Original article :

Association between Smartphones Addiction and Neck Disability among Private Universities Students in Riyadh.

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Abstract

Background and Aims:
Repeated and prolonged use of smartphones will have negative impacts on the human body. In talking about musculoskeletal problems, many studies found a relationship between neck disabilities and smart devices usage. Our study aimed to assess the association between smartphones addiction and neck disability among private universities students in Riyadh.

Method:
This cross-sectional study was conducted among private universities students in Riyadh include medical and non-medical colleges. The participants were given online and direct questionnaire to link the association between smartphones addiction using the problematic use of mobile phones (PUMP) scale and neck disability using the neck disability index.

Results:
The study included 527 participants; the majority of the participants were females (81%) as compared to

الملخص

الخلفية والأهداف:
الاستخدام المتكرر والمطول للهواتف الذكية سيكون له آثار سلبية على جسم الإنسان. في الحديث عن مشاكل العضلات والعظام ، وجدت العديد من الدراسات وجود علاقة بين إعاقات الرقبة واستخدام الأجهزة الذكية. هدفت دراستنا إلى تقييم العلاقة بين إدمان الهواتف الذكية وإعاقة الرقبة بين طلاب الجامعات الخاصة في الرياض.

طريقة البحث:
أجريت هذه الدراسة المستعرضة بين طلاب الجامعات الخاصة في الرياض ، بما في ذلك الكليات الطبية وغير الطبية. تم إعطاء المشاركين استبيانًا عبر الإنترنت ومباشرًا لربط العلاقة بين إدمان الهواتف الذكية باستخدام إشكالية استخدام مقياس الهواتف المحمولة (PUMP) وإعاقة العنق باستخدام مؤشر إعاقة العنق (NDI) .

النتائج:
تضمنت الدراسة ٥٢٧ مشاركاً. غالبية المشاركين من الإناث (٨١٪) مقارنة بالذكور (١٩٪). استخدم ٤٥٪ من المشاركين الأجهزة الذكية لمدة ٧ ساعات وما فوق ، متبوعين بـ (٤١,٢٪) الذين كانوا يستخدمونها بين ٤-٦ ساعات و ١٤٪ فقط من المشاركين كانوا يستخدمونها بين ١-٣ ساعات. لوحظ وجود إعاقة كبيرة في الرقبة عند المشاركين الذين كانوا يستخدمون الشاشة لمدة ٧ ساعات وأكثر

males (19%). Forty-five percent of the participants were using smart devices for 7 hours and above, followed by (41.2%) who were using it between 4-6 hours, and only 14% of the participants were using them between 1-3 hours. A significant higher neck disability was noticed in participants who were using the screen for 7 hours and more (p=0.015).

Conclusion:
The study concluded that the majority of university students are using smartphones for 7 hours and more. This finding was significantly associated with the development of neck disability.

Keywords:
Smartphones; Addiction; Neck Disability; University students; Saudi Arabia.

(٠,٠١٥ = p)

الخاتمة:
اوضحت الدراسة إلى أن غالبية طلاب الجامعات يستخدمون الهواتف الذكية لمدة ٧ ساعات فأكثر. وجدت هذه النتيجة مرتبطة بشكل كبير بتطور إعاقة الرقبة..

الكلمات الرئيسية:
الهواتف الذكية. إدمان؛ إعاقة العنق طلاب الجامعة؛ المملكة العربية السعودية.

Introduction

In the last few years, smartphones, and electronic devices (e-devices; smartphones, computers, and others) have been become widely spread among many communities and across all ages. Modern people use a smartphone in most areas of their lives, including occupational and leisure activities, which means their duration of smartphone usage is also increasing [1]. Recent estimates showed that at least 77% of the world's population has its own mobile phone [2]. The excessive use of smartphones to a level where it interferes with the daily lives of users is thus considered to be smartphone addiction [3].

