ANKARA MEDICAL JOURNAL

Research Article

Ankara Med J, 2025;(4):391-407 // 10.5505/amj.2025.62573

CORRELATION BETWEEN NECK DISABILITY INDEX, NOMOPHOBIA AND HAND GRIP STRENGTH AMONG FEMALE COLLEGE-GOING STUDENTS

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Submitted: 24.05.2025 // Accepted: 25.10.2025

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ANKARA MEDICAL JOURNAL

Abstract

Objectives: To determine the correlation between Neck Disability Index (NDI) and nomophobia, nomophobia and hand grip strength, and the impact of neck disability on hand grip strength in college-going female students.

Materials and Methods: A cross-sectional analysis was carried out involving 150 university students between the ages of 18 to 25. Data were collected using the Neck Disability Index (NDI) and Nomophobia Questionnaire (NMP-Q), hand grip measured with a dynamometer, and Cervical Range of Motion-Flexion (CROM-F) measured with a goniometer.

Results: The Spearman correlation analysis showed a strong positive correlation between NDI and CROM-F ($\rho = 0.745$, $p < 0.001$). A moderate positive correlation between screen time and NMP-Q score ($\rho = 0.288$, $p < 0.001$) and screen time and NDI ($\rho = 0.254$, $p = 0.002$) suggests that increased screen time is associated with a higher NDI score. A weak positive but not statistically significant correlation between NMP-Q and NDI ($\rho = 0.134$, $p = 0.103$) was seen, meaning musculoskeletal discomfort does not strongly correlate with neck disability. Grip strength does not significantly correlate with screen time, musculoskeletal discomfort, neck disability, or CROM-F.

Conclusion: Increased screen time is strongly associated with higher neck disability scores as well as greater musculoskeletal pain. There is a significant correlation between CROM-F and NDI Score, indicating that postural changes increase impairment. Screen time, NMP-Q score, and NDI score do not significantly correlate with grip strength.

Keywords: Hand strength, neck pain, range of motion, addictive, nomophobia questionnaire, neck disability index.

Introduction

A smartphone is a portable phone that has an electronic connection to a cellular network [1]. Initially, the purpose was to facilitate communication via email and calling, but today smartphones have evolved to encompass texting, gaming, and browsing the internet [2]. In India, smartphone use among teenagers and youth ranges from 24.6% to 44%, and in the world, the rate ranges from 10% to 67%.[3]

The growing demand for smartphones and their impact on various psychological processes have led to the discovery and investigation of new problems associated with these gadgets, such as nomophobia.[4] Nomophobia is the fear that comes with not having a smart phone [5] General symptoms of nomophobia include keeping the phone within arm's reach throughout the day, constant checking for missed calls and messages, and prioritizing digital communication over face-to-face communication.[6]

The disorder affects millions of individuals across the globe, with the age group of 18-24 being the most commonly affected.[7] Among various populations, nomophobia prevalence ranges from 6% to 73%. Considering how widespread smartphones are, it is expected that this prevalence will increase and become an urgent issue.[8] Studies suggest that heavy dependence on smartphones can worsen neck pain and may influence muscle strength, highlighting the connection between psychological stress and physical health conditions.[9]

Holding a smartphone in your hand with an awkward position of wrist position may lead to wrist joint problems. [10] The correlation between NDI, nomophobia, and hand grip strength is particularly relevant in the context of college-going female students, where psychological and physical health influences can manifest significantly.

The term "text neck," introduced by U.S. chiropractor Dr. Dean, describes an overuse condition that arises from extended periods of looking down at smartphones or other screens, leading to a forward-leaning head and neck posture. [11] The more the angle is, the higher the force will be: it will be 18 kg at 30°, 22 kg at 45°, and 27 kg at 60°.[12]

Neck pain is more common in women, particularly students.[13] Persistent neck discomfort and stress typically impair muscular endurance and postural alignment, resulting in decreased grip strength, which in turn can impact overall functional performance.[14] Furthermore, Exercise programs aimed at alleviating neck pain have

also been shown to be successful in increasing grip strength, highlighting the need to focus on neck health to improve overall physical performance.[15]

Examining these correlations can help us understand possible health consequences of excessive smartphone dependency and guide preventive or interventional measures for promoting healthier usage patterns. The study aims to examine the relationship between the Neck Disability Index and nomophobia and hand grip strength in college-going female students.

