters. Hand grip strength is a physiological variable that is affected by many factors including age, gender, body size, weight, height, muscle strength, fatigue, time of the day, age, nutritional status, restricted motion, percentage of body fat. Strong correlations between hand grip strength various anthropometric traits were eported[10,11]Correlation of dominant and non-dominant hand grip strength and percentage of body fat in cricket players were studied. This study offers the opportunity to enhance, update and clarify the understanding of the relationships between isometric hand grip strength and anthropometric dimensions, so that we can plan training programmes to increase hand grip which will lead to better performance of cricketers and football players.

Material and Methods:

Normal healthy cricket and football players playing cricket from last 3 years, still playing at university level, state level or national level with age group between 15- 25 years who were practicing in daily cricket and football practice for 2-3 hours for 6 days a week were included in the study. Subjects suffering from disease or injury or any treatment and surgery that affect upper extremity strength were excluded. Ambidextrous subject using both hands with equal ease were also excluded from study. Unpaired test was applied for the comparison between cricketers and football players for the variables of BMI, specific anthropometry, hand grip strength.

+ Suggestive significance $0.05 < P < 0.10$.

* Moderately significant $0.01 < P \leq 0.05$.

**Highly significant $P \leq 0.01$.

Not significant $P > 0.05$.

All the statistical calculations were performed using the software SPSS for windows (statistical package for social sciences) version 19.0. Pearson correlation coefficient established a correlation of anthropometric parameter with hand grip strength. Pearson correlation coefficient established a correlation of anthropometric parameter with hand grip strength.

$r > 0.7$ = highly positive correlation.

$0.4 < r < 0.7$ = moderately positive correlation.

$0.4 < r$ = low positive correlation.

The hand grip dynamometry used in the study was of the digital hand grip-3 (Product of SAEHAN Corporation Company, South Korea) (Figure 1a and b). It is type of electronic hand grip dynamometry. Instrument reliability digital handheld dynamometer used for in the study had been proved reliable by Faria in his study[12] Specifically, about Sehan's HGD, good validity and reliability are stated by Reis 2010.[13]A standard testing position as approved by American Society of Hand Therapists was used (Innes 1999[14], Mathiowetz 1985[15].How to use the hand grip dynamometry was demonstrated to all subjects[14,15,16,17,18] Measurements were taken for all subjects around midday, i.e., 11.00-12.30 h, as it is proved to be significantly stronger at these times[19] Johanson (1983)[20] found a significant difference between the volume of verbal command and isometric contractions, where increased volume resulted in increased strength. Hence, same tone and volume of instructions were given in this study each time a test was conducted. To get the maximum reliability of data collected, every subject was asked to squeeze the dynamometer for 3 times. Mean of these three trials were taken as the readings.[21] Innes14 recommended a 60 seconds rest period between trails on isometric tests. It was recommended that a 3seconds grip was usually sufficient to register a maximum reading hence 3 s is taken for the length of contraction time in this study[22]. For percentage of body fat, all measurements were taken along the skin lines over the bare skin. We measured the skin fold thickness at standard sites using skin fold caliper on the right side. This caliper is scientifically developed and calibrated (Figure 1c). The instrument has springs which exert a certain pressure on skin fold which measures the thickness in mm. By measuring at key locations, it is possible to estimate the total percentage of body fat of a person. We grasped the skin and underlying layer of fat with a finger and hold it with the fingers of

