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ASSOCIATION BETWEEN BMI AND HAND GRIP STRENGTH IN UNIVERSITY LEVEL CRICKET PLAYERS

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ABSTRACT

Background and objective of the study: Cricket is the most popular team sport in Indian subcontinent. Hand grip strength plays a vital part in all roles of cricket which may be associated with Body Mass Index. Grip strength is the force applied by the hand to pull or suspend from objects and is a specific part of hand strength. BMI is an attempt to quantify the amount of tissue mass (muscle, fat and bone) in an individual to categorize a person as underweight, normal weight, overweight or obese based on values. Objective of the study was to find out the association between BMI and hand grip strength in university level cricketers. **Methodology:** This was an experimental and cross-sectional type study carried out at Faculty of physiotherapy, Dr. M.G.R. Educational and research institute, Chennai. Total 30 male cricketers, with age group of 18 to 25 years were included in this study. Cricketers with upper limb fractures or dislocations within one year were excluded from the study. Hand grip dynamometer, weighing machine and inch tape were the materials and measurement tools used for the study. 30 University level cricketers were divided into 4 groups, Group A, Group B, Group C and Group D based on BMI level. Body Mass Index and Hand grip strength are the outcome measures. Body mass index were calculated by measuring the height and weight of the individuals. Hand grip strength was measured for their dominant side by using the hand grip dynamometer. **Result:** There is a positive association and strong correlation between Body Mass Index and Hand Grip Strength between the Groups at ($r = 0.523$) & ($P \leq 0.05$). **Conclusion:** The study concluded that cricket players with Obese Body Mass Index have more Hand Grip Strength. The study also reported a strong association of Hand Grip Strength with Body Mass Index.

Keywords: Body Mass Index (BMI), Hand grip strength, Cricketers, Hand grip dynamometer.

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INTRODUCTION

Cricket is the most popular team sport in Indian sub continent. Cricket is one of the physically demanding sports comprised of several specialism requiring different skills and types of fitness. Cricket is a game of endurance as well as strength and while batting, use of the fore arm strength is very essential. Cricket requires excellent eye to hand co-ordination, upper extremity power and hand grip strength. Fitness is an integral component of performance as fatigue develops; skill deteriorates being fit delays the onset of fatigue and prevention of overuse injuries¹⁻³.

Regular pre-participation fitness testing, musculoskeletal screening by physiotherapist and medical screening tests is an important part of pre-participation evaluation in cricket before season starts. Body mass index is one of the factors that determine health of an individual being over fat or having a higher than desirable content of that has a negative effect on person's health. The body mass index is the metric currently in use for defining anthropometric height/ weight in adults. It is given as $BMI = \text{weight (in Kg)} / \text{height (Square Meter)}^4,5$.

Many scientists have done a research on anthropometric parameters of cricket players and Hand Grip Strength in them. Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle and adipose tissue (fat). Anthropometric dimensions like Body Mass percentage and Hand Grip strength plays important role in cricket⁶.

Modern demands in one day competitions, especially for training of batsmen needs

adequate emphasis is given for the development of physical characteristics. In batsmen, an increase in upper body strength is particularly important when executing powerful cricket strokes. Batsmen will maintain their timing, placement, concentration and focus apart from playing different shots, running between wickets with less efforts. For batting use of forearm strength is essential^{7,8}.

Hand and forearm muscles are important in grip strength. Grip strength is often used as an indicator of overall physical strength, hand and forearm muscle performances. Hand Grip Strength access the muscular strength of an individual. The power of hand grip is a result of forceful flexion of all finger joints with maximum voluntary force that subject is able to exert under normal bio kinetic conditions. Hand Grip Strength has evolved as an important tool for the assessment of the nutritional status. It is being considered as a reliable marker of the muscle quality⁹⁻¹¹.

Research suggests that there are strong correlations between Grip Strength and Body Mass Index. It is widely accepted that grip strength provides an objective index of the functional integrity of the upper extremity. During gripping activities, muscle of the flexor mechanism in hand and forearm create grip strength while the extensors of the forearm stabilize the wrist^{12,13}.

