The relationship between hand grip strength and anthropometric parameters in men

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Abstract

Introduction: Hand grip strength (HGS) is a standard parameter for hand function evaluation. It is commonly used to assess the efficacy of different surgical procedures and treatments, such as the working capability of patients with either arm or hand lesions, or in clinical conditions, such as rheumatoid arthritis or muscular dystrophy.

Objective: To verify whether there is a relationship between hand grip strength and certain anthropometric parameters in Brazilian men, to evaluate whether differences exist between the right and left hands and between the dominant and non-dominant hands, and to gather data concerning normal HGS in Brazilian men.

Methods: A total of 1279 male (27.5 ± 10.1 years) volunteers in Brazil were evaluated. We examined the hand grip strength values in the left and right hands with a dynamometer. The data collection followed the recommendations of the American Society of Hand Therapists (ASHT). The height, weight and body mass index (BMI) of each participant were measured.

Results: The registered grip strength (in kgf) was 47.6 (8.1) for the right hand; 46.3 (8.2) for the left hand; 47.8 (8.2) for the dominant hand; and 46.1 (8.1) in the non-dominant hand. A weak and positive association was observed between the dominant hand grip strength and height (Spearman’s r= 0.28, p<0.01), weight (Spearman’s r=0.316, p<0.01), and BMI (Spearman’s r= 0.19, p<0.01) was observed.

Conclusion: A weak association was observed between the hand grip strength of the dominant hand and the anthropometric parameters of height, weight and BMI in Brazilian men. In this population, the studied anthropometric variables may be less relevant than the other physiological factors that influence the HGS. The dominant and right hands showed greater grip strength compared to the non-dominant and left hands, respectively.

Key words: Grip strength. Reference values. Dynamometer. Healthy brazilians. Anthropometric. Dominant hand.

Summary

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Purpose: To verify whether a relationship exists between hand grip strength and certain anthropometric parameters in Brazilian men, to evaluate whether differences exist between the right and left hands and between the dominant and non-dominant hands, and to gather data concerning normal HGS in Brazilian men.

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Resumen

Introducción: La fuerza de prensión manual (FPM) es un parámetro estándar para la evaluación de la función de la mano. Se utiliza comúnmente para evaluar la eficacia de diferentes procedimientos y tratamientos quirúrgicos, como la capacidad de trabajo de los pacientes con cualquier lesión en las manos e los brazos, o en condiciones clínicas tales como la artritis reumatoide o la distrofía muscular.

Objetivo: Comprobar si existe relación entre la fuerza de prensión manual y determinados parámetros antropométricos en hombres brasileños. Evaluar si hay diferencias entre las manos derecha e izquierda y entre las manos dominante y no dominante. Establecer los datos relativos normales a FPM en hombres brasileños.

Métodos: Fueron evaluados a 1279 hombres (27.5 ± 10.1 años) voluntarios en Brasil. Se examinó la fuerza de prensión manual de la mano izquierda y derecha, por medición de dinamómetro. La recopilación de datos siguió las recomendaciones de la American Society of Hand Therapists (ASHT). Se registraron la talla, peso e IMC.

Resultados: Se registraron una fuerza de prensión de 47.6 (8.1) kgf para la mano derecha; 46.3 (8.2) kgf para la mano izquierda; 47.8 (8.2) kgf para la mano dominante; y 46.1 (8.1) kgf en la mano no dominante. Se observó una asociación débil y positiva entre la fuerza de prensión manual dominante y la talla (Spearman’s r= 0.28, p<0.01), peso (Spearman’s r=0.316, p<0.01), y BMI (Spearman’s r= 0.19, p<0.01) fue observada.

Conclusión: Es posible establecer que existe una débil asociación entre la fuerza de prensión manual de la mano dominante frente a los parámetros antropométricos talla, peso e IMC en hombres brasileños. Para esta población variables antropométricas pueden ser menos relevantes que otros factores fisiológicos que influyen en FPM. La mano dominante y la mano derecha mostraron mayor fuerza de prensión en comparación con la mano no dominante y la izquierda, respectivamente.


Relación de fuerza de prensión manual frente a parámetros antropométricos en hombres

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Introduction

Hand grip strength (HGS) is a standard parameter for hand function evaluation. It is commonly used to assess the efficacy of different surgical procedures and treatments, such as the working capability of patients with either arm or hand lesions, or in clinical conditions, such as rheumatoid arthritis or muscular dystrophy. HGS can be quantified by measuring the amount of isometric force generated by the hand around a dynamometer. Hand dynamometry was randomly selected from the data collected at stations placed in a manner, this study may provide important information about HGS levels periodically throughout the study.

