

ASSOCIATION OF SMARTPHONE USAGE AND HAND GRIP STRENGTH AMONG YOUNG ADULTS – A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Prolonged smartphone use has been linked to musculoskeletal complaints; however, its relationship with objective hand-grip strength is unclear. **Aim:** This cross-sectional study was done to assess the association between smartphone use and hand-grip strength in first-year medical students. **Materials and Methods:** One hundred first-year MBBS students (age 18–24 years) were recruited using convenience sampling at Government Medical College, Thiruvallur (June–July 2025). Smartphone addiction was measured using the Smartphone Addiction Scale—Short Version (SAS-SV) and daily screen time was obtained from device screen-time monitoring. Hand-grip strength was measured with a calibrated dynamometer using ASHT protocol (three trials, mean reported). Normative sex-specific cutoffs defined “abnormal” grip. Association was assessed using correlation (Pearson p value <0.05 was considered to be statistically significant). **Result:** Mean age was 20.89 ± 2.54 years; 65% were male. Smartphone addiction prevalence was 68% and was more common in males (48/65) than females (20/35). Pearson’s correlation between daily screen time and grip strength was $r = 0.049$ ($p = 0.627$), indicating no significant linear association. **Conclusion:** In this sample of young medical students, smartphone use and addiction scores were not associated with objective hand-grip strength. Limitations include convenience sampling, exclusion of low-use participants (≥ 4 h/day criterion) and cross-sectional design. Future longitudinal studies with broader exposure ranges and posture assessments are recommended.

INTRODUCTION

Smartphones have become ubiquitous in modern society, particularly among young adults, who rely on them extensively for communication, education, entertainment, and social interaction.^[1] While smartphones offer unparalleled convenience and connectivity, their pervasive use has raised significant health concerns, including adverse impacts on physical, mental, and musculoskeletal health. Among these, the potential effects of smartphone overuse on hand function and grip strength have received growing attention in recent years.^[2,3]

Hand grip strength is a reliable and widely used measure of general muscular strength and overall physical health, with relevance in clinical, epidemiological, and sports settings. It serves as a biomarker for assessing musculoskeletal and

neuromuscular integrity and is often predictive of functional limitations, morbidity, and mortality in various populations^[4]. Reduced grip strength can be indicative of underlying neuromuscular fatigue or dysfunction, which may be precipitated by prolonged, repetitive hand and wrist movements involved in smartphone use.^[5]

Evidence suggests that excessive smartphone use, particularly with one-handed operation, may contribute to overuse injuries involving the thumb, fingers, and wrist due to repetitive strain and sustained awkward postures. Median nerve compression, decreased tendon mobility, and musculoskeletal strain are among the pathophysiological mechanisms proposed for the observed decline in hand function among habitual users.^[6,7] Furthermore, it is known that smartphone addiction, characterized by compulsive usage and inability to regulate screen time, is highly prevalent

among medical students, often correlating with decreased sleep quality, fatigue, and functional decline.^[8,9]

Given the increasing reliance on digital devices and the lack of adequate ergonomic awareness, it is critical to evaluate early markers of musculoskeletal compromise such as grip strength. Identifying such associations may facilitate the development of preventive strategies targeting modifiable risk factors in youth populations. With this background, the present study aims to explore the association between the duration of smartphone use and hand grip strength in young adults.

MATERIALS AND METHODS

Study Design and Setting

An analytical cross-sectional study was conducted in the Department of Physiology, Government Medical College, Thiruvallur, Tamil Nadu. The study was carried out over a period of two months (June 2025 - July 2025), focusing on assessing the relationship between smartphone usage and hand grip strength among medical undergraduates

Sample Size and Sampling Technique

A sample of 100 first-year MBBS students aged 18–24 years was selected using a convenient sampling method

Inclusion Criteria

- People of both genders, aged between 18 and 24 years
- Smartphone usage of at least 4 hours daily (detected using utilization app)
- Willingness to participate with informed consent

Exclusion Criteria

- < 18 years and > 24 years
- Other phases of MBBS students
- Any known neurological or musculoskeletal disorders affecting the upper limbs
- Recent hand/wrist injury or surgery
- Regular participation in strength training or professional athletic