Materials and Methods

Study Design

The study design was a cross-sectional study using convenience sampling. The study aimed to investigate the association between Neck Disability Index (NDI), Nomophobia, and Hand Grip Strength in College-Going Female Students.

Participants and sample size

Participants were female college-going students aged 18-25 years who used smartphones for more than three hours per day consistently, experienced neck pain in the past six months, and were currently enrolled in an undergraduate or postgraduate degree program at a recognized college or university. Exclusion criteria were male students who had recent neck injuries, all types of vertebral abnormalities, trauma, or any other acute musculoskeletal injuries in the last six months.

The sample size calculation formula used is:

$$N = \left(\frac{u_\alpha}{\delta}\right)^2 \times p \times (1 - p)$$

Where:

- p = Prevalence = 10% or .10 21
- δ= Desired margin of error = 5% or 0.05
- uα= Z-score for 95% confidence = 1.96

With a prevalence of 10% (0.10), a desired margin of error of 5% (0.05), and a confidence level is 95% (z-score = 1.96), the sample size calculation:

$$N = \left(\frac{1.96}{0.05}\right)^2 \times 0.10 \times (1 - 0.10)$$

$$N = (39.2)^2 \times 0.10 \times 0.90$$

$$N = 1536.64 \times 0.09 = 138.2976$$

The minimum required sample size was 138; a total of 150 participants were recruited for the study.

Data Collection Instruments

Data was collected by taking permission from subjects on an informed consent form. The whole research purpose and procedure were explained to the students. Then the data was collected using an NDI & Nomophobia questionnaire, grip strength measured with a hand dynamometer, and CROM-F measured with a goniometer.

Neck Disability Index

The Neck Disability Index (NDI) is the standard questionnaire to evaluate neck pain and disability. It comprises ten questions, each has six possible responses and ranges from 0 to 5, and the maximum score is 50.[16.] It has internal consistency, assessed using Cronbach's alpha, which was found to be good at 0.82, while the Intraclass Correlation Coefficient

(ICC), demonstrated excellent reliability at 0.97 with a 95% Confidence Interval ranging from 0.95 to 0.98.[17]

Nomophobia Questionnaire (NMP-Q)

The NMP-Q has 20 items; each item is scored from 1 (strongly disagree) to 7 (strongly agree). The highest possible score is 140. The overall score is classified in the following way: 20 score indicates no nomophobia, a score ranging from 21 to 59 means slight nomophobia, a score ranging from 60 to 99 indicates moderate nomophobia, and a score of 100 and above indicates severe nomophobia.6 It is good internal consistency with a Cronbach's alpha of 0.945. [18]

Jamar Hand Dynamometer

Hand grip strength was assessed with a Jamar Hydraulic Hand Dynamometer (Model 5030J1, Simmons Preston, Rolyon Bolingbrook, IL). Subjects were seated with the 90° flexed elbow and neutral wrist. Se hands were

instructed to maximally squeeze the dynamometer for 3–5 seconds. A maximum of three trials was conducted for each hand, with 30–60 seconds of rest between trials, and the highest value was recorded for the final score.[19]

Goniometer

CROM-F measured using a goniometer with the participant in a sitting position, with the thoracic & lumbar spine well supported by the back of the chair. For flexion, the fulcrum is over the external auditory meatus, the stationary arm perpendicular to the ground, and the movable arm parallel to the nostrils. The participant bent the neck forward and did not utilize the shoulder or back. Measure and record the angle. Three trials were obtained and averaged with a 10-15 second interval in between. Then the average value was taken. The goniometer has excellent intraclass and interclass reliability. The reliability value ranged from 0.999 and 0.931.[20]

Ethical Consideration

Ethical approval was obtained from the institutional Ethical Committee (CU/UIAHS/Ethical/2024-25/21), and permission was taken from the Departmental Research Committee (CU/UIAHS/Physio/2024-2025/183). Follow the Helsinki Declaration ethical standards. The study was conducted among university students and involved a total of 150 participants. Data were collected over the period from 8 February 2025 to 10 May 2025.

Statistical Analysis

Data analysis was done through SPSS version 27. To check normality, the Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted. Spearman's correlation was used to assess the relationship between NDI, nomophobia, and hand grip strength in college-going students.

