

## Effect of Smartphone Usage on Hand Grip Strength among Healthy Young Adults

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### Abstract

**Introduction:** The use of smartphones, which offer numerous advantages like the ability to communicate and browse the internet, has seen a significant rise in popularity among younger people. On the other hand, it has negative impacts on our lifestyles too. Our major purpose is to assess handgrip strength, as well as to compute the average period of time spent using smartphones and to investigate whether or not there is a correlation between smartphone usage and handgrip strength among healthy young adults.

**Material and Methods:** After obtaining ethical committee clearance from the institutional ethical board, a total of 122 participants aged between 18-30 years of both genders were taken. Hand grip strength was measured using digital hand grip dynamometer and the smartphone usage duration were noted.

**Results:** The mean Age among the subjects was 20.5 ( $\pm$  2.84) years ranging from 18 to 28 years. The mean smartphone usage duration (hours) has a significant negative correlation with Hand grip strength of dominant hand and non-dominant hand with a correlation coefficient of -0.75 & -0.61 respectively.

**Conclusion:** We found that the excessive usage of smartphones can have a detrimental effect on hand strength, both on the dominant and non-dominant side of the user's hands.

**Keywords:** Smartphones overuse, Hand-grip strength, smartphone addiction, Hand functions.

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### Introduction

The use of smart phones has become widely popular among young people. A smart phone is an integrated gadget that can perform tasks such as sending and receiving text messages and emails, browsing the web, gaming and organising one's schedule. Despite the benefits of smart phone usage, overuse of it has a negative impact on physical and mental health. The hand and wrist weakness is one

of the main complications associated with increased use of smart phones [1].

The number of people who own smart phones has skyrocketed in recent years. Around 3.5 billion people worldwide uses smartphone and more than half of those are under the age of 20. According to survey, teenagers spend 10 hours approximately on social media

daily. It has become an addition among adolescents [2].

The majority of young adults only use one hand when operating their smart phones, despite the fact that smart phones were designed to be utilised with both hands [3]. Musculoskeletal issues have been linked to prolonged usage of mobile phones. These disorders may occur due to repetitive movements that are typically carried out with the thumb and finger interaction with phone screen. The extended use of smartphone without taking regular breaks may lead to collective trauma disorders to neck, shoulder, wrist, hand and fingers [4].

Handgrip strength is “the maximal power of forceful voluntary flexion of all fingers under normal biokinetic conditions”. Hand grip strength is a reliable parameter to assess physical fitness and nutritional status. It is also used in evaluation of musculoskeletal & neuromuscular disorders [5]. Our study was aimed to determine the relationship between smart phone usage duration and hand grip strength among young people.

### Objectives

1. To measure handgrip strength.
2. To calculate average duration of smart phone usage.
3. To find out the association between smart phone usage and hand grip strength among healthy young adults.

### Materials & Methods

**Type of the Study:** Analytical Cross-Sectional Study

**Sample Size:** 122 (Using openepi software, by applying the method of two sample means with unequal sample sizes)

**Study population:** Age between 18-30 years

#### Inclusion criteria:

1. Age between 18-30 years using smartphone.

2. Both male and female.

#### Exclusion criteria:

If the subject had

1. Cerebrovascular accident
2. Neuromuscular disorders
3. Tendon lesion of hand
4. Thyroid disorders

### Methodology

The study was conducted after obtaining ethical committee clearance from institutional ethical board. The subjects were explained about the study and procedure in detail. After obtaining written informed consent from all the subjects, a brief history and a thorough clinical examination were done. Anthropometric measurements were taken. Hand grip strength was measured using digital hand grip dynamometer and finally the smart phone usage duration were noted.

The hand-grip measurement was carried out as directed by the American Society of Hand Therapists. Each participant was positioned such that they were seated in an upright position, with their shoulders abducted to a minor degree, their elbows flexed to ninety degrees, and their wrists in a neutral position. The participants were given the task of squeezing the handle of hand grip dynamometer as tightly as they could for a total of three times, with each squeeze lasting for a duration of five seconds and a rest interval of thirty seconds in between each squeeze. After that, the weight (kg) equivalent of the average of the three trials was recorded.