Diagnostic Criteria

Smartphone Addiction Scale – Short Version (SAS-SV),^[10]

A validated 10-item scale with responses on a 6-point Likert scale (score range: 10–60) was used to assess smartphone addiction. Gender-specific cut-off scores as follows were applied to classify participants as "at risk/addicted" or "not addicted":

- ≥ 31 for males
- ≥ 33 for females

Hand Grip Strength Measurement.^[11] Grip strength was measured using a calibrated hand-held dynamometer in accordance with American Society of Hand Therapists (ASHT) protocol. Participants were seated with elbows flexed at 90°, wrists in neutral, and asked to squeeze the device maximally for 5 seconds, in three trials with 30 seconds rest in between. The average of the three readings was recorded in kilograms. Normal and reduced hand grip

strength were classified using normative values adjusted for age and sex, based on reference standards

➤ Male: 35.7 – 56.6 Kg

➤ Female: 19.2– 35.3 Kg

Smartphone Usage Time.^[12]

Participants reported their average daily screen time based on built-in screen time monitoring features available in Android or iOS, averaged over the previous week

Ethical approval and consent:

Institutional Ethical Committee (IEC) approval was obtained before conducting the study. written and informed consent was obtained from all the participants and their confidentiality was maintained

Data Analysis

Data were entered in MS Excel and analyzed using SPSS Version 25. Descriptive statistics (mean, SD, frequencies) summarized demographic variables, screen time, and grip strength. Pearson's correlation coefficient tested the relationship between smartphone usage and hand grip strength. A p value < 0.05 was considered statistically significant.

RESULTS

Socio demographic details: The study included 100 participants, predominantly in the age group of 19–20 years (65%), followed by those aged ≤ 18 years (20%), and >20 years (15%). This age distribution reflects the targeted population of medical undergraduates, most of whom are in their late teens to early twenties. Male preponderance (65%) was observed among the gender of the study participants as shown in Table-1.

BMI classification: Among the participants, the majority (65%) had a normal BMI (18.5–24.9 kg/m²), which is expected in a relatively healthy young adult population as shown in Table-2 and Figure-1. However, 17% were categorized as overweight, and 4% were obese, indicating that nearly one-third of the sample had elevated BMI levels. Additionally, 14% were underweight. These variations suggest potential lifestyle imbalances, which could be linked to screen time, physical activity, or dietary habits. Since BMI can influence muscular strength, this stratification is relevant in interpreting hand grip performance.

Smartphone Addiction Prevalence: Table-3 and Figure-2 explains the association between smartphone addiction and gender. Out of 68 individuals identified with smartphone addiction, 48 (74%) were males and 20 (57%) were females. Among the 32 individuals without smartphone addiction, 17 (26%) were males while 15 (43%) were females. The odds ratio (OR) for males being addicted to smartphones compared to females is 2.117 which suggests that males are about three times as likely to have smartphone addiction compared to females.

Hand Grip Strength: Table-4 investigates the relationship between hand grip strength and gender. Among the 45 participants with normal hand grip strength, 25 (38%) were males and 20 (57%) were females. In contrast, among the 55 individuals with abnormal hand grip strength, 40 (61%) were males and about 15 (43%) were females. This is graphically represented in Figure-3. The odds ratio is 0.468 for males compared to females, which implies that males

are much more likely to have abnormal grip strength due to smart phone addiction.

Correlation Between Smartphone Usage and Hand Grip Strength: The key finding of this study examining the correlation between smartphone addiction and grip strength was analyzed using Pearson's correlation coefficient. The result ($r = 0.049$, $p = 0.627$) indicates a very weak positive correlation that is statistically not significant. This is depicted in Figure-4.

