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Correlation of arm fat index and hand grip strength in cricket players: A cross-sectional study

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Abstract

Introduction: Hand grip strength and arm fat index has been an indicator for determining strength.

Objectives: The purpose of study was to found out correlation of hand grip strength with arm fat index in cricket players.

Materials and Method: Total 30 healthy cricket players (15-25 years), from district sport academy, regularly practicing from last 3 years at university level and who don't have any abnormality of upper arm or any neurological problem, history of fracture of hand were included. Measurement of hand grip strength with help of Sahens hand grip digital dynamometer was done. Mean of three reading was taken as final reading. Arm fat index is calculated by formula, 100 x Mid upper arm fat area / mid upper arm area. Mid upper arm fat area determined by Mid upper arm muscle area and mid upper arm. Pearson correlation coefficient established a correlation of arm fat index with hand grip strength.

Result: It was also found that statistically there was highly significant negative correlation observed between AFI and dominant handgrip strength in Cricket players ($P < 0.01$).

Conclusion: Proper training for maintaining arm fat index will increase in hand grip strength. It will further lead to better strength and performance in cricket activities like bowling, throwing, fielding.

Keywords: Anthropometry, Arm fat index, Dynamometry, Handgrip strength, Herpendence calliper, Mid upper arm fat area, Mid upper arm muscle area, Tricep skin fold thickness

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Introduction

A sport is a worldwide phenomenon. It has become an interesting aspect for human amusement and a cultural phenomenon of great magnitude and complexity. It has got mass participation, as it attracts people either for recreation, physical fitness or for profession. Sports are organized at competitive levels since ancient times but now competition in sports has achieved the highest level. Hundreds of young aspirants are devoting time and energy for achieving success in these events. 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 lean body mass percentage and hand grip strength play an important role in cricket and football. Many scientist have done a research on anthropometric parameters of cricket players and hand grip strength in them.(4,5)

Contemporary sport science is designed to improve the performance of elite players and to discover talents as precisely as possible. Percentage of lean body mass is different in cricket and football. We can evaluate demand of each sport by doing comparison of it. We can plan training programmes for improvement of these parameters.

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 is able to 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.

Hand grip strength is a physiological variable that is affected by a number of factors including age, gender, body size, weight, height, muscle strength, fatigue, time of the day, age, nutritional status, restricted motion, percentage of body fat & lean body mass. Strong correlations between hand grip strength various anthropometric traits were reported.[10,11] Correlation of dominant and non-dominant hand grip strength and arm fat index 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 players.

Normally a person starts taking part in a game or event without proper guidance. It is thus a sheer chance that his choice of the sport may be suitable to his inherent capabilities. Therefore the failure to become a champion in most of the cases is inevitable. Thus there is an urgent need to provide counselling to those endowed with such suitable characteristics that form the basis of performance in a game or event. This may be one of the most important factors that can help in raising the standard of sports in most of the countries. In Japan however the system of selection keeping physique in view has been adopted in more than one thousand schools and was administered to some three hundred thousand subjects from the kindergartens to the universities. Physical fitness is required in the promotion of national programme of physical training. However, physique is not the exclusive factor for selection. The other factors which determine performance also need due consideration. With this in view it is desirable to focus attention of those who are connected with sports in one way or the other for improving selection procedures particularly in childhood. "Catch them young" should be the aim. The selection of talent in this way will help utilizing the time and energy of the coaches and the athletes in a more effective manner. It will also be useful in improving the methods of training for children and give a new look to the system. The poor performance of Indian athletes and sportsmen at the international competitions has been of great concern, especially to the coaches, physical educationists and sport scientists. Efforts have been made to improve the standards of our sportsmen since long, however little success has so far been achieved in this respect.

There is paucity of literature in correlation of most commonly played sports in India i.e. cricket which can explain anthropometrical difference in them. Hence, I felt the need to do this study, in which we have found out correlation of hand grip strength and arm fat index.