Grip strength can be measured quantitatively using a hand dynamometer. Hand dynamometer is the most valid and reliable tool to measure grip strength. Thus in this study hand dynamometer is used as an outcome measure for evaluation of grip strength^{14,15}.

METHODOLOGY

This was an experimental and cross-sectional type study. The study setting was carried out in Faculty of physiotherapy, Dr. M.G.R. Educational and research institute, Chennai. Total 30 male cricketers, with age group of 18 to 25 years were included in this study. Cricketers with upper limb fractures or dislocations within one year were excluded from the study. Hand grip dynamometer, weighing machine and inch tape were the materials and measurement tools used for the study. 30 University level cricketers were divided into 4 groups, Group A (underweight i.e., below 18.4), Group B (normal weight i.e., 18.5 – 24.9), Group C (over weight i.e., 25 – 29.9), Group D (obese i.e., above 30). Body Mass Index and Hand grip strength are the outcome measures. Body mass index were calculated by measuring the height and weight of the individuals. Hand grip strength was measured for their dominant side by using the hand grip dynamometer.

Procedure: Total 30 subjects were selected who are university level cricketers. Based on the data collected subjects were purposely selected who fulfilled the inclusion and exclusion criteria. And the players were divided

into four groups based on their BMI values as group A(Underweight i.e., below 18.4), group B(normal weight i.e., 18.5 - 24.9), group C(overweight i.e., 25 - 29.9), group D(obese i.e., 30 & above) respectively. And their hand grip strength for the dominant side was measured using hand grip dynamometer. The players were asked to hold the dynamometer in their dominant hand, with the arm at right angles and the elbow by the side of the body.

The base of the dynamometer should rest on first metacarpal, while the handle should rest on middle of four fingers. Then the players were asked to squeeze the dynamometer with their maximum isometric effect, which was maintained for about 5 seconds and no other body movements were allowed, the player was asked to put maximum effect while squeezing. These measurements were taken in standing position as it is the functional position. Three repetitions are taken at an interval of minimum one minute. Best of three readings is taken as the grip strength of the respective players. The best of the hand grip strength readings is then will be compared with their BMI values. The association between BMI and Hand Grip Strength will be obtained by descriptive statistical analysis.

Body Mass Index (BMI)	Mean	S.D	S.E	95% C.I of Mean	
				Lower Bound	Upper Bound
Under weight	18.22	.364	.115	17.96	18.48
Normal	21.83	1.33	.423	20.87	22.79
Over weight	25.93	.968	.306	25.23	26.62
Obese	32.15	1.39	.442	31.15	33.15

Table 1: Descriptive statistics of the samples

Groups	Mean	S.D	S.E	95% C.I of Mean	
				LOWER	UPPER
Group A	65.60	12.79	4.04	56.44	74.75
Group B	71.50	22.06	6.97	55.71	87.28
Group C	80.80	12.50	3.95	71.85	89.74
Group D	85.70	3.91	1.23	82.89	88.50

Table 2: Descriptive statistics of the hand grip strength measurement

Multiple Group Comparison		Mean Difference	Standard Error	Significance
Group A	GROUP B	-5.90	6.41	.794*
	GROUP C	-15.20	6.41	.101*
	GROUP D	-20.10	6.41	.017**
Group B	GROUP A	5.90	6.41	.794*
	GROUP C	-9.30	6.41	.477*
	GROUP D	-14.20	6.41	.039**
Group C	GROUP A	15.20	6.41	.101*
	GROUP B	9.30	6.41	.477*
	GROUP D	-4.90	6.41	.870*
Group D	GROUP A	20.10	6.41	.017**
	GROUP B	14.20	6.41	.039**
	GROUP C	4.90	6.41	.870*

(* - $P > 0.05$), (** - $P \leq 0.05$)

Table 3: Comparison of hand grip strength using one ANOVA multiple comparison post hoc tukey hsd test between Group A, group B, Group C & Group D

The above table reveals the Mean difference, Standard Error, Multiple Group Comparison Post Hoc Tukey test significance and p-value of the Hand grip strength measurement score between (Group A) ,(Group B), (Group C) &(Group D).