Table 1: Age wise Distribution of Study Participants

Variable	Frequency (N = 100)	Percentage (%)
Age		
18 years	20	20
19 - 20 years	65	65
> 20 years	15	15
Gender		
Male	65	65
Female	35	35

Table 2: Body mass index distribution of study participants

BMI Category (kg /m ²)	Frequency (N = 100)	Percentage (%)
< 18.5 (underweight)	14	14.0
18.5 - 24.9 (normal)	65	65.0
25.0 - 29.9 (overweight)	17	17.0
≥ 30.0 (obese)	4	4.0

Table 3: Association between smartphone addiction and gender

Smart Phone Addiction	PRESENT (n = 68)	ABSENT (n = 32)	CHI SQUARE	p VALUE	ODDS RATIO (95% CI)
Male	48 (73.8%)	17 (26.2%)	2.916	0.048*	2.117 (0.888 - 5.046)
Female	20 (57.1%)	15 (42.9%)			

*p value < 0.05 statistically significant

Table 4: Association between handgrip strength and gender

HAND GRIP STRENGTH	NORMAL (n = 45)	ABNORMAL (n = 55)	CHI SQUARE	p VALUE	ODDS RATIO (95% CI)
Male	25 (38.5%)	40 (61.5%)	3.207	<0.005*	0.468 (0.203 - 1.080)
Female	20 (57.1%)	15 (42.9%)			

*p value < 0.05 statistically significant

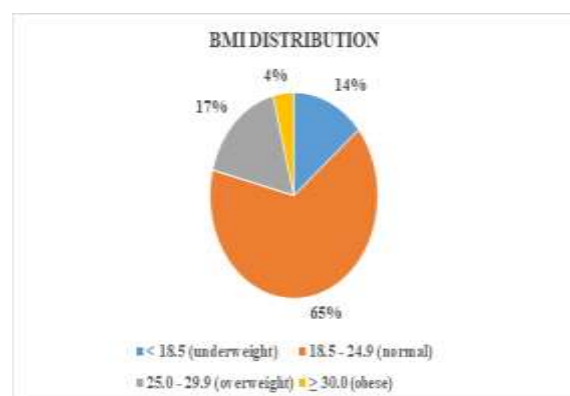


Figure 1: Body mass index distribution of study participants

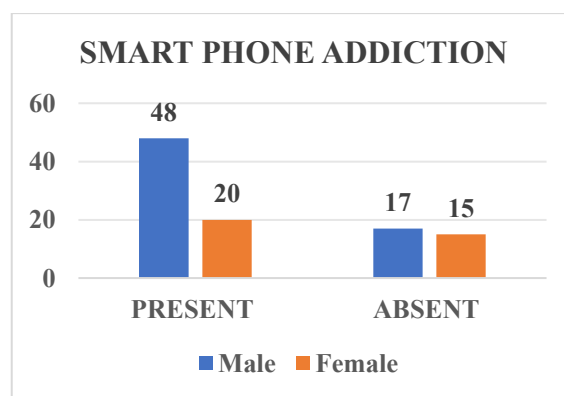


Figure 2: Association between smartphone addiction and gender

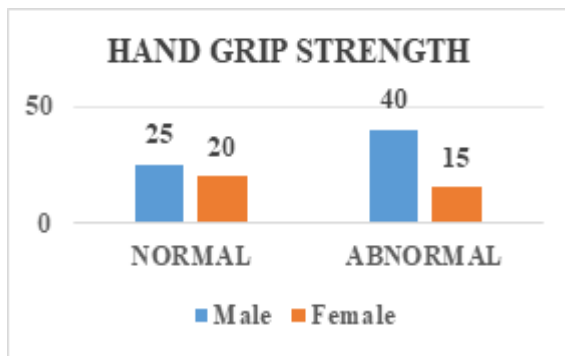


Figure 3: Association between handgrip strength and gender

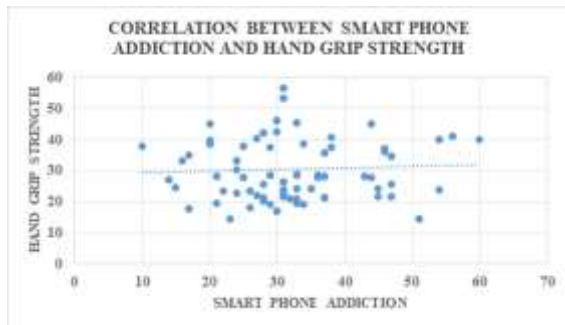


Figure 4: Correlation between smartphone usage and handgrip strength

Pearson's correlation coefficient (r) = 0.049, p = 0.627.