Regarding musculoskeletal problems, many studies found a relationship between neck disabilities and smart devices usage. For instance, in a study carried out in Korea in 2016, they found a significant correlation between neck flexion angle and posture while using the smartphone [4]. Moreover, a study from India conducted on university students in 2018 shows the repetitive and continuous neck flexion posture considered as a high risk of chronic neck pain, which explains the strong association between smartphone addiction and neck disability[5]. In another study in Saudi Arabia, there was a positive association between smartphone addiction and neck problems [6]. This pain is most proba-

bly explained by the inappropriate posture while using the smart device as the person bends his or her neck more on purpose of looking to a small screen [7]. In addition, as a normal response to keep the neck in balance, the extensor muscle activated more, which increases the load on the cervical erector spine and trapezius muscle [8]. Another study in Korea found out that smartphone usage produces chronic neck pain and severe upper back muscle spasm by reducing cervical lordosis and the pain threshold of the neck muscles. Also, it causes shoulder pain and tightness, resulting in painful shoulder muscle spasm [9]. Although this correlation remains controversial, as another study found that there is no correlation between neck pain and the time spends on smartphone usage [10].

On the other hand, there is a study in Saudi Arabia conducted in 2018 found that there is a positive correlation between long-time smart devices usage and neck pain, specifically for those who spend 5-8 hours a day on smart devices [11]. According to a study in Korea in 2016, when they evaluated 34 respondents of adult individuals and divided them into three groups with different duration of smartphone usage as group 1 for 10 minutes, group 2 for 20 minutes and group 3 for 30 minutes; showing a direct proportion between neck pain and duration, so the neck pain increases when the duration of the smartphone usage gets longer [12]. Another study conducted in Saudi Arabia finds out that nearly one-third of the students who complained of neck pain symptoms showed significant associations with female gender 44% in comparison with only 29% of male whose use smartphone either for study or leisure purposes [13]. Another study in Shanghai showed high prevalence neck/shoulder pain significantly more in females (44.5%) compared with males (36.8%) this is closely related to multiple factors including digital products, physical activity, and psychological status [14].

This study aims to measure the usage of smartphones among students studying in private universities in Riyadh and identify the negative effects and consequences in their life, particularly neck disabilities.

Methodology

This was a cross-sectional study by design and was carried out on a representative sample of students from private universities in Riyadh including medical and non-medical colleges, from the period of January to August 2019. We targeted females and males from private universities students in Riyadh city, Kingdom of Saudi Arabia. We expected a high response rate; however, we eliminated all invalid, in-

complete responses, or any responses that did not match the inclusion criteria with a total of 270 participants. Our sample size included 500 university students, including both females and males. The sample size derived based on computing the minimum sample size required for accuracy in estimating proportions by considering the normal standard deviation set at 95% confidence level (1.96), percentage picking a choice or response (50% = 0.5) and the confidence interval (0.05 = ±5) [15]. The formula is n=(z^2 (p)(1-p))/c^2 where,

z = standard normal deviation set at 95% confidence level

p = percentage picking a choice or response

c = confidence interval

Putting the values in the above formula yielded a minimum sample size of 384. However, for more precise results we increased the sample size to (500) including those who match the eligibility criteria which was 1(must be a university student 2) aged 18 years and above 3(regularly using the smartphones 4) no blindness or vision loss 5(no mental disability 6) No paralysis or physical disabilities.

Validated questionnaires were used to collect the data from study subjects; the data was collected by trained students using online and direct methods. The first part of the questionnaire contained sociodemographic data, whereas the second part contains 1) the Arabic version of the problematic use of mobile phones (PUMP) scale. The PUMP scale is a 20-item questionnaire that assesses mobile phone use based on the DSM-5 criteria for substance use disorder [16, 17]. The original English language PUMP scale score was compared to other scores of smartphone addiction and showed a convergent validity and excellent internal consistency. The PUMP scale score was positively correlated with excessive smartphone usage and the self-report feelings of addiction. All items were rated on a 5-point scale ranging from 1 = "strongly disagree" to 5 = "strongly agree" [17]. The Arabic version of the PUMP scale score was previously used in a study conducted in Saudi Arabia among university students. The Arabic version was validated by experts in psychiatry and addiction, and reliability tested as well. [16].(2) the neck disability index (NDI), which is a modification of the Oswestry Low Back Pain Disability Index [18]. Validity was ensured through peer-review and patient feedback sessions. Test-retest reliability was determined by using the correlation coefficient and Pearson's correlation analysis. For the determination of concurrent validity was assessed in two ways. First, on a smaller subset of 10 patients who completed a course of conservative care, the percentage of change on NDI scores before and after

treatment was compared to visual analog scale scores for perceived improvement in activity levels. These scores correlated at 0.60. Secondly, in a larger subset of 30 subjects, NDI scores were compared to scores on the McGill Pain Questionnaire, with similar moderately high correlations (0.69-0.70). While the sample size of some of the analyses is somewhat small, this study demonstrated that the NDI achieved a high degree of reliability and internal consistency.[19].