Materials and Method

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. The present study was approved by the Ethical Committee. Significant figures

- + 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 arm fat index 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 study was of the Digital Hand Grip (DHD-3). (Product of SAEHAN Corporation Company, South Korea). (Fig. a) 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 is stated by Reis 2010.[13]

A standard testing position as approved by American Society of Hand Therapist (ASHT) was used (Innes[14] 1999, Mathiowetz[15] 1985). How to use the hand grip dynamometry was demonstrated to all subjects.[14,16,17,18] Measurements were taken for all subjects around midday i.e. 11.00 hours to 12.30 hours, as it is proved to be significantly stronger at these times.[19] Johanson[20] (1983) 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 three times. Mean of these three trials were taken as the readings.[21] Innes[14] recommended a 60 seconds rest period between trails on isometric tests. It was recommended that a 3 seconds grip was usually sufficient to register a maximum reading hence 3 seconds is taken for length of contraction time in this study.[22]

Arm fat index is calculated by formula,[23] Arm fat index = 100 x Mid upper arm fat area / mid upper arm area.

Mid upper arm fat area is calculated from formula,[23]
Mid upper arm fat area = Mid upper arm area – mid upper arm muscle area.
Mid upper arm area is calculated from formula,[24,25,26]
Mid upper arm fat area = (Mid upper arm circumference)^2 /4 π
Mid upper arm muscle area is calculated from formula,[23]
Mid upper arm muscle area = (Mid upper arm muscle circumference)^2 /4 π
Mid upper arm muscle circumference is calculated from formula,[23] Mid upper arm muscle circumference = (Mid upper arm circumference) – (π x TSF/10)

TSF is measured by harpendence skin fold calliper.[27] This measurement were taken along the skin lines over the bare skin. We measured the skin fold thickness at standard sites using skin fold calliper on the right side. This calliper is scientifically developed and calibrated. The instrument has springs which exert a certain pressure on skin fold which measure the thickness in mm. We Grasped the skin and underlying layer of fat with finger and holded it with the fingers of lt 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 calliper were placed on either side of the cross below the fingers at a depth of approximately 1 cm. The surface of the calliper jaws were held parallel to the plane of the skin fold. The skin fold was held firmly throughout the application of the calliper and the reading was taken once the needle became steady. The skin fold thickness was measured using a validated skin calliper to the nearest 0.2 mm. While holding the calliper in the rt hand place the jaws of calliper should be about one fourth inch from the finger of left hand, which continues to hold the fold of skin. We measured locations tricep and noted down the readings For Tricep Skin fold Thickness (Fig. c, d) 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.[27]

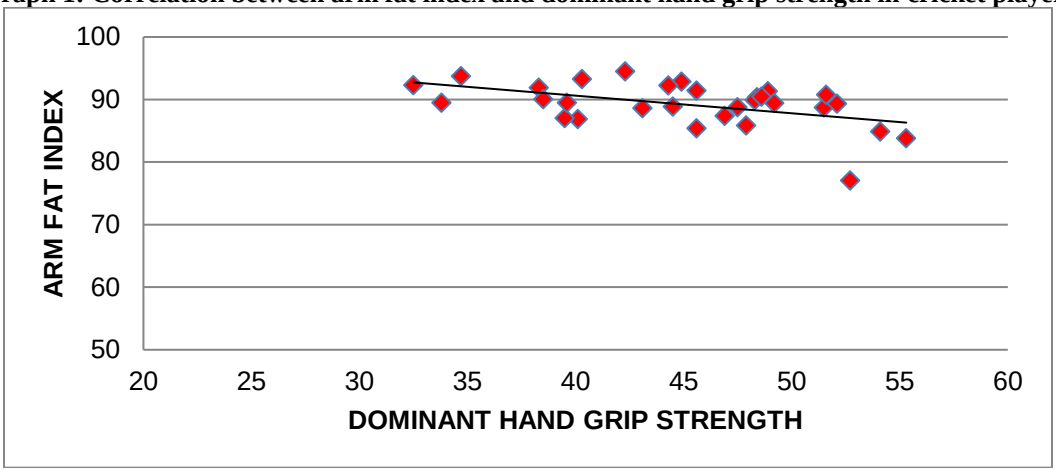
Fig. a: Sahen's HGD Front View

Fig. b: HGS Measurement DM Hand (Front View)