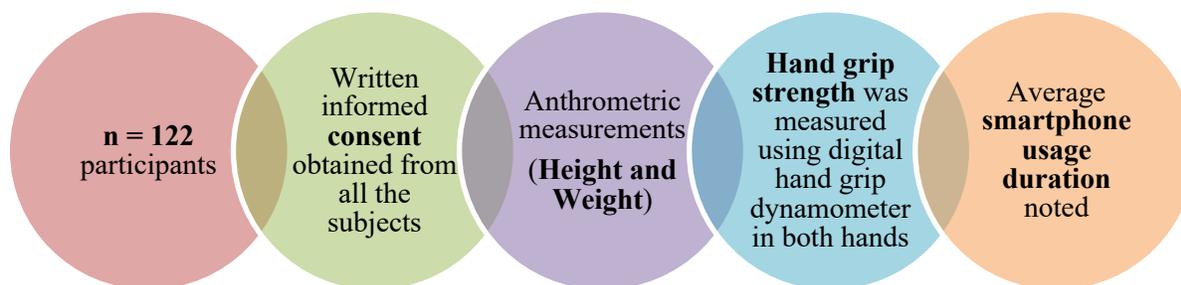
The duration of smartphone usage was determined by asking the participant to check the screen time on the smartphone (which is an option available for all smartphones with the iOS & android system) for the participant's typical daily use over the course of the previous week. The typical amount of

time spent using a smartphone each day over the course of a week was reported in hours [1].

### Statistical Analysis

Normally distributed variables were reported as mean and standard deviation. Pearson correlation test was used to find the

association between hand grip strength and smart phone usage. Linear regression was conducted to determine the factors associated with hand grip strength. p value less than 0.05 was considered significant. Data were statistically evaluated with IBM SPSS Statistics for Windows, Version 26.0., IBM Corp., Chicago, IL.



**Figure 1: Flow diagram of the procedures of the study (n=122)**

### Results

The demographic characteristics of study population are shown in table 1. The mean Age among the subjects was 20.5 ( $\pm$  2.84) years ranging from 18 to 28 years. The mean Height (cm) among the subjects was 164.67 ( $\pm$  9.1) cm ranging from 143 to 185 cm. The mean Weight (kg) among the subjects was 61.12 ( $\pm$  10.51) kg ranging from 30 to 95 kg. The mean BMI among the

subjects was 22.59 ( $\pm$  3.85) kg/m<sup>2</sup> ranging from 12.98 to 33.74 kg/m<sup>2</sup>. The mean Hand grip strength of dominant hand (kg) among the subjects was 44.21 ( $\pm$  22.43) kg ranging from 8 to 95 kg. The mean Hand grip strength of Non-dominant hand (kg) among the subjects was 42.02 ( $\pm$  22.9) kg ranging from 6 to 92 kg. The mean Smart phone usage duration (hours) among the subjects was 3.93 ( $\pm$  1.5) hours ranging from 1.33 to 7 hours.

