Estimation of Hand Grip Strength and its Association with some Anthropometric traits in Cricketers of Amritsar, Punjab, India

S Koley, M Yadav, J Sandhu

Citation

Abstract
The present study is based on the association of left and right hand grip strength with eight anthropometric traits, viz. height, weight, body mass index, hand length, hand breadth, upper arm length, forearm length and total arm length in 100 male cricketers aged 17 – 21 years (mean age 18.29 ± 2.21 years ) of Amritsar, Punjab, India. A total of 100 controls were also taken for comparisons. The findings of the present study indicate a strong association of right hand grip strength with height (r =0.383), weight (r=0.498), body mass index (r=0.401), hand length (r=0.444), hand breadth (r=0.326) and forearm length (r=0.215). Whereas left hand grip strength was reported to be closely associated with height (r=0.355), weight (r=0.472), body mass index (r=0.374), hand length (r=0.320) and hand breadth (r=0.330).

INTRODUCTION
Hand grip strength is a physiological variable that is affected by a number of factors including age, gender and body size among others. Strong correlations between grip strength and various anthropometric traits, (weight, height, hand length) were reported. In fact, the grip strength was reported to be higher in dominant hand with right handed subjects, but no such significant differences between sides could be documented for left handed people. Right and left hand grip strength was positively correlated with weight, height and body surface area. In case of relationships of hand grip strength with stature, weight, arm and calf circumferences and various subcutaneous skinfolds, it was found that boys attained greater values for these anthropometric variables and also had greater hand grip strength values than their girl counterparts. It was found too that age dependent increase of hand grip strength in boys and girls as well as inter-gender differences were strongly associated with changes of fat free mass during their childhood. Hand grip strength was found to be a significant determinant of bone mineral content and bone area at the forearm sites and had a positive correlation with lean body mass and physical activity. It determines the muscular strength of an individual. Hip/waist circumferences measurement is a good marker of fat mass, bone mineral content and lean mass which are strongly correlated with maximum isometric grip force. The assessment of hand grip strength assumes importance in a number of situations. It may be used in the investigation and follow – up of patients with neuromuscular disease. It is also of use as functional index of nutritional status and can predict the extent of complications following surgical intervention in hospitalized patients. The information regarding the association of hand grip strength and various anthropometric variables in cricketers is scanty from India, so the present study was planned.

MATERIALS AND METHODOLOGY
The present study is based on the sample of 100 male cricketers (60 district level and 40 state level) aged 17 – 21 years (mean age 18.29 ± 2.21 years ) of Amritsar, collected from Gandhi Ground, Amritsar, Punjab, India during March – September, 2008. An adequate number of controls (n=100) were also taken for comparison from the same place matching age, sex, socio – economic status and ethnicity, except the playing condition. In this cross-sectional study, the subjects were selected purposively and the age of the subjects were recorded from the records of their respective educational institutes. The subjects were divided in such a way that <=, for instance refers to the children aged 16 years and 6 months through 17 years and 5 months and 29 days. The study was registered with the local ethics committee.

Eight anthropometric traits, viz. height, weight, body mass
index, hand length, hand breadth, upper arm length, forearm length and total arm length were taken on each subject using the techniques provided by Weiner and Lourie. The grip strength of both right and left hands was measured using a standard adjustable digital hand grip dynamometer (Takei Scientific Instruments Co., LTD, Japan) at standing position with shoulder adducted and neutrally rotated and elbow in full extension. The subjects were asked to put maximum force on the dynamometer thrice from both sides of the hands. The average value was recorded in kilograms.

Data were analyzed using SPSS (Statistical Package for Social Science) version 7.5. Student’s t test was applied for the comparison of all the variables between cricketers and controls, and ANOVA was also applied. Multiple regression analyses were carried out with hand grip strength (separately) as a dependent variable and rest of the anthropometric variables as independent. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 shows the distribution of mean values of height, weight, body mass index, hand length, hand breadth, upper arm length, fore arm length, total arm length, right hand grip strength and left hand grip strength in cricketers and controls. Cricketers have higher mean values in height (172.41cm), hand length (18.90cm), hand breadth (8.35cm), total arm length (77.28cm), right hand grip strength (35.86kg) and left hand grip strength (35.41kg) and have lesser mean values in weight (59.19kg), BMI (19.79 kg/m^2), upper arm length (31.75cm) and forearm length (26.53cm) than their control counterparts (170.26cm, 18.40cm, 8.08cm, 76.08cm, 32.39kg, 31.17kg, 63.92kg, 21.92 kg/m^2, 32.26cm and 26.62cm respectively), showing statistically significant differences (P≤0.05) in height (t=2.75), weight (t=2.81), hand length (t=3.76), hand breadth (t=4.11) and right hand grip strength (t=3.28) and highly significant differences (P≤0.001) in BMI (t=4.40) and left hand grip strength (t=4.12).

