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CORRELATION OF SMARTPHONE USAGE DURATION WITH HAND-GRIP STRENGTH AMONG UNIVERSITY STUDENTS

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ABSTRACT **Introduction:** Smartphone use has become highly prevalent among young people, extending beyond communication to activities such as gaming and internet browsing. While these devices provide significant convenience, their excessive use can negatively affect lifestyle. One major consequence is hand and wrist weakness which results from repetitive movements of the wrist, thumb and fingers. Accordingly, the study sought to examine the correlation between the duration of smart phone use and hand-grip strength among university students. **Method:** Following ethical committee approval, a total of 200 students were enrolled in the study. Hand-grip strength was assessed using a digital handheld dynamometer and smart phone usage duration was determined based on the average daily screen time recorded over the previous seven days. **Results:** The results showed that the mean ± standard deviation of hand-grip strength was 39.46 ± 8.62 kg for male students and 21.35 ± 4.44 kg for female students. Pearson's correlation analysis revealed a weak but statistically significant negative relationship between smart phone usage duration and hand-grip strength in males ($r = -0.20$, $p = 0.04$). In females, a slightly stronger negative correlation was observed ($r = -0.25$, $p = 0.01$). **Conclusion:** The study concluded that higher levels of smart phone addiction are associated with reduced hand-grip strength indicating that prolonged and excessive smart phone use may negatively impact hand strength.

KEYWORDS : Hand-Grip Strength, Smartphone Overuse, Students, Hand Functions.

INTRODUCTION

Smartphone addiction is referred to by several terms including problematic smart phone use (PSU), mobile phone addiction, smart phone dependence, compulsive or excessive smart phone use, nomophobia and digital or technological addiction. Lin et al. have further characterized smart phone addiction as a form of technological addiction, highlighting its resemblance to other behavioral dependencies linked to contemporary digital devices [1]. Griffiths also classified technological addictions as a subset of behavioral addictions [2]. Accordingly, smart phone addiction is viewed as a growing issue in contemporary society and is considered part of the broader spectrum of behavioral addictions.

Behavioral addictions encompass both substance-related dependencies such as alcohol use and non-substance-related conditions like gambling and internet addiction. These types of addiction exhibit similar characteristics such as reduced impulse control, a strong urge to engage in the behavior and comparable neurobiological mechanisms linked to the brain's reward system [3]. A cross-sectional study reported that nearly half of the participating university students exhibited signs of smart phone addiction. Increased daily screen time and frequent phone-checking behaviors were significantly associated with higher levels of addiction. These findings suggest that prolonged and repetitive smart phone use may play a role in the development of addictive patterns among students [4]. Hand and wrist weakness is recognized as a common complication associated with excessive smart phone use [5].

Previous studies have suggested that maintaining an awkward wrist position while using a smart phone may increase the risk of wrist joint disorders. Additionally, repetitive and continuous hand movements can impair nutrient delivery to the muscles and reduce blood circulation in the hands potentially leading to muscle fatigue over time [6]. Because of their portable design, smart phones are commonly used with one hand placing significant reliance on thumb movements for navigation and typing. This repeated activity can contribute to discomfort and musculoskeletal problems in the thumb and hand. Research indicates that university students spend more than 3.5 hours daily on smart phone for activities such as texting, emailing, scheduling and browsing. Prolonged one-handed use is often associated with pain at the base of the thumb [7].

Research has shown that individuals who use smart phone more frequently often demonstrate lower handgrip and pinch-grip strength compared to those with less frequent use [8]. The inverse relationship between Smartphone usage duration and handgrip strength may be attributed to enlargement or impairment of the median nerve which has been associated with prolonged smart phone use [9]. Maintaining a constant hand and thumb posture while using a smart phone for prolonged periods can stress the median nerve and potentially result in its dysfunction [10]. The median nerve innervates the flexor–pronator muscles of the forearm as well as most muscles on the radial side of the hand. It is essential for functions such as thumb abduction, wrist and hand flexion and flexion of the finger phalanges [11].

