

Abstract

Handgrip strength is the measure of maximum force that is generated by one's forearm muscles. This measurement of isometric strength has been shown to be indicative of overall muscular strength and athletes' abilities to excel in sports that require a high degree of grasping and force application. Currently, there is minimal data that exists to correlate handgrip strength and 1 repetition maximum (1RM) lifts.

Purpose. The purpose of this project was to investigate the correlative relationship between handgrip strength and 1RM bench press measurement.

Methods. The design of this research project incorporated parts of the Methods of Resistance Training and Conditioning Lab (RTC Lab) at Florida Gulf Coast University (FGCU) and volunteers from its enrolled students. The Jamar® handgrip dynamometer was used to measure grip strength in accordance with the protocols defined by the American College of Sports Medicine (ACSM). The 1RM bench press protocol, practiced by students in RTC Lab under direct supervision, was completed in accordance with National Strength and Conditioning Association (NSCA) protocols.

Results. Anthropometric, handgrip, and 1RM bench press measurements were analyzed and compared through Microsoft Excel® and SPSS® (Statistical Package for the Social Sciences). In a linear regression analysis, a significant association between 1RM bench press measurement and handgrip strength was observed at a significance level of 0.01 ($r=0.840$, $P=>0.00001$). Additionally, a significant association was drawn from the male group ($r=0.471$, $P=0.031234$) at a significance level of 0.05 and the female group ($r=0.618$, $P=0.000591$) at a significance level of 0.01.

Discussion. The results from this study indicate that an individual's maximal grip strength is associated to their maximal upper body strength. Therefore, grip strength might be considered a valid predictor or variable of upper body strength.

Significance

There is an overall consensus among peer-reviewed literature that handgrip strength is a relevant indicator of physical function and outcomes of mortality and future disability in clinical populations. However, the practical use of handgrip measurement in generally healthy, young, and physically active populations is still lacking. Although there is data of handgrip strength measurements compared to specific athletic abilities, minimal data exists for varied levels of recreational lifters and the relationship of grip strength and 1RM bench press measures.

The absence of a defined significant relationship between handgrip and maximal upper body strength leaves space for doubt in the use of handgrip dynamometry as an assessment tool of overall upper body strength.

The development of the correlation between handgrip strength and upper body maximal strength in healthy, young, and physically active populations can provide relevant support and evidence for the use of handgrip dynamometry as a screening device of functional upper body maximal strength.

Methods

Forty-eight healthy individuals (21 males/ 27 females; age 22.313 ± 3.915 years; body mass 72.438 ± 17.232 kilograms; and height 170.083 ± 10.195 centimeters) with varied history of intensive resistance training participated in this study.

Handgrip strength and 1RM upper body strength were measured.

Materials

- Materials used for this project include a handheld Jamar® hand dynamometer and equipment for a 1RM bench press.

Subjects. The subjects for this research are recruited students from the Exercise Science program that are enrolled in RTC Lab and volunteered to participate.

- Selection Criteria.** Each subject must be above the age of 18 years old. Subjects must be healthy with no major health complications. Exclusion criteria includes any recent health status change, medication change, and/or injuries. At any time during the research, students had the opportunity to choose to withdraw from participating.

- Ethical Considerations.** Approval to conduct this study was granted by FGCU's Institutional Review Board (IRB) prior to any data collection.

Data Collection.

- Consent Form.** Consent forms were filled out in a face-to-face session, and are filled with the faculty sponsor. Consent could be withdrawn at any point.
- Measurements.** All data collection procedures meet IRB standards. Anthropometric, handgrip, and 1RM measures were collected and recorded by the primary investigator.
- Significance.** Degrees of freedom, alpha levels, and significance determinations, were based on a sample size of 48 with two variables. Analysis of data was done through SPSS® and Microsoft Excel®.

Protocols

- Handgrip Strength Protocol.** Hand grip strength dynamometry requires strict and rigid adherence to the protocols specified by ACSM in order to provide accurate and reliable measurements. All protocols were followed as defined.
 - Subjects were positioned with their head straight ahead and forearm held approximately 90 degrees of the upper arm.
 - Handgrip setting was set so that the participant's third digit's second phalanx is at a right angle.
 - The participant had two trials with each hand.
 - The force, in kilograms, was recorded. Handgrip score is the sum of the best trial of each hand.
- 1RM Bench Press Protocol.** The 1RM bench press testing protocol was practiced by students in RTC Lab with direct and complete supervision under the principle investigator or the faculty sponsor. All safety, technique, and testing considerations were drawn directly from NSCA and their protocols.
 - Sets were broken into warm-up, near max, and three to five maximal attempts.
 - Adequate weight increases and rest was provided.
 - The maximal weight, in kilograms, was recorded.