Fig. c: Harpendens Skinfold Cali

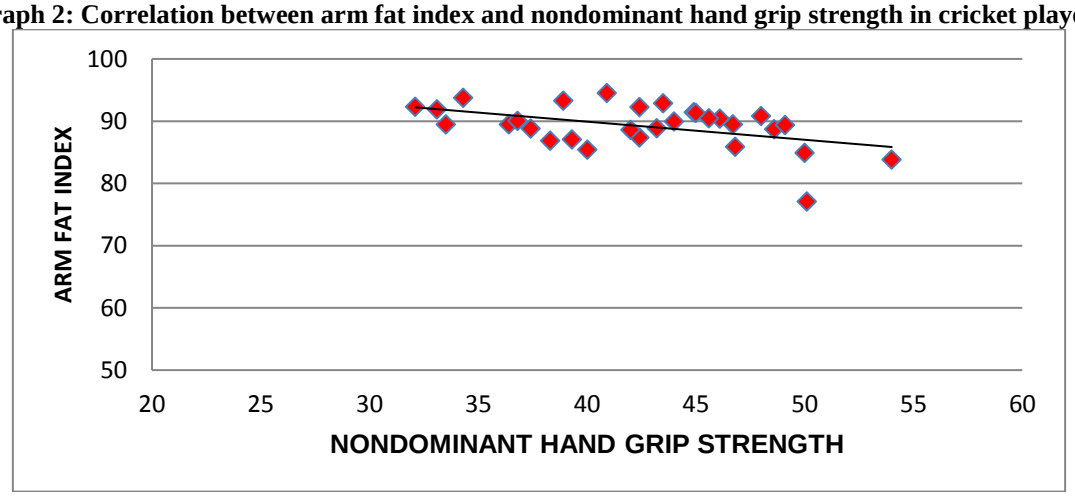
Fig. d: Ts Measurement

Graph 1: Correlation between arm fat index and dominant hand grip strength in cricket players



There is highly significant negative correlation observed between AFI and dominant handgrip strength in Cricket players ($P < 0.01$).

Graph 2: Correlation between arm fat index and nondominant hand grip strength in cricket players



There is highly significant negative correlation observed between Arm fat index and non-dominant handgrip strength in Cricket players.($P<0.01$).

Discussion

Our results shows that dominant and non-dominant hand grip strength (DM and NDM HGS) continued to be decreased with increase in arm fat index (AFI) in cricketers. For DM hands, cricketers r=-0.49, t=-2.95). (Table 1, Graph 1). For NDM hands, cricketers r = -0.47, t=-2.80) (Table 1, Graph 2).

There is paucity of literature for correlation of arm fat index cricket players Dissimilar result with our findings i.e. arm fat index is positively correlated with HGS in Indian cricket players is shown by author Koley S (2009, for rt hand r= 0.083 and for lt hand r= 0.014).[28] There must be some amount of fat will which is required for many activities in sport. Excess of this fat is not favourable. But within normal limit, this essential fat is helpful for exerting force on dynamometer which will lead to get better hand grip strength.

Also, arm fat index (AFI) is dependent variable which is derived from formula,[23]

$$AFI = 100 \times \frac{MUAFA}{MUAA}$$

MUAFA= mid upper arm fat area

MUAA= mid upper arm area

Mid upper arm fat area (MUAFA) and mid upper arm area (MUAA) are again dependent on muscle area, mid upper arm circumference. MUAFA and MUAA are positively correlated with hand grip strength.

These may be the reasons for positive correlation of hand grip strength and arm fat index.

Arm fat index should be maintained 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, different methodologies, diet plans, nutrition factors, practicing hours should be

considered and a appropriate plan of guideline given to the player to maintain arm fat index. The coach should take daily follow up of all above factors. And he should do the proper plan to get better performance of player.

Hence there is need to improve physical fitness parameter to enhance players performance. Hand grip strength has relatively high heritability and importance of genetic factor seems to be of equal size. We can use this phenotypic information when looking for genes important for physical function in second half of life. Hand grip strength training programmes should be planned. Talent identification programmes, scientific training programmes should be held at various level such as school, college, university, state. All anthropometric parameters should be assessed by coach periodically. He should consider all factors affecting it i.e. nutrition, motivation, practicing hours, economical condition, type of exercise. He should give proper guideline to player and arrange proper training programmes. All anthropometric parameters like arm fat index, hand grip strength should be assessed by coach periodically.

Conclusion

There is need to improve physical fitness parameter to enhance players performance. Body fat training and hand grip strength training should be implemented at junior level to build whole body mass and to counter asymmetric load placed 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 player while 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" should be served.

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Self

Conflict of Interest

Nil

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