Increasing concerns have emerged regarding smart phone addiction, as more individuals are becoming reliant on these devices [12]. A study examined the effects of restricting smart phone use and whether such limitation could lead to withdrawal symptoms. In this research, 127 participants were instructed to refrain from smart phone use for 72 hours and three different scales were employed to evaluate withdrawal-related symptoms. The findings revealed that scores on the Smartphone Withdrawal Scale (SWS) and the Fear of Missing out Scale (FoMOS) were significantly higher compared to the control group suggesting that participants who were restricted from smart phone use experienced evident withdrawal symptoms [13]. A study carried out in the United States found that about 46% of smart phone users reported that they could not imagine living without their phones [12].

Research has indicated that excessive smart phone use can affect hand coordination and functional performance. Ongoing digital interaction involves rapid, repetitive finger movements which may disrupt normal neuromuscular control. These changes can reduce the efficiency of muscle recruitment in the hand, ultimately leading to a gradual decline in grip strength among frequent smart phone users [14]. Frequent one-handed smart phone use dominated by repetitive thumb movement's places excessive strain on the thenar muscles and tendons. Additionally, changes in hand posture during smart phone use can influence grip strength. Many users hold their devices with a flexed wrist and curved fingers, positioning the hand muscles at a mechanical disadvantage which can decrease the efficiency of force generation during gripping tasks [5].

MATERIALS & METHODS

Following ethical approval, a total of 200 students (100 males and 100 females) aged 18–25 years were recruited for the study. Hand-grip strength was measured in the dominant hand using a standardized protocol to ensure consistency and reliability. A digital handgrip dynamometer specifically the CAMRY EH101 was used to assess maximum isometric hand muscle strength expressed in kilograms.

Hand-grip strength refers to the maximum force generated during voluntary flexion of all fingers under normal biomechanical conditions. The device was adjusted according to each participant's hand size and measurements were conducted in accordance with the American Society of Hand Therapists' guidelines to ensure accurate and representative results [15]. This approach enhances the validity of the data for evaluating hand function and strength performance.

RESULTS

Based on hand dominance the results show that 5% of male students and 3% of female students were left-handed whereas the majority 95% of males and 97% of females were right-handed (Figure 1). Male students exhibited higher hand-grip strength (39.46 ± 8.62 kg) compared to female students (21.35 ± 4.44 kg) (Figure 2). Despite this difference, both groups showed a negative relationship between smart phone usage duration and hand-grip strength.

In male students, the correlation was weak but statistically significant (r = -0.20, p = 0.04) suggesting that increased smart phone use is associated with a slight reduction in grip strength. Among female students, the negative correlation was somewhat stronger (r = -0.25, p = 0.011) indicating a more noticeable decline in hand strength with greater usage (Table 1). These results imply that prolonged smart phone use may adversely affect hand muscle performance in both genders. Although the correlations are not strong, their statistical significance highlights a consistent trend. The slightly stronger association in females suggests they may be more affected by excessive use.