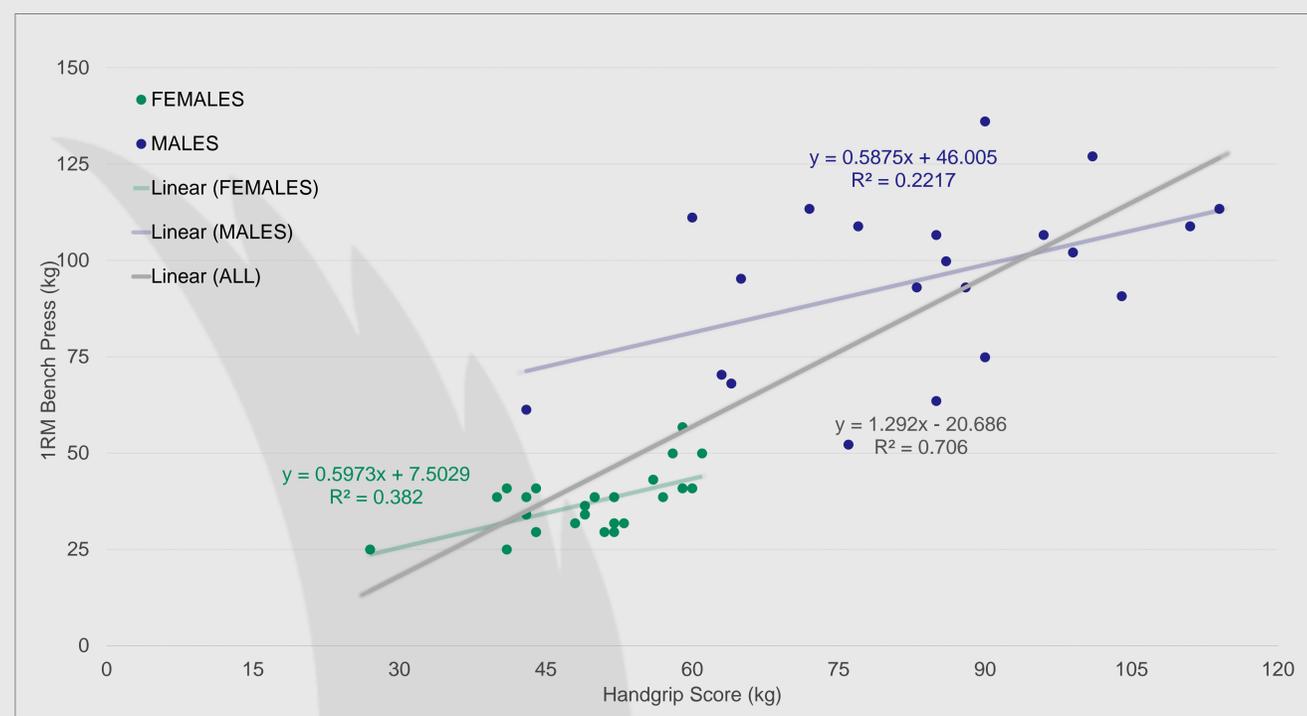


Figure 1. 1RM Bench Press VS Handgrip Score. This graph illustrates the relationship between 1RM bench press and handgrip score. Data points from female participants are shown in green, while points from male participants are shown in dark blue. The trendlines for each group, shown in their respective color, detail the line of best fit. The gray trendline shows the linear relationship between all data points.

Results

Data was analyzed using SPSS® and Microsoft Excel®. The average handgrip measurement is 64 ± 21.481 kilograms. The average 1RM measurement is 62 ± 33.030 kilograms. The male group's handgrip average is 83 ± 18.016 kilograms and the average 1RM measurement is 95 ± 22.481 . The female group's handgrip average is 49 ± 7.728 kilograms and the average 1RM measurement is 37 ± 7.468 kilograms.

In a linear regression analysis, a significant association between 1RM bench press measurement and handgrip strength was observed at a significance level of 0.01 ($r=0.840$, $P=>0.00001$). Additionally, a significant association was drawn from the male group ($r=0.471$, $P=0.031234$) at a significance level of 0.05 and the female group ($r=0.618$, $P=0.000591$) at a significance level of 0.01.



Figure 2. Handgrip Dynamometry



Figure 3. Bench Press.

Discussion and Summary

The results drawn from this study show that an individual's maximal grip strength is associated to their maximal upper body strength. Therefore, grip strength might be considered a valid predictor or variable of upper body strength in a young, general population, athletic context.

It was unexpected that females had a higher correlation between the two variables than men. A possible reasoning behind the closer relationship in females may be due to the lack of range between both variables. In females, the range between handgrip score was 33 kilograms and the range between bench press was 32 kilograms. This can be compared to the males' range of 68 kilograms and 84 kilograms, respectively.

Another interesting factor is that the slope of the male and female line of best fit is very similar. The female data set's trendline has a slope (m) of .597 and the men's trendline has a slope (m) of .588. This means that the change in handgrip score is proportional to the change in 1RM in both males and females.

In conclusion, the relatively simple and quick measurement of handgrip dynamometry is found to reveal more than an individual's handgrip strength. This cost-effective, noninvasive screening device can be a valuable tool in sport or fitness context.

It is unclear whether handgrip affects bench press performance or if an increase in upper body strength increases maximal handgrip strength. Future studies are needed to further explore the relationship between handgrip and overall strength based on sex, weight, and body composition in varying populations. This study was limited to young, healthy individuals with varied training age and history of resistance training.