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Original Research Article

EFFECT OF BMI ON HAND GRIP STRENGTH IN ELITE CRICKET PLAYERS

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ABSTRACT

Background: Cricket is most popular team sport in Indian subcontinent. Hand-grip strength (HGS) plays a vital part in all roles of cricket which may be affected by BMI. **Objective:** To find-out the effect of BMI on HGS in Indian professional cricket players.

Materials and Methods: Study-design: Experimental study; different subject design. Sampling technique: Convenient sampling Sample size: 322 male cricket players aged between 13 and 38 years. Independent variable: BMI group (Below 19, 20-22, 23-25, 26-32) Dependent variable: HGS in 3 different position for both right and left side. Instrument used: Jamar hand-held electronic hand-grip dynamometer. Statistics: Mean, standard deviation (SD) as descriptive and one-way ANNOVA with LSD post-hoc analysis as inferential statistics.

Results: Below 19 BMI group showed significantly lower HGS than other three BMI groups. 20-23 BMI group significantly lower than 23-25 and 26-32 BMI groups. 23-25 group HGS values are lower than 26-32 group without statistical significance.

Conclusion: HGS improve as BMI rise in professional cricket players which may be explained by low fat and high muscle mass due to high intensity training in this group.

KEY WORDS: HGS, Jamar dynamometer, BMI, Team sport, Muscle fat ratio.

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INTRODUCTION

Fitness is an integral component of performance; as fatigue develops, skill deteriorates being fit delays the onset of fatigue and prevention of overuse injuries. Therefore optimal fitness levels will enable fast bowlers to bring together longer spells at top pace without losing line and length; batsman will maintain their timing, placement, concentration and focus apart from playing different shots, running between wickets with less efforts; fielders will hold their physical performance by reaction timing, focus and concentration for longer duration. Those players possessing adequate levels of strength, power, muscle endurance, stamina (Cardiac endurance), explosive power and flexibility in the muscle groups used in cricket not only will enhance their potential to perform better, but also may reduce their susceptibility to injury.

Regular pre-participation fitness testing, musculoskeletal screening by physiotherapist and medical screening tests is now an important part of pre-participation evaluation in Cricket before season starts. Even though hand-grip strength (HGS) is one of the parameter that is correlated with shoulder power in cricket [1] and may predispose upper limb injuries [2], it is not the integral part of pre-participation evaluation in Cricket. Thus, we decided to incorporate HGS evaluation in professional cricket players' thorough systematic research. In our previous publications, we have shown HGS evaluation has excellent test-retest reliability in cricket players [3]. It has lower values in 13-16 yrs age group possibly due to hormonal changes associated with puberty and increase with age up to 36 years without significant difference possibly due to achieving peak testosterone level by high intensity training [4].

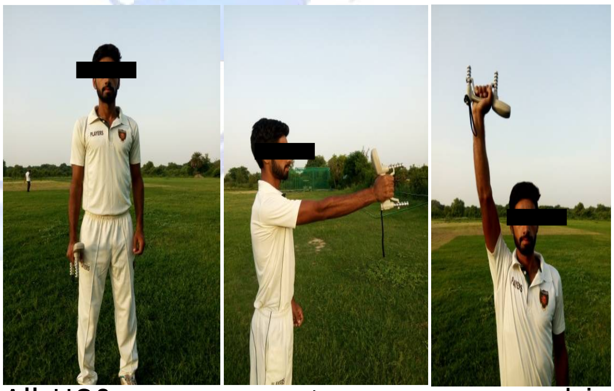
Prof. Shyamal Koley from India is pioneer in HGS studies and many of his studies reported HGS is correlated with age, height, weight (both fat and fat-free), BMI in both normal and athletic population [5, 6]. Since in our previous publication we discussed about effect of age on HGS in cricket players and found interesting results, in this paper we have attempted to see the effect of BMI on HGS. Given the higher HGS values in lower BMI when compared to control, we hypothesized that cricket players would have more HGS as BMI progress owing to higher lean body mass percentage [6].

MATERIALS AND METHODS

Present study was an experimental study with different subject design based on cross sectional survey. 322 Indian male cricket players were recruited through convenient sampling technique after screening following inclusion and exclusion criteria: Inclusion criteria: Professional male cricket players who practices minimum 4 days week and plays regular matches for their clubs, districts, states and national level for the period of at least 2 years. Age should be between 13 to 38 years. Exclusion criteria: Professional players who is suffering from any acute or chronic upper limb injuries. Selected candidates were given informed written consent to participate in the present study.

