

# Hand Grip Strength as a Determinant for Upper Extremity Strength

This project makes no effort to suggest generalizability. Instead, it was designed to demonstrate competency using lab equipment, capacity to integrate knowledge with application, and understanding of the scientific method.

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## Introduction

According to Norman and associates (2011), hand grip strength is a measure of maximum contraction of the extrinsic and intrinsic hand muscles which allow for hand flexion. The main factors influencing hand grip strength include age, gender, and body composition. Hand grip strength is measured using a hand dynamometer (shown below), and is a preferred clinical method for assessing upper extremity strength and mortality due to its ease of use, affordability, and prognostic value (Norman et al., 2011). In clinical settings, hand grip strength is indicative of bone mineral density & osteoporosis risk in postmenopausal women. Furthermore, poor hand grip strength is associated with elevated cardiovascular disease and cancer risk (Massy-Westropp et al., 2011). Research shows that males generally have higher absolute and relative grip strength than females across all age groups. Hand grip strength has been used as positive link to upper extremity strength in various testing settings (Massy-Westropp et al., 2011). This study sought to determine the relationship between grip strength and upper extremity strength, and



how the values differ between males and females. It was hypothesized that grip strength was a valid determinant of upper extremity strength, with females having higher relative strength due to having generally smaller body masses than males.

## Methods

Testing occurred in the Exercise Science skills lab. Body mass was recorded for each subject. A warm-up was initiated before test trials began. Warm-up consisted of arm circles (15 each way), five push-ups, one rotation of pogos (hands on hips), one rotation of high knee pulls, one rotation of forward lunges and reverse lunges, and one lap was jogged. A rest period of 30 seconds was given for each subject before bicep assessment occurred. Subjects performed a 1 rep max via bicep curl with dominant and non-dominant arms. Each subject was given 3 attempts with a 30 second rest in between each attempt. Best result out of three was recorded for each subject. Each subject performed a tricep push for a 1 rep max with dominant and non-dominant arms. Each subject was given 3 attempts with a 30 second rest in between each attempt. Best result out of three was recorded for each subject. Hand dynamometer was used for 5 seconds for each subject and results were recorded in kilograms. Dominant and non-dominant arms were tested. Three attempts were given, and the highest result was recorded for each subject. A 30 second rest was given between each trial. Subjects were shadowed for 5 minutes after session was completed. Data was analyzed by comparing dominant and non-dominant grip strength to dominant and non-dominant bicep curl and tricep extension along with relative strength.