Results

A total of 150 female students aged between 18-25 years, with the majority having phone usage more than three hours per day. Among the total participants, the majority of students are in the 18- 20 age group, with a frequency of 55 and a percentage of 36.7. The 21- 23 age group showed a frequency of 43, representing 28.7%. The 24- 25 age group had a frequency of 52 and a percentage of 34.7. The study sample was composed of female students. As a result, the frequency for gender was 150, representing 100 % of the total population. All participants have their Right hand Dominant, leading to a hand dominance frequency of 150 and a percentage of 100. All the Demographic Data is summarized in Table 1.

Table 1. Shows frequency and percentage of demographic data

Demographic Data		Frequency	Percentage
Age	18-20	55	36.7
	21-23	43	28.7
	24-25	52	34.7
Gender	Female	150	100
Hand Dominance	Right hand	150	100

Spearman's correlation coefficient was used to assess the relationship between NDI, NMP-Q, Hand Grip Strength, and CROM-F. The result indicated that there is a Strong Positive correlation between NDI Score and CROM-F ($\rho = 0.745$, $p < 0.001$). There is a moderate positive correlation between screen time and NMP-Q score ($\rho=0.288$, $p< 0.001$), screen time and NDI score ($\rho=0.254$, $p=0.002$). There is weak or insignificant correlation between NMP-Q and NDI score ($\rho=0.134$, $p=0.103$), screen time with dominance hand grip ($\rho=-0.071$, $p=0.390$), Grip strength and CROM-F ($\rho=0.016$, $p=0.846$), screen time and CROM-F ($\rho = -0.066$, $p = 0.422$). Grip strength

does not significantly correlate with screen time, musculoskeletal discomfort, neck disability, or CROM-F. All the correlations are summarized in Table 2.

Table 2. Represent different Statistical values of all outcome measures

		Screen Time	NMP-Q Score	NDI Score	Dominance Hand Grip (in pounds)	CROM-F (in degrees)
Screen time	ρ		.288	.254	-0.71	-0.66
	P		<.001	.002	.390	.422
NMP-Q Score	ρ	.288		134	.042	.128
	P	<.001		.103	.608	.119
NDI Score	ρ	.254	.134		-.051	.745
	P	.002	.103		.539	<.001
Dominance Hand Grip (in Pounds)	ρ	-.071	.042	-.051		.016
	P	.390	.608	.539		.846
CROM-F (in degrees)	ρ	-066	.128	.745	.016	
	P	.422	.119	<.001	.846	

ρ = Spearman's correlation

* Significant Correlation at the 0.01 level (2-tailed).

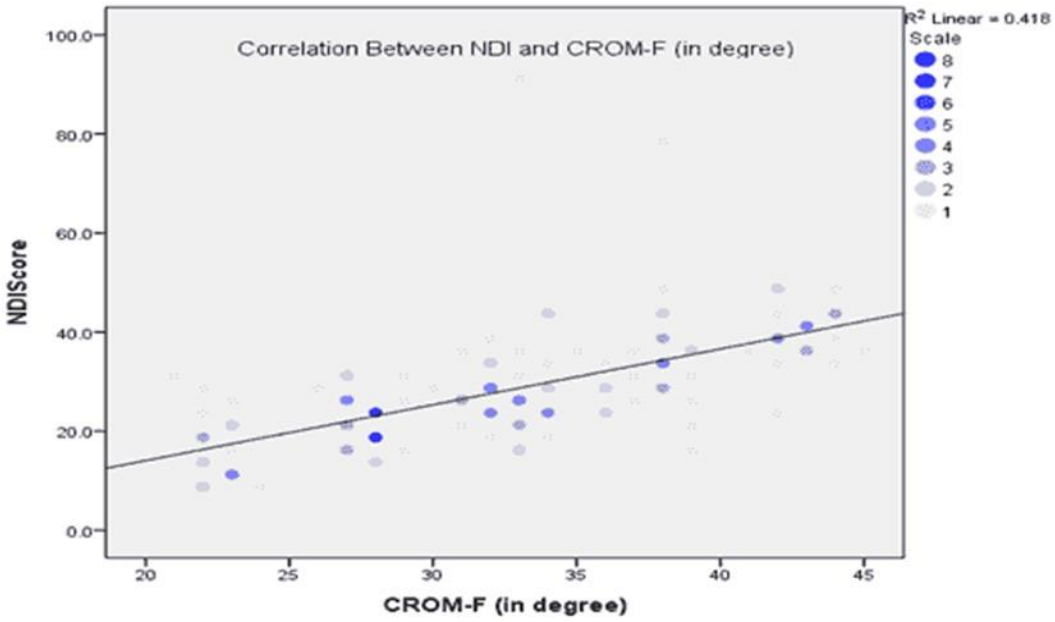

Figure 1. Correlation between NDI score and CROM-F in degrees. (ρ = 0.745, p < 0.001). (NDI: Neck Disability Index).