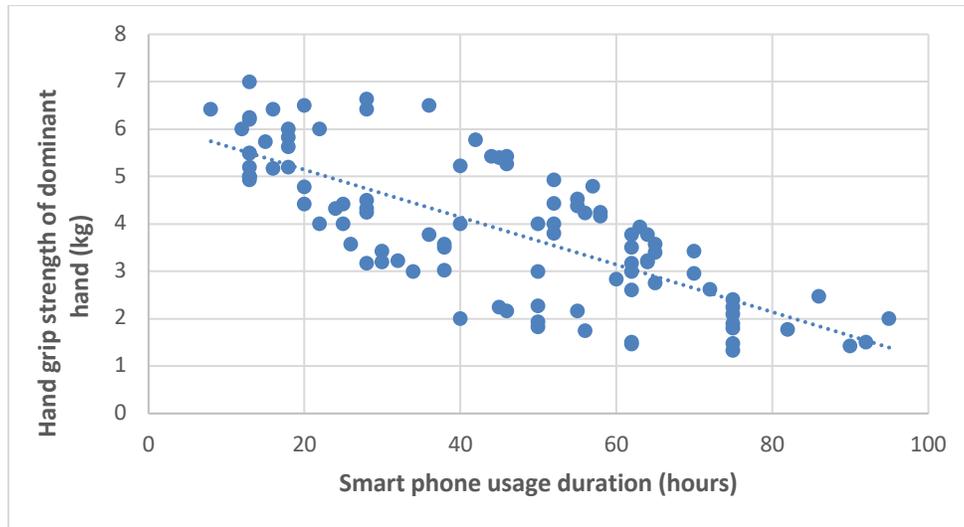
**Table 1: Distribution of study variables among the study participants (n=122)**

Variables	Mean ( $\pm$ S.D.)	Range
Age (years)	20.5 ( $\pm$ 2.84)	18 - 28
Height (cm)	164.67 ( $\pm$ 9.1)	143 - 185
Weight (kg)	61.12 ( $\pm$ 10.51)	30 - 95
BMI (kg/m <sup>2</sup> )	22.59 ( $\pm$ 3.85)	13 - 33.7
Hand grip (DH)	44.21 ( $\pm$ 22.43)	8 - 95
Hand grip (NDH)	42.02 ( $\pm$ 22.9)	6 - 92
Screen Time (hours)	3.93 ( $\pm$ 1.49)	1.33 - 7

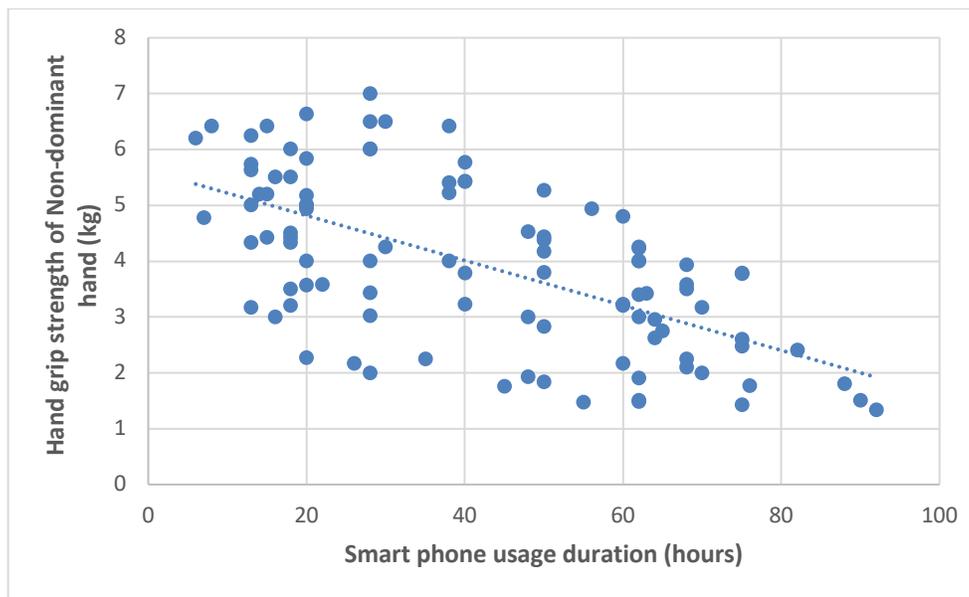
**Table 2: Distribution of association between smart phone usage and hand grip strength among healthy young adults (n=122)**

Variable	Smart phone usage duration (hours)	
	r	p
Hand grip strength of dominant hand (kg)	-0.748	0.0001
Hand grip strength of Non-dominant hand (kg)	-0.614	0.0001

Smart phone usage duration (hours) has a significant negative correlation with Hand grip strength of dominant hand with a correlation coefficient of -0.75 (Table 2, Figure 2). Smart phone usage duration (hours) has a significant negative correlation with Hand grip strength of Non-dominant Hand with a correlation coefficient of -0.61 (Table 2, Figure 3).