## Results

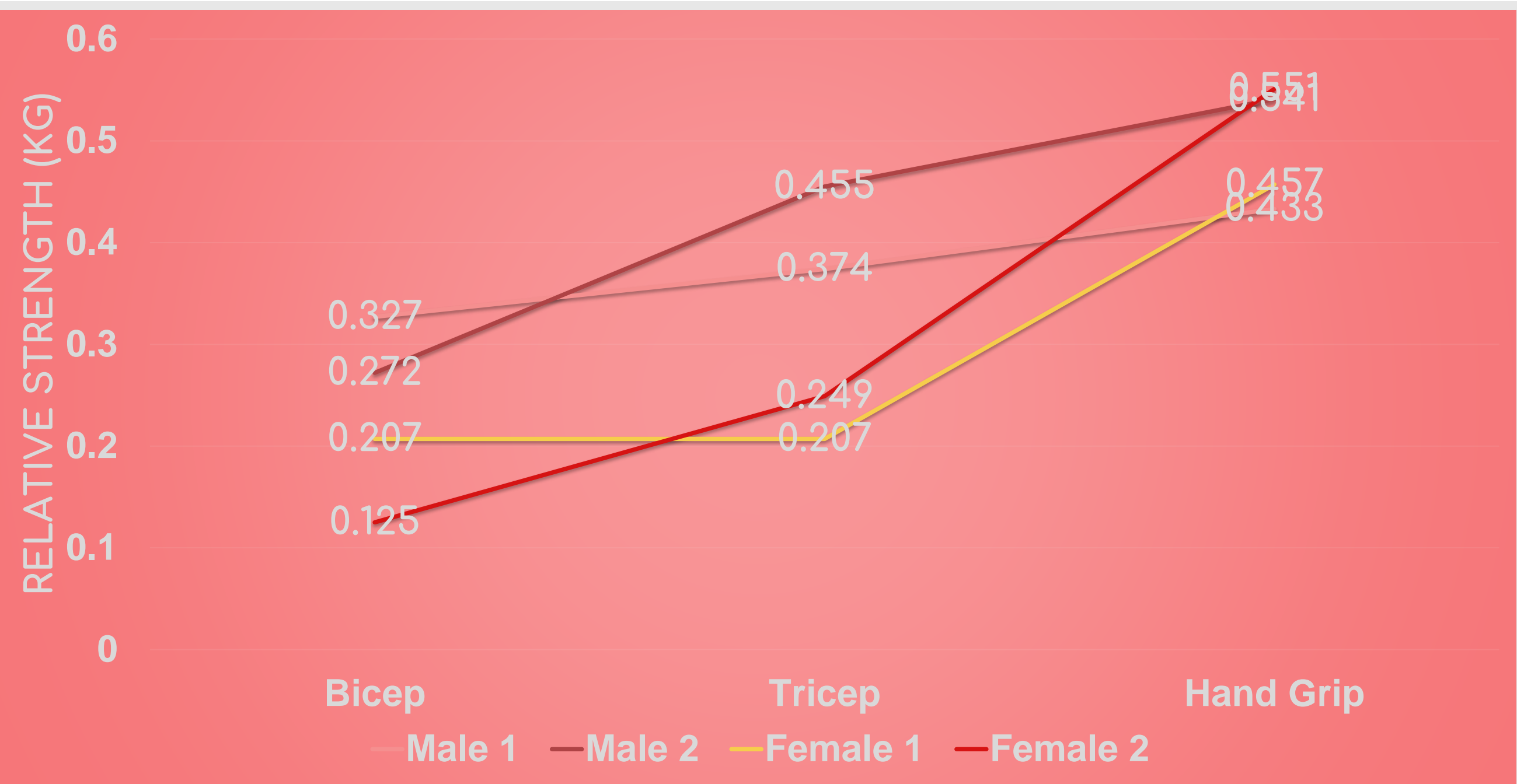


Figure 1. Compares relative strength scores between male & female subjects.

| Table 1   |               |         |           |                 |         |           |
|---|---------------|---------|-----------|-----------------|---------|-----------|
| Descriptive Statistics for Dominant Limb and Hand Grip in Males & Females |               |         |           |                 |         |           |
| Descriptive Statistic   | Male Dominant |         |           | Female Dominant |         |           |
|   | Bicep         | Triceps | Hand Grip | Bicep           | Triceps | Hand Grip |
| Mean  | 0.299         | 0.414   | 0.487     | 0.166           | 0.228   | 0.504     |
| St. Deviation   | 0.038         | 0.057   | 0.076     | 0.057           | -0.029  | 0.066     |
| Range   | 0.055         | 0.081   | 0.108     | 0.082           | 0.042   | 0.094     |
| Hand Grip Correlation   | -1            | 1       | n/a       | -1              | 1       | n/a       |

Table 1. Descriptive statistics for male & female subjects.

Figure 1 represents a structured analysis of relative strength seen in bicep, tricep, and hand grip strength. Four subjects were assessed, including two non-athletes and two athletes. Highest recorded relative bicep strength was 0.327 kg for male 1 and highest recorded strength for tricep strength was 0.455 kg for male 2. Relative strength observed in male 1 and female 1 represents an accurate description of how non-athletic individuals possess a lack of increased strength. This is due to less training and repetitive involvement of muscle groups over time. Athletic individuals (male 2 and female 2) adapted over the assessment period and increased the amount of weight lifted. Trained individuals are able to adapt to stressful metabolic situations at a quicker pace in order to produce a higher workload. This is due to conditioned muscle groups that are able to perform at a more efficient rate.

Table 1 presents generalized descriptive statistics shown in dominant hand strength in males and females. Overall, higher strength is observed in dominant hands for males compared to females. Relative strength seen in triceps is higher than for biceps in both genders. Hand grip strength tends to decline over repetitive duration due to fatigue. Dominant hand relative strength is overall higher when compared to non-dominant assessment.

## Discussion

The variables collected were dominant and non-dominant hand grip strength, dominant and non-dominant bicep curl, and dominant and non-dominant tricep extension. According to Xiao and Menon (2019), forces at the wrist correlate with resistance load during bicep curls. The norm for hand grip strength in men is 45kg to 47kg regardless of hand dominance (Massy-Westropp, Gill, Taylor, Bohannon, & Hill, 2011). The norm for hand grip strength in women is 28 to 30kg regardless of hand dominance (Westropp et al., 2011). Handgrip strength is an evaluation of general upper limb strength (Vilím, Juránková, & Janíčková, 2015). Incel et al. (1999) reports that studies have found the dominant hand to be significantly stronger. Armstrong & Oldham (1999) found considerable variability in relative strength between the dominant and non-dominant. Our findings agree with the discussed literature. These findings could be applied to rehabilitation and athletic performance environments. In rehabilitation and, the goal should be to have regain strength and create balance after injury. In training, two limbs of equal strength would allow for greater performance.

## Conclusion

It is concluded that hand-grip strength is a determinant of upper body strength. Hand-grip strength is less in underweight or overweight people (Rpai, Tajpuriya, Mishra, 2016). People that engage in physical activity have a better hand-grip strength than people who are sedentary. It is concluded that the dominant hand correlates directly to dominant arm in upper body strength as seen in the results section. Hang-grip strength is even positively correlated with muscle girth% and skeletal muscle mass (Rpai, Tajpuriya, Mishra, 2016). Knowing a person's hand-grip strength is very important, in that it is an indicator of health status, based on the incidence of disability, morbidity, and mortality in the adult population. Elderly people with a good hand-grip strength are at a lesser risk for disability and joint impairment. Even mortality rate goes down when an individual has a good hand-grip strength. Testing ones hand-grip strength is a good predictor of muscle weakness in a healthy population as well as in diseased individuals. An important thing hand-grip strength can identify is the success of a training program, and improvement by itself is a strong motivator of the participant (Rpai, Tajpuriya, Mishra, 2016).



## References

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