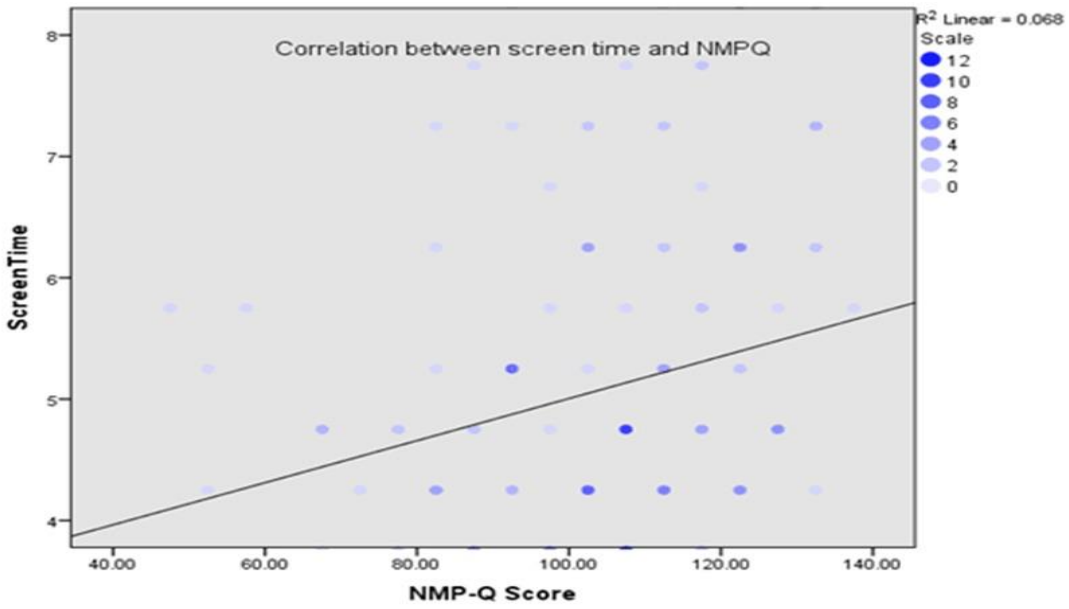

Figure 2. Correlation between screen time and NMP-Q score. (ρ=0.288, p< 0.001). (NMP-Q: Nomophobia Questionnaire).