Ethical Considerations:

The study was reviewed and approved by the ethical committee at Dar Al Uloom University, Riyadh, Saudi Arabia. The participants informed that all the collected information for statistical analysis only and their consents have obtained.

Data Analysis:

The collected data was entered and analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 23. Descriptive statistics were calculated. Percentages are reported for qualitative variables. Fisher Exact test was applied to observe associations between qualitative variables. One-Way-Analysis was applied to compare the PUMP score with Neck Disability Syndrome. Post-Hoc Tukey test was also applied to observe significant multiple comparison differences. A p-value of < 0.05 was considered statistically significant.

Results

The majority of the participants n=465 (88.2%) belonged to the age group of 18-25 years, followed by n=43 (8.2%), who belonged to the age group of 26-33 years. A few numbers of respondents n=19 (3.7%) were from the age group of 34-55 years. The major chunk of the participants was females n=427 (81%) as compared to males n=100 (19%). Most of the participants were single n=449 (85.2%), around 14% were married, and a small percentage were divorced and widowed.

Table 1: Educational characteristics and smart devise usage of participants (n=527)

	n (%)		n (%)
University		Academic Level	
DAU	240 (45.5)	1st – 2nd	97 (18.4)
AMU	101 (19.2)	3rd – 4th	96 (18.2)
PSU	60 (11.4)	5th – 6th	62 (11.8)
IMC	34 (6.5)	7th – 8th	70 (13.3)
AU	33 (6.3)	9th – 10th	66 (12.5)
REU	31 (5.9)	11th – 12th	47 (8.9)
FC	12 (2.3)	13th – 14th	76 (14.4)
Others	5 (0.9)	Master	10 (1.9)
YU	4 (0.8)	Ph.D.	3 (0.6)
GC	4 (0.8)		
AOU	3 (0.6)		
Academic Performance		Smart Device	
Excellent	146 (27.7)	Mobile phone	485 (92.0)
Very Good	261 (49.5)	Laptop	25 (4.7)
Good	105 (19.9)	iPad	9 (1.7)
Poor	15 (2.8)	Video game	5 (0.9)
		Desktop computer	3 (0.6)
Hours Spending on using smart devices (hours)		Specialty	
1-3	73 (13.9)	Non-medical	189 (35.9)
4-6	217 (41.2)	Medical	338 (64.1)
7 and above	237 (45.0)		

PUMP: problematic use of mobile phones, NDI: Neck disability index, DAU: Dar Al Uloom University, AMU: AlMaarefa University, PSU: Prince Sultan University, IMC: Inaya Medical College, AU: Alfaisal University, REU: Riyadh Elm University, FC: Al-Farabi College, YU: Al Yamamah University, GC: Al Ghad Colleges, AOU: Arab Open University.

Results presented in Table 1 showed that majority of the participants were studying in DAU n=240 (45.5%), followed by n=101 (19.2%) who were studying in AMU, n=60 (11.4%) in PSU, nearly 6% were studying in REU, AU, and IMC respectively. A few numbers of participants were studying in FC, YU, GC AOU, and others. The academic performance categorized into excellent, very good, good, and poor based on the university grade point average range from 0.00 to 4.00. Excellent performance range from 4.00 to 3.5, very good from 3.49 to 2.75, good from 2.74 to 1.75, and from 1.74 to 0.00 considered poor. Most of the participants were very good n=261 (49.5%), around 28% has excellent performance, one-fifth had good academic performance, and only n=15 (2.8%) had