left hand. A fold of skin and subcutaneous tissue was picked up firmly between the thumb and forefinger 1-2 cm above the marked cross and pulled away from the underlying muscle. The jaws of the caliper were placed on either side
of the cross below the fingers at a depth of approximately 1 cm. The surface of the caliper jaws was held parallel to the plane of the skin fold. The skin fold was held firmly throughout the application of the caliper, and the reading was taken once the needle became steady. The skin fold thickness was measured using a validated skin caliper to the nearest 0.2 mm. While holding the caliper in the righthand place the jaws of caliper should be about one-fourth inch from the finger of left hand, which continues to hold the fold of skin. We measured all 4 locations bicep, triceps, and noted down the readings. Then added four readings and percentage of body fat can then be determined[23]. For bicep skin fold thickness (Figure 1d) midpoint between the acromion process and the lateral condyle of the elbow was marked. The subject was asked to sit, and flex the elbow to 90°, and the measurement was taken at the anterior aspect of the arm at the marked level[23]. For triceps skin fold thickness (Figure 1e), subject was asked to stand with the arm hanging by the sides, and the midpoint between the acromion process and the lateral condyle of the was marked. The measurement was taken on the posterior aspect of the arm over the bulk of the triceps at the level marked[23]. For suprailiac skin fold thickness (Figure 1f) it was located 5 cm above the anterior superior iliac spine. It was measured with a fold descending medially (inwards) and downward at an angle of 45° to the horizontal, i.e., the protrusion of the hip bone a little toward front and parallel to the bone below lifted diagonally, following the natural line of the iliac crest[23] For subscapular skinfold thickness (Figure 1g) measurement was made just below the inferior angle of the scapula. It was measured in an oblique plane descending laterally (outwards) and downward at an angle 45° to the horizontal, i.e., below the inferior angle of the scapular skinfold parallel to the border was taken, i.e., back,below the shoulder blade[23] Then add four readings and percentage of body fat[23] can then be determined from Annexure I

Fig a- Sehans dynamometer . Fig b- meaurement of HGS by dynamometer . Fig c-Harpendence caliper. Fig d- bicep skin fold thickness measurement.
Fig e- tricep skin fold thickness measurement.
Fig f- suprailiac bicep skinfold thickness measurement.
Fig g-subscapular skin fold thickness measurement.

Result:

1)Statistically, there is a highly significant difference observed in percentage of body fat between football and cricket players ($P < 0.01$) (Table 1).

2)There is positive correlation observed between percentage of body fat with DM and NDM HGS in football and cricket players (Table 2).

Table No. 1 : Comparison of % Of Body Fat between Football and cricket players

% of Body fat	Football players	Cricket players
N	30	30
Mean	12.53	16.81
SD	4.55	3.88
t test	3.85 (p<.0.01)	

*Statistically, there is highly significant difference observed in % of Body fat, DM & NDM HGS between Football and Cricket players (p<0.01).

Table No. 2 : Correlation between % of body fat with hand grip strength in football & cricket players

	Football players (N=30)		Cricket players (N= 30)	
	DM	NDM	DM	NDM
Correlation coefficient (r)	-0.05	-0.27	-0.16	-0.03

**There is negative correlation observed between % of body fat with HGS in football & cricket players

Discussion:

Our study shows that statistically highly significant difference observed in percentage of lean body mass between football and cricket players (P < 0.01) and also there is negative correlation observed between percentage of body fat with DM and NDM HGS in football and cricket players.