When one way analysis of variance was done (Table 2), highly significant between group differences (P≤0.001) were found in height (F=75.73), weight (F=7.90), BMI (F=19.39), hand length (F=14.13), hand breadth (F=16.94), right hand grip strength (F=10.74) and left hand grip strength (F=16.95), keeping the parity with the result of table 1.

DISCUSSION

The findings of the study indicate that cricketers have higher mean values in height, hand length, hand breadth, total arm length, and both right and left hand grip strength and lesser mean values in weight, BMI, upper arm length and forearm length than their control counterparts, showing statistically significant differences (P≤0.05) in height (t=2.75), weight (t=2.81), hand length (t=3.76), hand breadth (t=4.11), right hand grip strength (t=3.28) and left hand grip strength (t=4.12) between cricketers and controls. The differences may be due to the effect of regular physical

Regression with right hand grip strength and other anthropometric variables in cricketers only. In cricketers, right and left hand grip strength have significantly positive correlations with height (r = 0.383 and 0.355 respectively), weight (r = 0.498 and 0.472 respectively), BMI (r = 0.401 and 0.374 respectively), hand length (r = 0.444 and 0.310 respectively), hand breadth (r = 0.326 and 0.330 respectively), and forearm length (r=0.215 with right hand grip strength only). In controls, right and left hand grip strength have significantly positive correlations with height (r = 0.566 and 0.549 respectively), weight (r = 0.505 and 0.419 respectively), BMI (r = 0.342 and 0.244 respectively), hand length (r = 0.493 and 0.451 respectively), hand breadth (r = 0.565 and 0.544 respectively), upper arm length (r = 0.359 and 0.293 respectively), forearm length (r = 0.209 and 0.229 respectively) and with total arm length (r = 0.360 and 0.315 respectively).

Figure 1

Table 1: Distribution of some anthropometric traits and right and left hand grip strength in cricketers and controls

<table>
<thead>
<tr>
<th>Anthropometric Trait</th>
<th>Mean Cricketers (n=100)</th>
<th>Mean Controls (n=100)</th>
<th>* value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height (cm)</strong></td>
<td>172.41 ± 5.60</td>
<td>170.26 ± 5.40</td>
<td></td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>59.13 ± 15.59</td>
<td>59.13 ± 15.60</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m^2)</td>
<td>19.79 ± 3.42</td>
<td>19.79 ± 3.42</td>
<td></td>
</tr>
<tr>
<td><strong>Hand Length (cm)</strong></td>
<td>18.90 ± 0.62</td>
<td>18.90 ± 0.62</td>
<td></td>
</tr>
<tr>
<td><strong>Hand Breadth (cm)</strong></td>
<td>8.35 ± 0.16</td>
<td>8.35 ± 0.16</td>
<td></td>
</tr>
<tr>
<td><strong>Arm Length (cm)</strong></td>
<td>77.28 ± 2.86</td>
<td>77.28 ± 2.86</td>
<td></td>
</tr>
<tr>
<td><strong>Right Grip Strength</strong></td>
<td>35.86 ± 2.34</td>
<td>35.86 ± 2.34</td>
<td></td>
</tr>
<tr>
<td><strong>Left Grip Strength</strong></td>
<td>35.41 ± 2.34</td>
<td>35.41 ± 2.34</td>
<td></td>
</tr>
</tbody>
</table>

* indicates P<0.05; ** indicates P<0.001

DISCUSSION

The findings of the study indicate that cricketers have higher mean values in height, hand length, hand breadth, total arm length, and both right and left hand grip strength and lesser mean values in weight, BMI, upper arm length and forearm length than their control counterparts, showing statistically significant differences (P≤0.05) in height (t=2.75), weight (t=2.81), hand length (t=3.76), hand breadth (t=4.11), right hand grip strength (t=3.28) and left hand grip strength (t=4.12) between cricketers and controls. The differences may be due to the effect of regular physical

Table 3 shows the correlation coefficient of right and left head grip strength with other anthropometric variables in cricketers and controls. Figs 1-8 also show the linear
Table 2: One way analysis of variance of anthropometric traits and right and left hand grip strength in cricketers and controls reduce the body weight, BMI in cricketers. In this direction, references are available related to some other sports events. Grants et al. reported significantly higher values for right hand grip strength in elite rock climbers than recreational climbers. Watts et al. in 1996 reported that hand grip strength and hand grip endurance decreased with continuous difficult rock climbing and remained depressed after 20 minutes of resting recovery. Latter, they opined that hand grip strength recovered at a faster rate than hand endurance. De et al. stated that the hand grip strength values of inter-university Kabaddi (an ancient Indian rural game) players (male) were higher in comparison to those of Indian footballers and hockey players.