The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS 17.0, Chicago, IL, USA). To ensure anonymity, the participants were unidentified using a numbering codification scheme. The Kolmogorov-Smirnov test was used for the data normality test. The Mann-Whitney U-test for independent samples was applied to determine the existence of significant discrepancies between the values for both hands. Spearman's correlation coefficients were calculated for the nonparametric data and abnormally distributed data. Relationships between age, height, weight, height and BMI and dominant HGS were analysed using linear regression. A one-way analysis of variance (ANOVA) was used to compare the dominant HGS in the groups. The significance level was α<0.05.

Results

Right hand grip strength was higher than that of the left, and dominant HGS was higher than that of non-dominant HGS.

There was weak and positive association between height and grip strength of the dominant hand (Spearman r = 0.28, p<0.01) (Figure 1A). In the sample, for every centimetre increase in height, a 0.35 Kgf increase occurred in dominant HGS (95% CI, 0.22-0.49, p<0.01).
A moderate and positive association between the dominant HGS and body weight was observed (Spearman’s $r = 0.316$, $p<0.01$) (Figure 1B). For each kilogram of body weight increase there was a 0.29 Kgf increase (95% CI, 0.14-0.44, $p<0.01$) in the grip strength of the dominant hand.

A weak, positive association between the BMI and dominant HGS was observed (Spearman’s $r = 0.19$, $p<0.01$). For every BMI unit increase, a 0.48 Kgf increase occurred in the dominant HGS, (95% CI, 0.41-0.55, $p<0.01$).

Our sample included men ranging in age from 14 to 59 years. We divided them into age groups to provide a general view of these data. Table 2 shows the sample’s main characteristics, divided into eight age groups.

Table 1. Characteristics of 1279 men recruited from Minas Gerais, Brazil.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>27.5 (10.1)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.6 (6.9)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>69.3 (9.3)</td>
</tr>
<tr>
<td>BMI</td>
<td>22.9 (2.8)</td>
</tr>
<tr>
<td>GS right hand</td>
<td>47.6 (8.1)</td>
</tr>
<tr>
<td>GS left hand</td>
<td>46.3 (8.2)*</td>
</tr>
<tr>
<td>GS dominant hand</td>
<td>47.8 (8.2)</td>
</tr>
<tr>
<td>GS non-dominant hand</td>
<td>46.1 (8.1)**</td>
</tr>
</tbody>
</table>

Grip strength (GS)
*Significantly different from the right hand $p<0.05$.
**Significantly different from the dominant hand $p<0.05$.

Figure 1. (A) A scatter plot showing a weak and positive association between height and dominant HGS and (B) a scatter plot showing a moderate and positive association between weight and of dominant HGS.

Table 2. Characteristics of the study sample by age groups. All values are presented as average. The hand grip strength is represented in Kgf with mean (SD).

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>%</th>
<th>Age</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI</th>
<th>GSRH</th>
<th>GSLH</th>
<th>GSHDom</th>
<th>GSHNDom</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-19</td>
<td>431</td>
<td>33.7</td>
<td>17.9</td>
<td>174.5</td>
<td>66.5</td>
<td>21.7</td>
<td>46.6</td>
<td>45.3</td>
<td>46.8</td>
<td>45.0</td>
</tr>
<tr>
<td>20-24</td>
<td>223</td>
<td>17.4</td>
<td>22.0</td>
<td>174.7</td>
<td>72.7</td>
<td>23.8</td>
<td>48.6</td>
<td>47.5</td>
<td>48.8</td>
<td>48.7</td>
</tr>
<tr>
<td>25-29</td>
<td>165</td>
<td>12.9</td>
<td>26.8</td>
<td>174.0</td>
<td>71.5</td>
<td>23.6</td>
<td>50.4</td>
<td>48.9</td>
<td>50.5</td>
<td>48.7</td>
</tr>
<tr>
<td>30-34</td>
<td>129</td>
<td>10.1</td>
<td>31.9</td>
<td>173.5</td>
<td>70.9</td>
<td>23.6</td>
<td>47.7</td>
<td>46.8</td>
<td>47.9</td>
<td>46.5</td>
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<tr>
<td>35-39</td>
<td>119</td>
<td>9.3</td>
<td>37.1</td>
<td>172.0</td>
<td>69.0</td>
<td>23.4</td>
<td>47.1</td>
<td>45.5</td>
<td>47.1</td>
<td>45.3</td>
</tr>
<tr>
<td>40-44</td>
<td>115</td>
<td>9.0</td>
<td>41.6</td>
<td>171.7</td>
<td>68.9</td>
<td>23.4</td>
<td>45.6</td>
<td>44.4</td>
<td>45.7</td>
<td>44.3</td>
</tr>
<tr>
<td>45-49</td>
<td>61</td>
<td>4.8</td>
<td>46.6</td>
<td>170.9</td>
<td>68.3</td>
<td>23.4</td>
<td>43.9</td>
<td>42.8</td>
<td>43.9</td>
<td>42.8</td>
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<tr>
<td>&gt;50</td>
<td>36</td>
<td>2.8</td>
<td>53.4</td>
<td>169.3</td>
<td>68.5</td>
<td>23.9</td>
<td>41.4</td>
<td>39.5</td>
<td>41.3</td>
<td>39.6</td>
</tr>
</tbody>
</table>