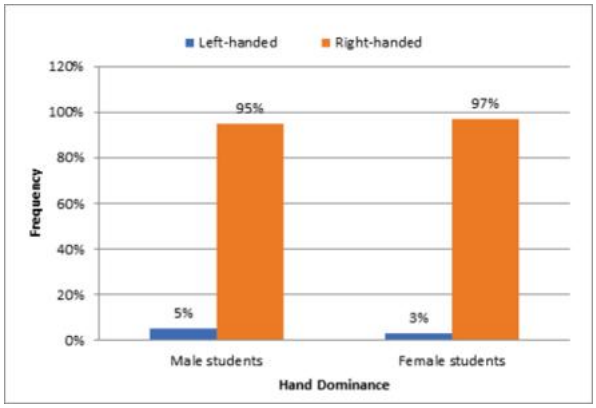

Figure 1: Shows Hand Dominance of Students While Using Smart Phone

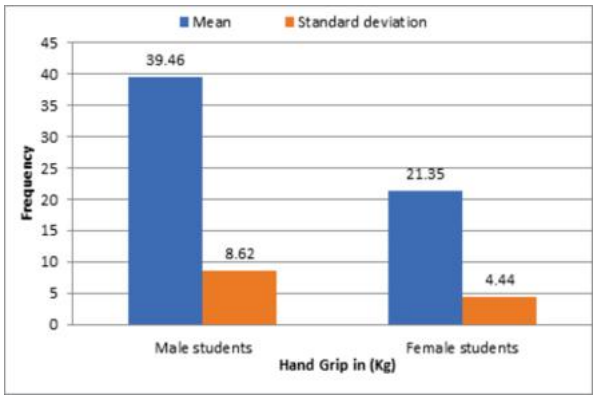

Figure 2: Shows Hand-grip Strength of Dominant Hand Among Students

Table 1: Shows Correlation of Smartphone Usage Duration with Hand-grip Strength

Correlation between Smartphone usage duration in hours with Hand grip Strength		Mean	Standard Deviation	r value	p value
Male Students (N=100)	Smartphone usage duration	5.35	0.79	-0.203783	0.041992*
	Hand grip	39.46	8.62		
Female Students (N=100)	Smartphone usage duration	5.09	1.07	-0.250693	0.011879*
	Hand grip	21.35	4.43		

* Result is significant, p<0.05

DISCUSSION

The present study reported average handgrip strength of 39.46 ± 8.62 kg in male students and 21.35 ± 4.44 kg in female students. A study by Fiaq and Huseyin (2018) reported a significant rise in smart phone use in recent years which may contribute to various hand-related disorders. Excessive use can increase pressure on the median nerve potentially leading to conditions such as Carpal Tunnel Syndrome. The study also found that De Quervain's tenosynovitis is commonly seen in individuals who send more than 50 messages per day. Furthermore, frequent use of messaging applications has been linked to bilateral extensor pollicis longus tendinitis often referred to as "WhatsAppitis" [16]. Another study reported that 66.4% of participants showed signs of smart phone addiction, while 19.1% had positive results on Finkelstein's test [17].

During smart phone use prolonged gripping, wrist flexion, ulnar deviation and repetitive thumb movements are key contributors to discomfort and related symptoms. Texting involves frequent thumb adduction and sustained pressure on the keys. Over time, extended smart phone use can have adverse effects on the musculoskeletal system of the hand [18]. An observational study by Esra Erkol and colleagues found that excessive smart phone use can cause pain and numbness in the thumb. The study also indicated that prolonged use may increase the cross-sectional area of the median nerve potentially leading to reduced hand function and decreased pinch strength [9]. Furthermore, a study by Nadia et al. compared high-frequency and low-frequency smart phone users and found that individuals with higher usage exhibited significantly reduced hand function and pinch strength [19].

The analysis of present study examining the relationship between smart phone usage duration and handgrip strength revealed a weak negative correlation in males (r = −0.20) and a slightly stronger negative correlation in females (r = −0.25) which indicates that longer smart phone use may be associated with a slight decline in grip strength. These findings are in line with the study by Ahmad Osailan (2021) which also identified a weak yet statistically significant negative correlation (r = −0.22, p = 0.03) between daily smart phone use and handgrip strength in young adults. Using a dynamometer to assess hand and pinch grip along with self-reported screen time, the study suggested that prolonged smart phone use may slightly decrease grip strength due to repetitive thumb, finger and wrist movements that place stress on the hand's musculoskeletal structures [5].

Similarly, Marina et al. (2018) examined the impact of prolonged smart phone use on cervical posture, grip strength and nerve conduction in adolescents. The study found that individuals with high smart phone usage exhibited more pronounced forward head posture, increased neck pain and reduced ulnar nerve conduction velocity. This observation is consistent with the present study suggesting that although excessive smart phone use may influence certain musculoskeletal and neurological factors, its effect on handgrip strength appears to be minimal or weak [20]. Another study conducted at Majmaah University reported that excessive smart phone use significantly increases the risk of carpal tunnel syndrome symptoms and may adversely impact wrist mobility [21].

Ilik et al. (2018) reported that repetitive wrist flexion and extension may lead to enlargement of the median nerve in frequent smart phone users. These continuous movements can increase pressure within the carpal tunnel reducing the available space for the median nerve and potentially causing compression. Furthermore, poor ergonomic habits during smart phone use such as one-handed operation and repeated rapid thumb movements can place additional strain on the joints and soft tissues of the hand. Over time, this persistent mechanical stress may result in pain, stiffness and reduced hand function among students who use smart phone for prolonged periods [22].

CONCLUSION

The present study identified a statistically significant negative correlation between smart phone usage duration and hand-grip strength. This indicates that as the time spent using smart phone increases, hand-grip strength tends to decrease. The findings suggest that prolonged and excessive smart phone use may contribute to reduced hand muscle performance. Therefore, extended usage may have a detrimental impact on overall hand strength.

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