Group D shows Statistically Significant difference compared with Group A & Group B at (**- $P \leq 0.05$)

Group D shows Observable Mean difference compared with Group C.

Test	Groups	Mean	S.D	Df1	Df2	F-Value	Significance
Hand Grip Strength (Kgs)	GROUP-A	65.60	12.79	3	36	3.47	.015**
	GROUP-B	71.50	22.06	3	36		
	GROUP-C	80.80	12.50	3	36		
	GROUP-D	85.70	3.91	3	36		

** - $P \leq 0.05$)

Table 4: Comparison of Hand Grip Strength using One way Anova Test between Group A , Group B, Group C & Group D

The above table reveals the Mean, Standard Deviation (S.D), Homogeneity variance, ANOVA test, degree of freedom(df), F -value & P value significance of the hand grip strength with different Body Mass Index(BMI) between (Group A),(Group B), (Group C) & (Group D)

This table shows that there is a Statistically Significant difference in hand grip strength between (Group A), (Group B) & (Group C) & (Group D) (**- $P \leq 0.05$).

Parameters	Male subjects	
	'r' value	P value
Hand Grip Strength	0.523	≤ 0.05
BMI	0.99	≤ 0.05

Table 5: Pearson Correlation of Coefficient between Hand Grip Strength and Body Mass Index between groups

The above table reveals the Pearson Correlation of coefficient ' r ' value and p-value groups between Hand Grip Strength and Body Mass Index.

There is a positive Association and correlation between Body Mass Index and Hand Grip Strength in the subjects. The Body Mass Index had the strongest correlation with Hand Grip Strength ($P \leq 0.05$).

RESULTS

On comparing the mean values of Group A, Group B, Group C & Group D on Hand Grip Strength shows significant increase in the mean values, in which Obese Body Mass Index (Group D) shows (85.70) which has the highest mean value when compared with other groups (Group C) (80.80), (Group B) (71.50) & (Group A) (65.60) at $P \leq 0.05$.

There is a positive association and strong correlation between Body Mass Index and Hand Grip Strength between the Groups at ($r = 0.523$) & ($P \leq 0.05$).

DISCUSSION

There are many studies supporting positive correlation between the hand grip strength and shoulder power. Thus while training cricket players equal importance should be given to strength hand grip and shoulder power. A study concluded that proper training required for maintaining percentage of lean body mass and HGS. Studies also reported hand dimensions and Hand grip strength have positive association between cricket players and volley ball players¹⁶.

A study has proved that there is significant positive correlation of dominant hand's grip strength with the age and BMI. There is

positive correlation between BMI and shoulder power and vice versa. Another study has reported significant difference in height of cricket players; significant difference found in BMI of cricket players¹⁷.

Studies have proved that Hand Grip Strength improves as BMI rise in professional cricket players which may be explained by low fat and high muscle mass due to high intensity training in that group. A study has concluded that Hand length and forearm circumference significantly impacted on hand grip strength in healthy adult males^{18,19}.

Studies have reported that underweight and overweight groups had a lower grip Strength and endurance than the normal weight group in males, but not in females. The correlation was weak and it suggested that on both sides of the normal BMI, the hand grip endurance tended to decrease in males as well as females²⁰.

Ethical Clearance: Ethical clearance has obtained from Faculty of Physiotherapy, DR.MGR. Educational and Research Institute, Chennai to conduct this study with reference number: A-033/PHSIO/IRB/2018-19 dated 07/01/2019.

Conflict of interest: There was no conflict of interest to conduct this study.

Fund for the study: It was a self financed study.

CONCLUSION

The study concluded that cricket players with Obese Body Mass Index have more Hand Grip Strength. The study also report strong association of Hand Grip Strength with Body Mass Index.