There is paucity of literature for comparison of % of body fat in football and cricket players, but regarding football game, Serbian, Spanish, Australian, United kingdom football players shows dis-similar range of % of body fat i.e. lower % of body fat when compared with % of body fat with our players in study done by Popovic S (2014, mean of % of body fat 9.64%)[3], Alburquerque F(2005, mean of % of body fat 8.6%)[24] ,Veale JP (2010, mean of % of body fat 11.10%)[25],Reilly T (2000, mean of % of body fat 10.6%)[26]. Regarding cricket game, similar range of % of body fat with our result, shown by Koley S in interuniversity cricket players which is lower than their control counterpart (2011, mean of % of BF 14.05)[4].Dissimilar range of % of BF i.e. lower range of % of BF with our result, shown by shown by Koley S in his another study in Indian cricketers (2009, Mean of % of BF 14.05)[4]. Noakes(2000), Bartlett(2003)states that cricketers have average body fat 12-14%[27,28].our player shows similarity with this statement. Present study showed a proper % of body fat in the young players. From our study, it is observed that, significantly lower% of body fat present in football players compared to cricket players. It may be due to heritability coefficient estimates of variables related to talent in football for skin fold thickness is 0.55. So this heritability in skin fold thickness affect % of body fat. Kemi (2003) and Stolen (2005) states that football is predominantly aerobic sport as per the previous results studies. This will also lead to lower range of % of body fat[29,30].and Sporis(2008) stated that anaerobic energy is essential only to performance in high-intensity runs and duel plays all of which may contribute to the final outcome of the game[31].The National strength and conditioning association, indicates that % of body fat vary from less than 7 to 17 % among the male athletes, depending on the sports discipline.3Study done by Manna L (2006), to observe effect of training on morphological parameters in young Indian football player, shows that in preparatory phase 6 month (PP) and in competitive phase 12 month (CP) leads to improve. Mean body fat before starting exercise was 19.6%. It changes to 18% and 14.6% after PP and CP. So proper training programmes should held to get improvement[32].So would like to stress that these are just guidelines and the athlete would work together with their coaches and their personal physician to determine the individual % of body fat to enhance their physical abilities and their health. Though Present study showed a proper % of body fat in the players but it should be maintained by proper training. Aerobic training increases the fat utilization during exercise, which may be the cause of the reduced fat level after training. Therefore, a low level of % of body fat as well as an increase in fat free body mass plays a key role in keeping physical fitness[32].% of body fat should be maintained within normal range to get proper performance of cricket and football players. So proper and specific training, methodologies, diet plans, nutrition, nutrition factors, practice hours should be considered and appropriate plan of guideline given to the player. The coach should take daily follow up of all above factors to get success.

Our results show that dominant and non-dominant hand grip strength (DM and NDM HGS) continued to be decreased with increase in % of body fat in both cricketers and football players. For DM hands, in cricketers r=-0.16in football players r=-0.03 (table 2).For NDM hands, in cricketers r=-0.27 in football players r=-0.05, (table 2).Dissimilar result

with our finding i.e. hand grip strength is positively correlated with is % of body fat is shown by other authors like Koley S (2009, for right hand r= 0.401and for left hand 0.374 in Indian cricket players[33],Fallahi AA(2011,r=0.079)[34]. Neimpoog S (2007) states that no correlation between hand grip strength and body fat %[35]. % of Body fat increased then it may lead to decrease in % of muscle mass. Hand grip strength measures strength of muscle mass, fiber. More muscle mass will exert more force on dynamometer, which may lead to more hand grip strength. More fat may lead less muscle mass, which may lead less hand grip strength. This may cause negative relationship of % of body fat and hand grip strength. % of body fat should be maintain within normal range to get proper hand grip strength. Better hand grip strength lead to better performance of cricket and football players. So proper and specific training, diet plans, nutrition factors, practicing hours should be considered and a appropriate plan of guideline given to the player. The coach should take daily follow up of all above factors to get better performance.

Conclusion:

All anthropometric parameters like percentage of body fat, hand grip strength should be assessed by coachperiodically. There is need to improve physical fitness parameter to enhanceplayers performance. Body fat training and hand grip strength training should be implemented at junior levelto build whole body mass and to counter asymmetric loadplaced on the body through the nature of game. Hand grip strength training programmes should be planned at various level such as school, college, university, state. Through this we can give a specific sport prescription to playerwhile selecting a sport. In Japan, they have already implemented this sport prescription method at earlier stages which help person to choose a game. So it should be considered in India as it will be helpful for the performance of the player our purpose of "RIGHT SPORT FOR RIGHT PERSON" shouldbe served.