Selected 322 players, had following characteristics: age, height, weight, BMI was 19.83 ± 4.71 years, 172.17 ± 7.03 cms , 67.53 ± 9.69 Kg and 22.74±2.65 $Kg.m^{-2}$ respectively (values are in mean± SD). They were divided into four groups based on BMI (values are in $Kg.m^{-2}$) criteria specific to Asian Indians: Below 19 (50 players), 20-22 (127 players), 23-25 (117 players) and 26-32 (29 players) [7, 8]. Maximal hand-grip strength (HGS) was measured in three different positions (P1- Shoulder in 0º flexion, Elbow in extension (0º), Forearm in midprone, Wrist in neutral position and fingers maximum flexion; P2- Shoulder in 90º flexion, Elbow in extension (0º), Forearm in midprone, Wrist in neutral position and fingers maximum flexion; P3- Shoulder in 180º flexion, Elbow in extension (0º), Forearm in prone, Wrist in neutral position and fingers maximum flexion) using Jamar digital hand-held hydrolic hand dynamometer [Jamar® Plus+, Sammons Preston, Bolingbrook, IL] which has excellent internal consistency (Cronbach's alpha > 0.956) and moderate to high test-retest reliability (r 0.743-0.856) in both hands of professional Cricket players [3].

Position-1 **Position-2** **Position-3**



All HGS measurements were measured in standing position as it was a functional position in Cricket as well as this position produced maximal strength as compared to sitting or lying position. Each player was asked to maintain the desired upper limb position, which was physically demonstrated by the therapist, and asked to press as hard as possible for 5 seconds (command given was press...one... two...three... four...five...relax). Three repetations was taken for each position in both hands. Minimum one minute rest was given between the repeatation. Mean of three readings was used for analysis.

BMI group was the independent variable while HGS was the dependent variable in the present study.

Values were presented as mean ± SD (Descriptive statistics) and one-way ANNOVA was used to compare BMI groups (Inferential statistics). If there were significant differences between these groups then LSD post-hoc test was used to find where the difference exists.

RESULTS

In order to see the effect of BMI on HGS, we divided cricket players according to Indian norms (i.e.) <19 Kg.m^{-2} (under weight), 20-22 Kg.m^{-2} (normal weight), 23-25 Kg.m^{-2} (over weight) and 26-32 Kg.m^{-2} (Obese). Table 1 shows descriptive statistics along with one way-ANNOVA (F value) for different BMI groups. In general right side was greater than left side in all three positions for all the four groups. HGS values were lowest in Below 19 BMI group, gradually increased in subsequent groups and highest in 26-32 BMI group. This was confirmed by ANNOVA where F values were highly significant in all groups with p<0.001.

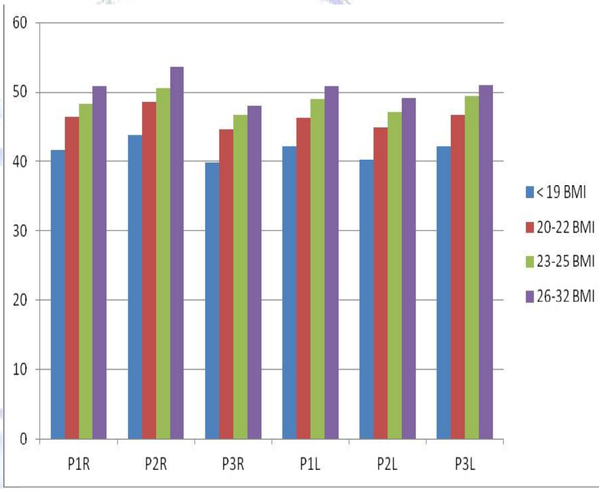
Table 1: Descriptive statistics along with F values for different HGS positions in BMI group (n=322).

Positions	<19 (50)	20-22 (127)	23-25 (117)	26-32 (29)	F value (Sig)
P1L	41.63±5.77	46.48±7.15	48.30±8.11	50.86±8.37	12.590***
P1R	43.83±6.97	48.58±7.34	50.62±7.84	53.63±7.66	13.555***
P2L	39.82±5.76	44.57±6.86	46.78±7.59	48.00±7.17	13.522***
P2R	42.15±6.16	46.32±7.25	48.93±7.67	50.85±6.84	13.401***
P3L	40.20±5.47	44.89±6.59	47.08±7.69	49.17±7.00	14.870***
P3R	42.19±6.34	46.66±6.95	49.40±7.73	50.95±6.07	14.977***

*, **, *** means 'p' value less than 0.05,0.01, 0.001 respectively

LSD post-hoc analysis showed <19 Kg.m^{-2} group P1L position HGS values were significantly lower than 20-22 group (MD -4.85, 95% CI -7.29 to -2.40, p<0.001), 23-25 group (MD -6.67, 95% CI -9.15 to -4.20, p<0.001) and 26-32 group (MD -9.24, 95% CI -12.65 to -5.82, p<0.001). 20-22 Kg.m^{-2} group was significantly lower than 26-32 group (MD -4.39, 95% CI -7.40 to -1.37, p<0.01). In P1R position, <19 group was significantly lower than 20-22 group (MD -4.75, 95% CI -7.22 to -2.29), 23-25 group (MD -6.79, 95% CI -9.29 to -4.30), 26-32 group (MD -9.81, 95% CI -13.25 to -6.36). All values were significant at p<0.001. 20-22 group was significantly lower than 23-25 group (MD -2.04, 95% CI -3.93 to -0.15, p<0.05), 26-32 group (MD -5.05, 95% CI -8.09 to -2.02, p=0.001). In P2L position, <19 group HGS was significantly lower than 20-22 group (MD -4.75, 95% CI -7.05 to -2.44, p<0.001), 23-25 group (MD -6.96, 95% CI -9.29 to -4.63, p<0.001), 26-32 group (MD -8.18, 95% CI -11.40 to -4.96, p<0.001). 20-22 group was significantly lower than 23-25 group (MD -2.21, 95% CI -3.98 to -0.44, p<0.05), 26-32 group (MD -3.43, 95% CI 6.27 to -0.59, p<0.05). In P2R position, <19 group was significantly lower than 20-22 group (MD -4.16, 95% CI -6.54 to -1.79, p=0.001), 23-25 group (MD -6.77, 95% CI -9.17 to -4.37, p<0.001) and 26-32 group (MD -8.70, 95% CI -12.02 to -5.38, p<0.001). 20-22 group was significantly lower than 23-25 group (MD -2.61, 95% CI -4.43 to -0.79, p<0.01), 26-32 group (MD -4.54, 95% CI -7.46 to -1.61, p<0.01).