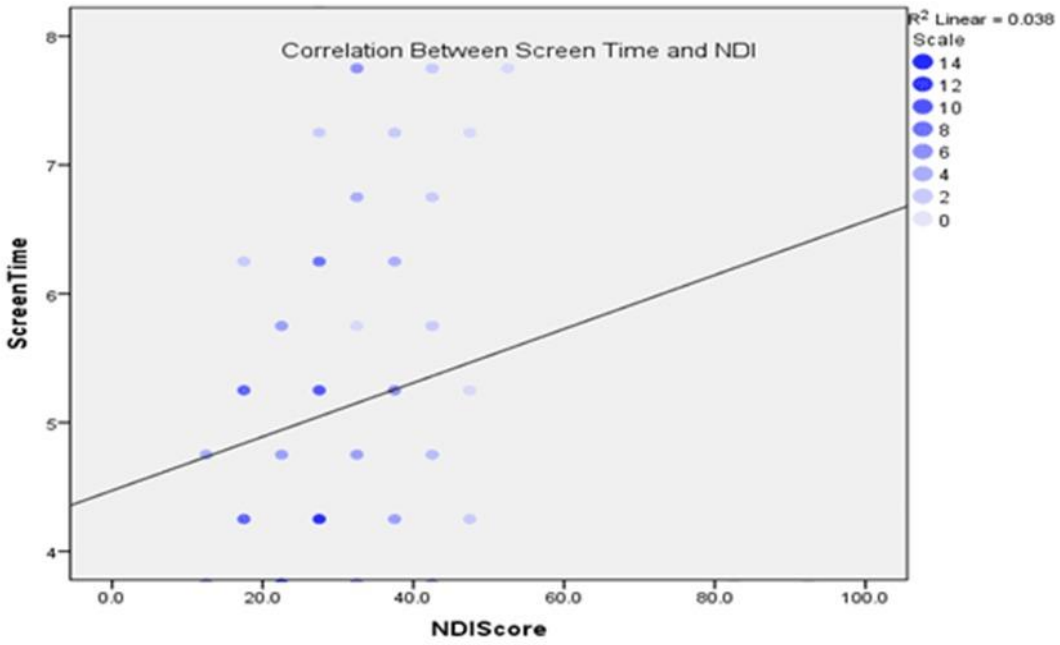

Figure 3. Correlation between screentime and NDI score. (ρ= 0.254, p= 0.002). (NDI: Neck Disability Index).

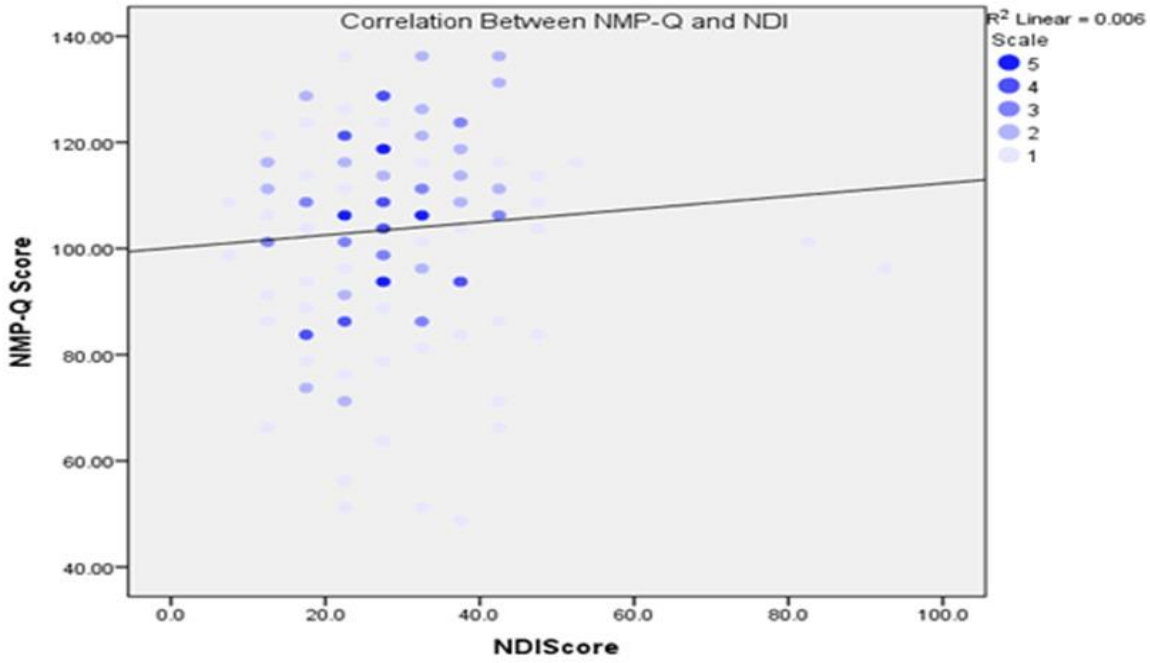

Figure 4. Correlation between NMP-Q and NDI score (ρ=0.134, p=0.103). (NDI: Neck Disability Index, NMP-Q: Nomophobia Questionnaire)

Figure 5. Correlation between screen time and hand grip strength. (ρ=-0.071, p= 0.390).

