Handgrip strength and aggression in young adults

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Abstract

Background: Many clinical and epidemiological studies have used handgrip strength (HGS), which is a noninvasive, simple, and fast measure. It is also considered as the most trustworthy clinical estimation of human strength. HGS is influenced by various factors such as age, body size, posture, and gender, i.e., it shows sexual dimorphism. Aggression is also one such trait that shows sexual dimorphism. **Aims and Objective:** To examine the relationship between HGS and aggression in 137 first-year medical students (female students = 69, male students = 68). **Materials and Methods:** HGS was determined using handgrip dynamometer, and aggression scores were assessed by Buss–Perry Questionnaire. Gender-wise difference was analyzed by Student's unpaired "*t*" test. Correlation between HGS and the various subscales of aggression was assessed by calculating Pearson's correlation coefficient. **Results:** Male subjects showed higher HGS than female subjects. There was a significantly higher score for physical aggression among male than female subjects, i.e., it showed significant sexual dimorphism. We found a significant positive correlation between HGS and physical aggression in male subjects only. **Conclusion:** These results may be attributed to the effects of testosterone on muscles strength and the organizational effect of testosterone on adult physical aggression in male subjects.

KEY WORDS: Aggression; Gender Difference; Handgrip Strength

Introduction

Many clinical and epidemiological studies have used handgrip strength (HGS), which is a noninvasive, simple, and fast measure.[1] It is also considered as the most trustworthy clinical estimation of human strength.

HGS is a physiological variable that is affected by a number of factors including age,[2] gender,[3] body size and weight,[4] and position of hand.[5] HGS is also strongly influenced by genetic factors.[6] However, at all levels of body weight, there is a wide variability in strength. At all ages, girls have lower average values than boys and after puberty, this difference increases. In female subjects, highest grip strength at 30 years of age is about 40% weaker compared with male subjects of same age.[3] In other words, male subjects have consistently greater HGS than women throughout life, i.e., it is highly sexually dimorphic.[7]

Aggression is also one such trait that shows sexual dimorphism. Men score higher than women in various subscales of aggression.[8] It has been widely observed that testosterone is a determinant for the onset of aggressive behavior in animals and in man.[9]

Gallup et al.[10] studied HGS in relation to somatic and self-reported measures of physical attractiveness in a sample of American students. They included a measure of aggression in their study and found a small association between this and HGS. Similar results were found in the study by Archer and Thanzami[11] in which relation between physical aggression, size, and strength in Indian men was studied.

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With this background, we investigated the correlation between HGS and aggression scores in both male and female subjects.

Materials and Methods

This study was conducted in Department of Physiology, AJIMS and RC, Mangalore, Karnataka, India, with 137 first-year medical students (female students = 69, male students = 68) after obtaining their informed consent for the study. Ethical clearance was obtained from Institutional Ethical Clearance Committee.

Subjects included did not have any diagnosed medical or surgical condition, muscular disorder, hand pain, or arthritis as per history.

All participants completed a questionnaire based on Buss–Perry Aggression Scale[12] for aggression, which consists of 29 questions. The questionnaire includes questions for the four subscales of aggression, which are physical aggression (9 questions), verbal aggression (5 questions), anger (7 questions), and hostility (8 questions). Each question is based on a 7-point Likert scale scoring from one to seven ("extremely uncharacteristic of me" to "extremely characteristic of me"). For each student, score of each subscale of aggression was calculated.

HGS of the dominant hand was determined using a Handgrip Dynamometer, as the maximum voluntary contraction (kilograms) sustained for at least 3 s.

Statistical Analysis

Descriptive data are presented as mean ± standard deviation. Gender-wise difference was analyzed by Student's unpaired "*t*" test. Correlation between HGS and all subscales of aggression was assessed by calculating Pearson's correlation coefficient. Results were considered to be significant taking 5% as the level of significance. The data were analyzed by using SPSS version 17.

Results

In our study, we observed that male students showed significantly higher HGS than female students ($p < 0.001$). There was significantly higher score for physical aggression among male students than female students ($p < 0.001$), i.e., it showed significant sexual dimorphism. Verbal aggression and hostility were higher in female students, while anger scores were higher in male students. However, all these scores did not show significant difference (Table 1).

On analyzing the correlation between HGS and aggression subscales, we observed that HGS was significantly and positively correlated with physical aggression ($p < 0.001$) and verbal aggression, only in male students ($p = 0.008$; Table 2).

There was no significant correlation between HGS and subscales of aggression in female students.

Discussion

Our results showed significantly higher HGS in male than female students. Similar findings were reported in previous studies.[13,14]

Muscle strength is largely determined by muscle girth. In other words, girths of upper arm and forearm have high correlation with grip strength.[15] Absolute genetic influences on HGS growth were nearly ninefold higher in male subjects. This developmental pattern implicates testosterone as a prime determinant of male HGS.[6] Hence, men tend to have more muscle strength than women.

Previous study also showed that supplemental increase in testosterone, increases HGS, and lean body mass, in elderly men with low serum testosterone.[16]

We found significant sexual dimorphism in physical aggression but not in other subscales of aggression such as verbal aggression, anger, and hostility.

Bailey and HUrd[8] and Buss–Perry[12] found significant difference in physical aggression, verbal aggression, and hostility but not in anger. Physical aggression was found to be the most dimorphic of the aggression subscales.

We found significant positive correlation between HGS and physical aggression in male subjects, similar to that reported by Gallup et al.[10] They found in their study that male participants who self-reported more aggressive behaviors toward their peers while growing up showed stronger grip strength, similar to our findings.

HGS is a very good marker of physical health, good muscle performance, and an overall indicator of health status and vitality. Testosterone, as a hormone primarily responsible for secondary sexual traits development, is also strongly correlated to body strength and somatic features, which represent it. It has been widely observed that testosterone levels are related to aggressive behavior.[9] If testosterone levels indeed contribute to HGS, it may explain the aggressive behavior in men with high HGS. However, no

Table 1: Comparison of handgrip strength (HGS) and all subscales of aggression in male and female subjects

	Male subjects (n =68)	Female subjects (n = 69)	p
Handgrip strength (kg)	28.80 ± 8.16	12.15 ± 5.27	<0.001**
Physical aggression	31.47 ± 9.91	23.88 ± 7.73	<0.001**
Verbal aggression	17.79 ± 6.2	17.88 ± 7.11	0.937
Anger	23.67 ± 8.01	22.46 ± 8.21	0.384
Hostility	26.3 ± 9.47	26.55 ± 9.08	0.879

* significant, ** highly significant.

Table 2: Correlations between aggression subscales and HGS in male and female subjects

Aggression subscales	HGS			
	Male subjects		Female subjects	
	r	*p*	*r*	*p*
Physical aggression	0.568**	< 0.001	0.161	0.187
Verbal aggression	0.321*	0.008	0.091	0.458
Anger	0.043	0.726	0.081	0.507
Hostility	-0.099	0.42	-0.169	0.164

* significant, ** highly significant.

such correlation was seen among female subjects. Hormone secretions and fluctuations during menstrual cycle might possibly modulate some of the physiological aspects of the behavioral parameters in female subjects, which could be the reason for the lack of any correlation in female subjects.[17] A small sample size, limited to medical undergraduates, failure to measure serum testosterone level in participants, and not considering the phase of menstrual cycle in females are few shortcomings of this study.

Conclusion

To conclude, in our study, we found sexual dimorphism in HGS and physical aggression and significant positive correlation between HGS and physical aggression only in male students, indicating the role of testosterone on muscles strength and organizational effect of testosterone on adult physical aggression in male subjects.

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