Fig. 1: Comparison of mean HGS values in different positions among BMI group.



In P3L position, <19 group was significantly lower than 20-22 group (MD -4.69, 95% CI -6.96 to -2.42, p<0.001), 23-25 group (MD -6.88, 95% CI -9.18 to -4.59, p<0.001), 26-32 group (MD -8.97, 95% CI -12.14 to -5.80, p<0.001). 20-22 group was significantly lower than 23-25 group (MD -2.19, 95% CI -3.94 to -0.45, p<0.05), 26-32 group (MD -4.28, 95% -7.08 to -1.48, p<0.01). In P3R position, <19 group was significantly lower than 20-22 group (MD -4.47, 95% CI -6.80 to -2.14, p<0.001), 23-25 group (MD -7.21, 95% CI -9.57 to -4.86, p<0.001) and 26-32 group (MD -8.76, 95% CI -12.02 to -5.50, p<0.001). 20-22 group was significantly lower than 23-25 group (MD -2.74, 95% CI -4.53 to -0.95, p<0.01), 26-32 group (MD -4.29, 95% CI -7.16 to -1.41, p<0.01). There was no significant difference between 23-25 group and 26-32 groups in all 6 (3 right and 3 left) positions. These results diagrammatically presented in Figure 1.

DISCUSSION

The main objective of our study was to find out the effect of BMI on HGS in different BMI groups (Below 19 BMI group, 20-22 BMI group, 23-25 BMI group and 26-32 BMI group), of professional cricket players in different shoulder and forearm positions. We found that Below 19 BMI group has significantly lower values than other three groups and 20-22 BMI group has significantly lower values than 23-25 and 26-32 group. Even though 26-32 BMI group HGS values are always higher than 23-25 group, difference is not significant.

Koley and Yadav [6] have reported that HGS has affected by BMI, height and weight has positive correlation with right and left hand HGS in cricketers. They also noted HGS values are positively correlated with fat percentage and negatively correlated with lean body mass. In general look it may seem later statement is surprising and contrary to our hypothesis, these findings in fact support our results. Body fat percentage increases as the weight increases (i.e) lower the weight, lower the fat percentage and vice vera. Since height reached static in adult cricket players, weight will be the determining factor of BMI in this population. So, lower BMI categories will have lowest fat percentage as compared to higher BMI categories hence positive correlation with HGS because weight also has positive correlation. But lean body mass percentage decrease as the weight increase with higher BMI hence negative correlation. The contribution of lean body mass on HGS is significantly higher than the fat percentage, our hypothesis, is supported by our findings. The significant difference in HGS present only in lower BMI values (i.e) below 19, 20-22 group where lean body mass high. Lack of significant difference between 23-25 and 26-32 group may be explained by low lean body mass percentage in those groups. Later other studies also support our results- Massy-Westropp et.al. [9] concluded that Higher HGS was weakly related to higher BMI in adults under the age 30 years and over the age of 70, but inversely related to high BMI possibly due to low lean body mass percentage. Bansoda et.al., [10] showed the significant positive correlation of dominant hand grip strength with age, body height, body weight, BMI and hand span. Jadhav et.al. [11] found positive correlation in HGS and percentage of lean body mass in cricketers.

CONCLUSION

In general HGS increases as BMI increases, but values are statistically lower in low BMI categories than insignificant rise in higher BMI categories. These findings may be explained by differences in fat percentage-lean body mass percentage ratio between different BMI groups. Trainers should improve the lean body mass by aerobic training in high BMI categories and should improve weight by resistance training in low BMI categories as this will improve the performance in Cricket by improving HGS.

ABBREVIATIONS

ANNOVA- Analysis of Variance
BMI- Body mass index; 95% CI- 95% confidence interval
HGS- Hand-grip strength
MD- Mean difference
P1L- Position 1 in left side
P1R- Position 1 in right side
P2L- Position 2 in left side
P2R- Position 2 in right side
P3L- Position 3 in left side
P3R- Position 3 in right side
SD- Standard deviation

Conflicts of interest: None

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