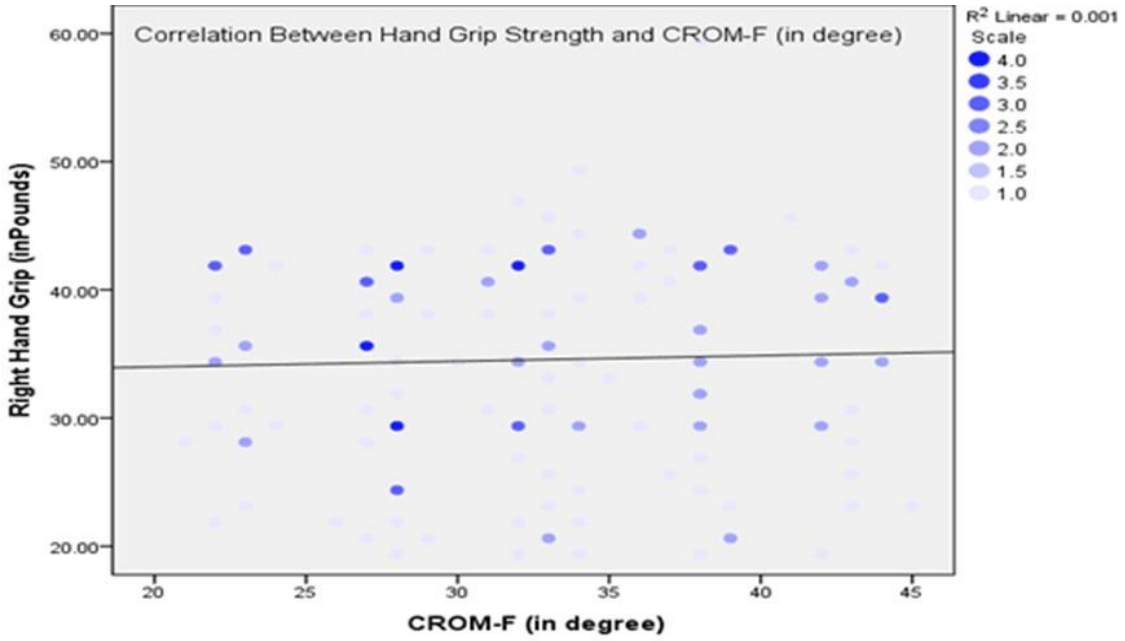

Figure 6. Correlation between grip strength and CROM-F in degrees. (ρ=0.016 to 0.092, p> 0.05).

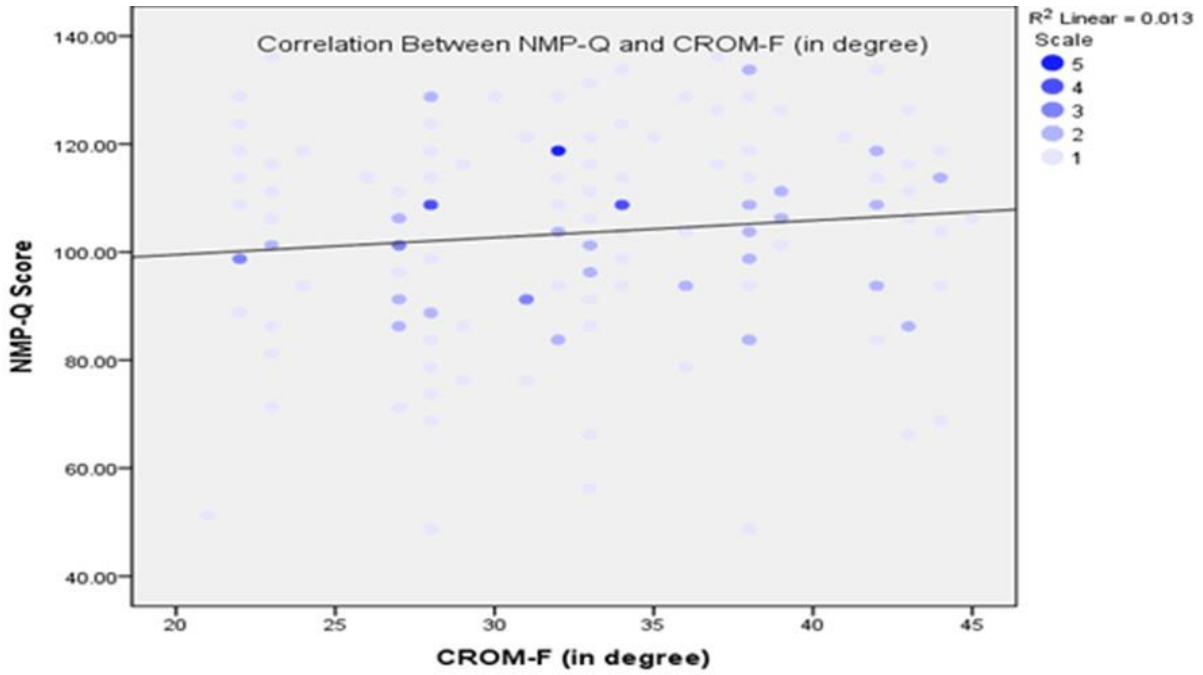

Figure 7. Correlation between NMP-Q and CROM-F in degrees. (ρ= 0.129, p> 0.05). (NMP-Q: Nomophobia Questionnaire).