GSRH: grip strength right hand; GSLH: grip strength left hand; GSHDom: Grip strength dominant hand; GSHNDom: Grip strength non-dominant hand. *Significantly different $p<0.05$ between >50 vs. others groups. **Significantly different $p<0.05$ between 25-29 and 14-19; 30-34; 35-39; 40-44; 45-49. ††Significantly different $p<0.05$ between 20-24 and 14-19; 40-44; 45-49. †††Significantly different $p<0.05$ between 45-49 and 14-19; 30-34; 35-39.
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Discussion

When the associations between the HGS, height and body weight were analysed, a weak and positive correlation between these two anthropometric variables was found. These results show that for this population, the use of these variables in equations for predicting HGS or classification tables must be viewed with caution. These same associations were found in other studies[1,5,12,18,38-40], in which the correlation values obtained were greater than those presented in this study.

Our study also demonstrated a positive association between HGS and BMI. Similar results were also observed by[26,30,32], however, in the studies by[1,9,12,33] no association between the two variables was ever noted. As the result indicates a disagreement in the literature, we suggest future studies in which a more valid measure, such as the percentage of lean muscle mass, could be used to evaluate the relationship between body composition and HGS.

The adolescent and adult men in this study reflected the worldwide trend for significantly greater right HGS[1,12,21]. In this study, the average difference was 3%. This strength difference between hands appears to be a constant, regardless of ethnicity. Significant differences in values were found between the dominant (47.8 Kgf) and non-dominant hands (46.2 Kgf, a 3.5% difference). Similar findings were noted in the aforementioned published studies.

After comparing the Brazilian results with other studies conducted with different populations in the same age groups, it was noted that these values may be lower for the right (55.8 Kgf) and left (50.4 Kgf) hands in a Greek population[23], or similar for both hands (46.7 Kgf) in an Australian population[34]. After comparing these results with other studies conducted with different populations in the same age group, it was noted that these values may be lower for the dominant (55.9 Kgf) and left (50.4 Kgf) hands in a Greek population[23]. The dominant right and left HGS were (53.0 Kgf) and (50.3 Kgf), respectively, in a Swiss population[35]. Moreover, there was a decrease in values in a Nigerian population[30] for the dominant (35.2 Kgf) and non-dominant (31.6 Kgf) hands compared with the present study.

One explanation for the ethnic disparity could be that the Australian, Swiss and Greek samples may have included larger and heavier men. The other explanation may be that the recruitment strategies used in the different studies resulted in slightly different types of participants. The only other explanation for the different values between countries could be a constant, regardless of ethnicity. Significant differences in values were found between the dominant (47.8 Kgf) and non-dominant hands (46.2 Kgf, a 3.5% difference). Similar findings were noted in the aforementioned published studies.

Conclusion

In conclusion, a weak and positive association between dominant HGS and height, weight, and BMI was observed. For this studied population, anthropometric variables may be less relevant than the other physiological factors that influence HGS. The dominant hand and right hand showed higher grip strength compared to the non-dominant hand and left hand, respectively. The normative values for HGS in this Brazilian male population add important information to the international effort to establish coefficients for HGS evaluation.

References