REFERENCES

1. Bohannon, Richard W. (1997): "Reference values for extremity muscle strength obtained by hand-held dynamometry from adults aged 20 to 79 years." *Archives of physical medicine and rehabilitation* 78; 1; 26-32.
2. Richards, Lorie Gage, Bonni Olson, and Pamela Palmiter-Thomas. (1996): "How forearm position affects grip strength." *American Journal of Occupational Therapy*, 50; 2; 133-138.
3. Foo, Leng Huat, et al. (2007): "Influence of body composition, muscle strength, diet and physical activity on total body and forearm bone mass in Chinese adolescent girls." *British journal of nutrition*, 98; 06; 1281-1287.
4. Massy-Westropp, Nicola, et al. (2004). Measuring grip strength in normal adults: reference ranges and a comparison of electronic and hydraulic instruments." *The Journal of hand surgery* 29; 3; 514-519.
5. Nwuga, V. C. (1975). Grip strength and grip endurance in physical therapy students." *Archives of physical medicine and rehabilitation* 56; 7; 297-300.
6. Chilima, D. M., & Ismail, S. J. (2001). Nutrition and hand grip strength of older adults in rural Malawi. *Public Health Nutr.*, 9, 11-17.
7. Samson, Monique M., et al. (2000): Relationships between physical performance measures, age, height and body weight in healthy adults. *Age and ageing*, 29; 3; 235-242.
8. De, S., et al. (2011). Effect of body posture on hand grip strength in adult Bengalee population." *Journal of Exercise Science and Physiotherapy*, 7; 2; 79.
9. P. Sathya, Ramakrishnan K. S, S. Makesh Babu, S. Khushboo & Vidyalaxmi V. (2014). Power web, resistive hand Exerciser and hand putty exercises for pinch strength in dental professionals. *International Journal of Humanities, Arts, Medicine and Sciences* 2; 713-20.
10. Mathiowetz, Virgil, et al. (1985). Grip and pinch strength: normative data for adults. *Arch Phys Med Rehab.* 66; 2; 69-74.
11. Cook, Ellen E., et al. (1987). Shoulder antagonistic strength ratios: a comparison between college-level baseball pitchers and non pitchers." *Journal of Orthopaedic & Sports Physical Therapy*, 8; 9; 451-461.
12. Housh, Terry J., et al. (1989). Isokinetic strength and body composition of high school wrestlers across age." *Medicine and science in sports and exercise*, 21; 1; 105-109.
13. Thorland, William G., et al. (1987). Strength and anaerobic responses of elite young female sprint and distance runners." *Medicine and science in sports and exercise*, 19; 1; 56-61.
14. Elder, G. C., K. Bradbury, and R. Roberts. (1982). Variability of fiber type distributions within human muscles." *Journal of Applied Physiology* 53, 6; 1473-1480.
15. Glenmark, B., et al. (1994). Muscle strength from adolescence to adulthood—relationship to muscle fibre types. *European journal of applied physiology and occupational physiology*; 68; 1; 9-19.
16. Petersen, Paul, et al. (1989). Grip strength and hand dominance: challenging the 10% rule." *American Journal of Occupational Therapy*, 43; 7; 444-447.
17. Crosby, Carla A., and Marwan A. Wehbé. (1994). Hand strength: normative values."

- The Journal of hand surgery; 19; 4; 665-670.
18. Froese, E. A., and M. E. Houston. (1987). Performance during the Wingate anaerobic test and muscle morphology in males and females. *International journal of sports medicine*; 8; 1; 35-39.
 19. Sargeant, et al. (1981). Maximum leg force and power output during short-term dynamic exercise. *Journal of Applied Physiology* 51; 5; 1175-1182.
 20. Parvatikar, V. B., and P. B. Mukkannavar. (2009): Comparative study of grip strength in different positions of shoulder and elbow with wrist in neutral and extension positions. *Journal of Exercise Science and Physiotherapy*; 5; 2; 67.

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