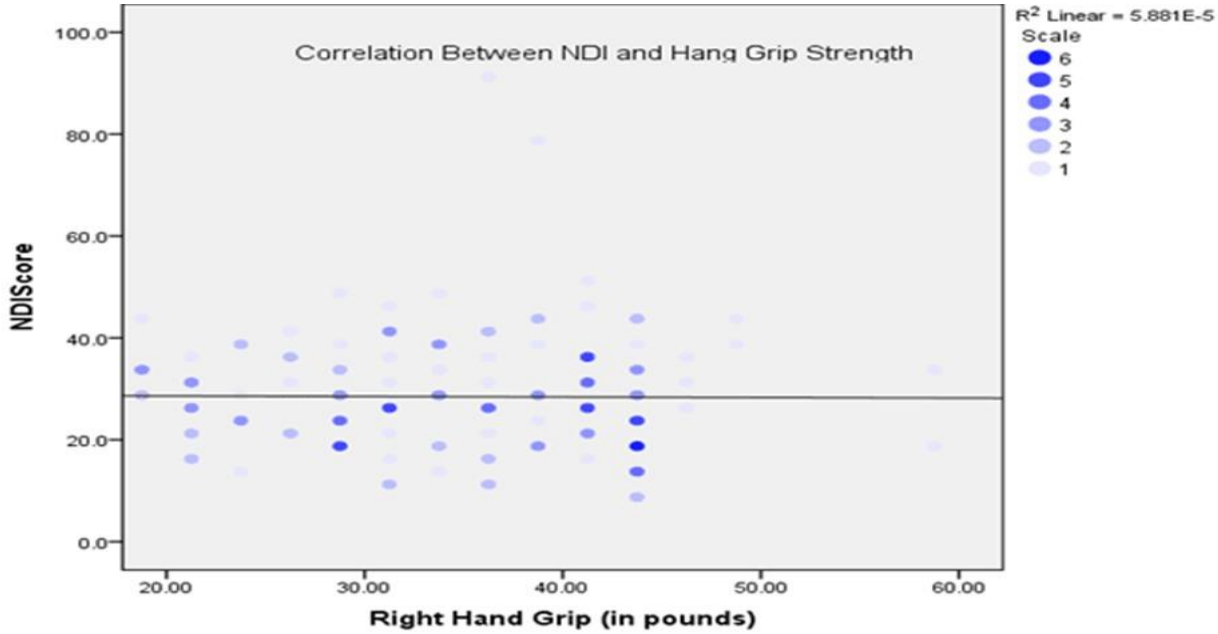

Figure 8. Correlation between NDI score and hand grip strength. (ρ=-0.051, p= 0.539). (NDI: Neck Disability Index).

The analyses showed that a Strong Positive correlation was found between NDI Score and CROM-F (Fig. 1), a moderate positive correlation between screen time and NMP-Q (Fig. 2), and screen time and NDI score (Fig. 3). There is a weak or insignificant correlation between NMP-Q and NDI score (Fig 4), screen time with dominance hand grip (Fig 5), grip strength and CROM-F in degree (Fig 6), NMP-Q and CROM-F in degree (Fig 7), NDI score and hand grip strength. (Fig. 8).