DISCUSSION

The present cross-sectional study investigated the association between smartphone usage and hand grip strength among 100 first-year medical undergraduates. While smartphone addiction (as measured by SAS-SV) was significantly more prevalent among males (OR = 2.117, p = 0.048), an unexpected trend was observed in hand grip strength, with males being overrepresented in the "abnormal" group. The overall correlation between smartphone usage and grip strength was weak and non-significant (r = 0.049, p = 0.627). These results highlight a complex relationship in which smartphone overuse may contribute to early musculoskeletal changes, though maximal voluntary grip strength appears variably affected in young adults.

This study finding partially aligns with the observational study by Osailan et al. (2021),^[8] who demonstrated a weak but significant inverse relationship between smartphone screen-time duration and both hand-grip and pinch-grip strength in young people. Their use of dynamometry and smartphone-recorded screen-time data parallels the present study methodology, supporting the notion that prolonged use can impair hand function, even though this study correlation was not statistically significant. The discrepancy likely arises from the restricted exposure range (≥ 4 h/day inclusion) and

smaller sample size, which limited the ability to detect weak associations.

Similarly, Banadaki et al. (2024),^[5] reported that prolonged smartphone use combined with non-ergonomic posture significantly increased the prevalence of hand pain and reduced grip function in college students. Their findings reinforce the biological plausibility that repetitive thumb use, tendon strain, and sustained posture compromise hand function. The absence of correlation in this study may therefore reflect methodological differences, particularly the lack of posture assessment and smaller cohort size, rather than a true absence of association.

In contrast, Akçay et al. (2023),^[13] found that overall smartphone addiction levels did not consistently affect hand grip strength across university students. Only selective, sex-specific effects were identified, such as reduced palmar pinch and dexterity in males. This supports the possibility that SAS-SV "addiction" scores alone may not directly predict grip strength outcomes, echoing the present study observation of non-significant linear correlations despite gender-based differences.

Further, Shetty et al. (2024),^[14] reported no significant correlation between smartphone addiction scores and dynamometer-measured grip strength in healthcare students. Instead, associations were stronger with scapular and cervical posture changes. This divergence suggests that maximal voluntary grip strength may remain preserved in healthy young adults, while musculoskeletal strain manifests more clearly in posture or pain outcomes. This interpretation helps contextualize the null correlation and supports the need to investigate posture-related mediators in future work.

CONCLUSION

Summary: This study contributes to the ongoing debate on whether smartphone overuse measurably impacts hand function in young adults. While categorical analyses revealed gender differences in smartphone addiction prevalence and an unexpected grip-strength pattern, the linear correlation between smartphone use and grip strength was not significant. Our results mirror the mixed findings of prior research: some studies demonstrate weak inverse associations, while others highlight only subgroup-specific or non-significant relationships.

Conclusion: In conclusion, smartphone overuse may represent a modifiable risk factor for musculoskeletal dysfunction, but its effect on maximal grip strength is not yet definitive. The observed sex differences and abnormal grip distribution in the present cohort warrant further investigation, particularly in relation to posture, BMI, and dominant-hand use. Larger, prospective studies are needed to clarify causality and identify vulnerable subgroups.

Strengths: The strengths of this work include the use of validated tools (SAS-SV for addiction, ASHT

protocol for grip strength), objective smartphone screen-time monitoring, and a focused, homogenous cohort that reduces occupational confounding. These methodological choices improve comparability with international literature and add to limited Indian data on this emerging public health concern.

Limitations: Limitations include the small sample size, cross-sectional design, and exclusion of low-use participants, which reduces the ability to detect dose-response effects. Potential confounders such as posture, dominant hand, recent hand activity and physical training status were not assessed. Additionally, the classification of “abnormal” grip strength requires clearer justification against standardized normative data.

Recommendations: Future research should employ larger, more diverse cohorts including both low and high-use participants, with stratification by sex, BMI, and dominant hand. Incorporating posture analysis, thumb-use patterns, and musculoskeletal symptom tracking will provide a more holistic understanding of smartphone-related impacts. Clinically, educational interventions promoting ergonomic posture and moderated screen time may mitigate early musculoskeletal strain among young adults.

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