Table 3: Correlation coefficient of right and left hand grip strength with other 8 anthropometric traits in cricketers and controls

Figure 1: Scatter plot of hand grip strength (right) of Indian Cricketers by height

Figure 3

Table 4: Correlation coefficient of right and left hand grip strength with other 8 anthropometric traits in cricketers and controls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cricketers (n=100)</th>
<th>Controls (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>0.383***</td>
<td>0.566***</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.490**</td>
<td>0.505**</td>
</tr>
<tr>
<td>BMl (kg/m²)</td>
<td>0.401**</td>
<td>0.419**</td>
</tr>
<tr>
<td>Hand length(cm)</td>
<td>0.444**</td>
<td>0.493**</td>
</tr>
<tr>
<td>Hand breadth(cm)</td>
<td>0.326**</td>
<td>0.565**</td>
</tr>
<tr>
<td>Upper arm length(cm)</td>
<td>0.162</td>
<td>0.359**</td>
</tr>
<tr>
<td>Fore arm length(cm)</td>
<td>0.215*</td>
<td>0.209*</td>
</tr>
<tr>
<td>Total arm length(cm)</td>
<td>0.134</td>
<td>0.073</td>
</tr>
</tbody>
</table>
| * indicates P<0.05; ** indicates P<0.01
Estimation of Hand Grip Strength and its Association with some Anthropometric traits in Cricketers of Amritsar, Punjab, India

Figure 5
Figure 2: Scatter plot of hand grip strength (right) of Indian Cricketers by weight

Figure 7
Figure 4: Scatter plot of hand grip strength (right) of Indian Cricketers by hand length

Figure 6
Figure 3: Scatter plot of hand grip strength (right) of Indian Cricketers By BMI

Figure 8
Figure 5: Scatter plot of hand grip strength (right) of Indian Cricketers by hand breadth
In cricketers, right hand grip strength had significantly positive correlations with height ($r = 0.383$), weight ($r = 0.498$), BMI ($r = 0.401$), hand length ($r = 0.444$), hand breadth ($r = 0.326$) and forearm length ($r = 0.215$). Only three left hand dominant cricketers participated in the study. In fact, correlation of handedness with hand grip strength was established by Incel et al.\textsuperscript{3}. That’s why, in the present study, discussion would be confined in right hand only.

Though information is lacking regarding the hand grip strength and its association with physical and physiological traits, research findings are available in other sports too. Tsuji et al.\textsuperscript{18} opined that grip strength was one of the determinant factors of radial bone mineral density in the dominant forearm of young college athletes. Whereas, Ducher et al.\textsuperscript{19} found that forearm bone mineral content adjusted to lean tissue mass or grip strength was higher on the dominant side, suggesting that tennis playing exerted a direct effect on bone. Pugh et al.\textsuperscript{20} observed that hand grip strength correlated with throwing speed in experienced pitchers. Though, later in 2003, they showed no significant relationship among the strength variables and ball speed during the tennis serve\textsuperscript{21}. The findings of the study of Hughes et al.\textsuperscript{22} suggested that hand grip strength and bat velocity were not significantly correlated. In the same direction, Tan et al.\textsuperscript{23} (2001) showed that the correlation coefficient between the bowling grip strength and bowling score was not significant. Some normative values of grip strength in adolescent population of north India was reported by Koley et al.\textsuperscript{24} and future dementia in elderly men of Honolulu was found by Taaffe et al.\textsuperscript{25}. Association of hand
grip strength and occupation was studied by Bandopadhyay

The findings of the present study carry immense practical application in selection of talents in cricket, though more future studies are required considering vast sample size with numbers of anthropometric traits.

References

Author Information

Shyamal Koley
Department of Sports medicine and physiotherapy, Guru Nanak Dev University

Mahendra Kumar Yadav
Department of Sports medicine and physiotherapy, Guru Nanak Dev University

J.S. Sandhu
Department of Sports medicine and physiotherapy, Guru Nanak Dev University