Source of funding:

Self

Conflict of Interest:

Nil

ANNEXURE – I

% OF BODY FAT CALCULATION STANDARD CHART[23]

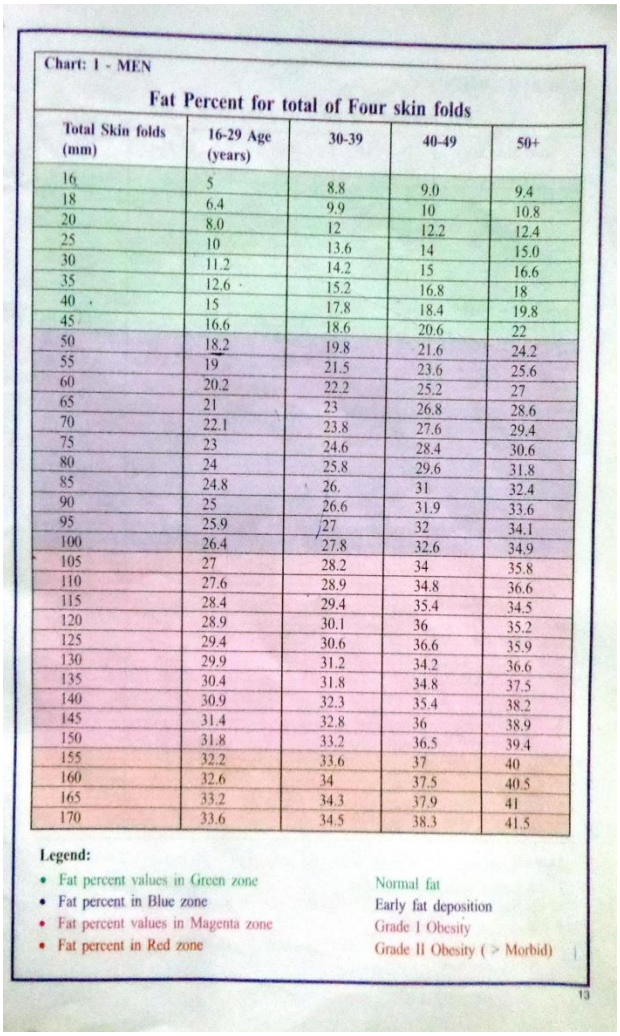

Chart: 1 - MEN

Fat Percent for total of Four skin folds

Total Skin folds (mm)	16-29 Age (years)	30-39	40-49	50+
16	5	8.8	9.0	9.4
18	6.4	9.9	10	10.8
20	8.0	12	12.2	12.4
25	10	13.6	14	15.0
30	11.2	14.2	15	16.6
35	12.6	15.2	16.8	18
40	15	17.8	18.4	19.8
45	16.6	18.6	20.6	22
50	18.2	19.8	21.6	24.2
55	19	21.5	23.6	25.6
60	20.2	22.2	25.2	27
65	21	23	26.8	28.6
70	22.1	23.8	27.6	29.4
75	23	24.6	28.4	30.6
80	24	25.8	29.6	31.8
85	24.8	26.	31	32.4
90	25	26.6	31.9	33.6
95	25.9	27	32	34.1
100	26.4	27.8	32.6	34.9
105	27	28.2	34	35.8
110	27.6	28.9	34.8	36.6
115	28.4	29.4	35.4	34.5
120	28.9	30.1	36	35.2
125	29.4	30.6	36.6	35.9
130	29.9	31.2	34.2	36.6
135	30.4	31.8	34.8	37.5
140	30.9	32.3	35.4	38.2
145	31.4	32.8	36	38.9
150	31.8	33.2	36.5	39.4
155	32.2	33.6	37	40
160	32.6	34	37.5	40.5
165	33.2	34.3	37.9	41
170	33.6	34.5	38.3	41.5

Legend:

- Fat percent values in Green zone — Normal fat
- Fat percent in Blue zone — Early fat deposition
- Fat percent values in Magenta zone — Grade I Obesity
- Fat percent in Red zone — Grade II Obesity (> Morbid)

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