Discussion

Prolonged smartphone use has been linked to a higher risk of neck pain, discomfort, and a higher Neck Disability Index score [21, 22]. In the present study, most participants used their smartphones for more than three hours in the neck flexion posture. So, they are slightly more prone to getting a higher score in the neck disability index. The study showed that a significant positive relationship ($\rho = 0.745$, $p < 0.001$) exists between CROM-F and NDI score, suggesting that individuals with higher neck disability tend to exhibit greater CROM-F, possibly indicating poor posture. The result aligns with previous research, in which a study done by Sarraf et al in 2022 showed that increased neck flexion angles during smartphone use lead to neck discomfort and potential disability.[23]

Our results showed that the degree of screen time is significantly correlated with neck discomfort in the participants. A moderate positive correlation between screen time and NMP-Q score ($\rho = 0.288$, $p < 0.001$). The result aligns with previous research in which a study done by Goncalves et al found a positive correlation between average daily smartphone usage hours and nomophobia ($r= 0.428$, $p <.001$).[24] A moderate positive correlation between screen time and NDI ($\rho = 0.254$, $p = 0.002$) suggests that increased screen time is associated with a higher Neck Disability Index (NDI) score. Abdul et al conducted a study that found that overuse of mobile phones can result in habitual, repeated, and constant head and neck movements towards the screen all day long. Such motions may account for the strong correlation between smartphone addiction and NDI scores and are linked to a high risk of persistent neck pain.[25]

A weak correlation between NMP-Q and NDI ($\rho = 0.134$, $p = 0.103$), but not statistically significant ($p > 0.05$), meaning musculoskeletal discomfort does not strongly correlate with neck disability. Patel and Yadav

concluded the positive association between NDI and Smartphone Addiction Scale- Short Version (SAS-SV) (r=0.52, p>0.05). However, no statistically significant correlation (r >0.05) was found between the variables.[26] Our present study shows that correlation between screen time with dominant hand grip (ρ = -0.071, p = 0.390) and NDI Score with dominant hand grip strength (ρ = -0.051, p = 0.539). A very weak and non-significant association between screen time does not seem to influence hand strength. The result aligns with previous research in which a study done by Iqbal et al concluded that there was no correlation between grip strength and smartphone usage (ρ = 0.06; P < 0.91).[27]

The relationship between hand grip strength and CROM-F (ρ = 0.016 to 0.092, p > 0.05) shows minimal, non-significant correlations. The result aligns with previous research in which a study done by Ojha et al found a weakly significant correlation between the length of time spent using a smartphone and the strength of the dominant hand grip (r = -0.22, p = 0.03).[28]

The findings show that the relationship between NMP-Q and CROM-F is weakly or insignificantly correlated. The study done by Bhalchandra and Kulkarni using NMP-Q, along with physical measures of CROM-F. The result showed a weak correlation between nomophobia levels and forward head posture.[29]

This study shows that the correlation between NDI and hand grip strength is weak or insignificant. The study by Alshahrani et al showed smartphone addicted students reduced neck flexor endurance, but it did not significantly impact hand grip or pinch strength.[30]

The study has some limitations. The use of self-reported measures like the Neck Disability Index and nomophobia questionnaire can lead to recall and response bias. Variations in smartphone usage patterns and differences in device types may introduce variability that isn't considered in the analysis. This study may lack generalizability due to the specific sample (college-going females). There are some external factors, like activity levels, which may affect the outcomes. Cervical Range of Motion assessments were limited to flexion.

Conclusion

Higher screen time is strongly associated with higher neck disability scores as well as greater musculoskeletal pain. There is a significant correlation between CROM-F and neck disability (NDI Score), indicating that postural changes increase impairment. Screen time, NMPQ score, and NDI score do not significantly correlate with grip strength. Reducing screen time may help reduce neck impairment and musculoskeletal pain. Neck disability is strongly associated with changes in neck angle, suggesting that postural modifications may be helpful. Notwithstanding its limitations, the study has a number of strengths. The combination of objective physical measurements with standardized questionnaires allowed for an in-depth assessment of smartphone use and the associated effects. The study provides new knowledge in an understudied field by simultaneously evaluating screen time, musculoskeletal discomfort, cervical posture, and grip strength. The remarkable correlation between CROM-F and NDI confirms the robustness of our results, and the emphasis on a common lifestyle behaviour underscores the clinical and public health impact of our results.

Ethical Considerations: Ethical approval was obtained from the institutional Ethical Committee (CU/UIAHS/Ethical/2024-25/21), and permission was taken from the Departmental Research Committee (CU/UIAHS/Physio/2024-2025/183). Follow the Helsinki Declaration ethical standards. The study was conducted among university students and involved a total of 150 participants. Data were collected over the period from 8 February 2025 to 10 May 2025.

Conflict of Interest: The authors declare no conflict of interest.

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