**Figure 2: Correlation of Hand grip strength of Dominant hand and smart phone usage duration among the study participants (n=122)**



**Figure 3: Correlation of Hand grip strength of Non-dominant hand and smart phone usage duration among the study participants (n=122)**

**Table 3: Linear Regression for predicting Hand grip strength of dominant hand (n=122)**

Predictors for Hand grip strength of dominant hand (kg)	Adjusted B (95% C.I.)	p value	Adjusted R <sup>2</sup>
Smart phone usage duration (hours)	-9.233 (-10.99 - -7.47)	0.001*	0.697
Height (cm)	0.968 (0.68 - 1.26)	0.001*	

The model with these predictors explains 69.74% variability of Hand grip strength of dominant Hand. Hand grip strength of dominant Hand decreases by -9.23 times for each unit increase in Smart phone usage duration (hours) and is statistically significant. Hand grip strength of dominant Hand increases 0.97 times for each unit increase in Height (cm) and is statistically significant (Table 3).

**Table 4: Linear Regression for predicting Hand grip strength of Non-dominant hand (N=122)**

Predictors for Hand grip strength of Non-dominant hand (kg)	Adjusted B (95% C.I.)	p value	Adjusted R <sup>2</sup>
Smart phone usage duration (hours)	-6.842 (-8.91 - -4.77)	0.001*	0.597
Height (cm)	1.252 (0.91 - 1.59)	0.001*	

The model with these predictors explains 59.73% variability of Hand grip strength of Non-dominant hand. Hand grip strength of Non-dominant hand decreases by -6.84 times for each unit increase in Smart phone usage duration (hours) and is statistically significant. Hand grip strength of Non-dominant hand increases 1.25 times for each unit increase in Height (cm) and is statistically significant (Table 4).

## Discussion

The purpose of our study was to explore the effect of over usage of smartphone on hand grip strength. There was a significant inverse relationship between the variables. This indicates that the longer duration of smartphone usage leads to weaker handgrip strength. This can be explained by the prolonged usage of smartphone which leads to median nerve damage [6]. The median nerve innervates flexor-pronator muscles in forearm, thenar muscles and first two lumbricals which helps in abduction of thumb, flexion of hand and wrist, flexion of distal phalanx of fingers [7] So, the repeated movements of wrist such as flexion and extension and increased use of thumb may lead to median nerve damage.

Our results were similar to the study conducted by Berolo *et al* where they assessed 137 mobile hand-held device users and observed musculoskeletal symptoms in them [8]. The increased use of smartphones

result in hand and wrist weakness. The weakness is due to repeated movements like flexion and extension of thumb, fingers and wrist, which is increased with more duration spent over smartphones [9].

Contradictory to the present study, Samiha conducted a study among 188 female students of age 18-25 years residing in Saudi Arabia and found no significant difference in the handgrip between smartphone user and non-user. This may be due to various factors which can affect handgrip strength like level of physical activity, sports participation, exercise and types of work. 99.1% Saudi Arabian women who own a smartphone use only internet to browse [10]. Despite the benefits, the use of smartphones has forced individuals to limit their day-to-day life activities. Addiction to smartphones was shown to be more prevalent among medical college students. The results of an investigation into the excessive usage of smartphones by 195 medical students revealed that the students suffer from a high level of addiction to their devices. It also highlighted the substantial link between this smartphone addiction and poorer sleep quality in addition to increased stress levels. These findings suggest that there is a need for psychosocial treatments that can assist undergraduate students in overcoming their addiction to their smartphones [11].

## Conclusion

The present study found that there was a significant negative correlation between smartphone overuse and hand grip strength. This study concluded that prolonged use of smartphone decreases the hand grip strength in both dominant and non – dominant hand but more in the dominant hand.

## Acknowledgment

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