a poor academic performance. The major chunk of the participants was using smart devices for 7 hours and above, followed by n=217 (41.2%) who were using it between 4-6 hours, and only 14% of the participants were using them between 1-3 hours. The distribution of participants studying in 1st-2nd and 3rd-4th was almost equal (18%) respectively. Around 15% were studying in the 13th-14th year, followed by 7th-8th (13.3%), 9th-10th (12.5%), 9% were studying in the 11th-12th year, around 2% were doing master's and a small number of participants were enrolled in Ph.D. Mobile phone was the most used smart device by the participants n=485 (92%), followed by laptop n=25 (4.7%), iPad n=9 (1.7%) and less than 1% were using a desktop computer and video games. Almost two-quarter of the participants belonged to medical specialty, and one-quarter were enrolled in the non-medical specialty.

Table 2: Association between Neck Disability Syndrome, sociodemographic data and device usage

PARAMETER	NECK DISABILITY SYNDROME						P-value (Fischer Exact Test)
	No n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	Complete n (%)	Total	
Age	148 (87.1)	244 (89.4)	61 (89.7)	9 (75.0)	3 (75.0)		0.197
18-25	14 (8.2)	21 (7.7)	6 (8.8)	1 (8.3)	1 (25.0)	465	
26-33	7 (4.1)	4 (1.5)	0 (0.0)	2 (16.7)	0 (0.0)	43	
34-41	0 (0.0)	3 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	13	
42-49	1 (0.6)	1 (0.4)	1 (1.5)	0 (0.0)	0 (0.0)	3	
50-55						3	
Total (n)	170	273	68	12	4	527	
Gender	45 (26.5)	49 (17.9)		2 (16.7)			0.005*
Male	125 (73.5)	224 (82.1)	4 (5.9)	10	0 (0.0)	100	
Female			64 (94.1)	(83.3)	4 (100)	427	
Total (n)	170	273	68	12	4	527	
Marital Status	145 (53.7)	232 (85.0)	60 (88.2)	9 (75.0)	3 (75.0)		0.076
Single	25 (19.0)	39 (14.3)	5 (7.4)	3 (25.0)	1 (25.0)	449	
Married	0 (0.0)	2 (0.7)	1 (1.5)	0 (0.0)	0 (0.0)	73	
Divorced	0 (0.0)	0 (0.0)	2 (2.9)	0 (0.0)	0 (0.0)	3	
Widow / Widowed						2	
Total (n)	170	273	68	12	4	527	
Center Screen							0.326
Above	9 (5.3)	17 (6.2)	5 (7.4)	1 (8.3)	0 (0.0)	32	
Lower	100 (58.8)	153 (56.0)	43 (63.2)	11	3 (75.0)	310	
Same Level	61 (35.9)	103 (37.7)	20 (29.4)	(91.7)	1 (25.0)	185	
				0 (0.0)			

Total (n)	170	273	68	12	4	527	
Hours Spending							0.015*
1-3	27 (15.9)	38 (13.9)	5 (7.4)	2 (16.7)	0 (0.0)	72	
4-6	86 (50.6)	108 (39.6)	18 (26.5)	4 (33.3)	0 (0.0)	216	
7 and above	57 (33.5)	127 (46.6)	45 (66.2)	6 (50.0)	4 (100.0)	237	
Total (n)	170	273	68	12	4	527	
*-Statistically significant (P<0.05), n and % – Number and percent of subjects respectively							

The Neck disability was significantly more in females as compared to males (p=0.005). Likewise, neck disability was significantly more in participants who were using the screen for 7 hours and more (p=0.015). No significant association was observed between neck disability and age (p=0.197), marital status (p=0.076), and screen angle (p=0.326). The results are presented in Table 2.

Table 3: Association between Neck Disability Syndrome and Academic data

	NECK DISABILITY SYNDROME						
PARAMETER	No n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	Complete n (%)	Total	P value (Fischer Exact Test)
University	79 (46.5)	122 (44.7)	34 (50.0)	4 (33.3)	1 (25.0)		
DAU	46 (27.1)	50 (18.3)	5 (7.4)	0 (0.0)	0 (0.0)	240	
AMU	8 (4.7)	18 (6.6)	3 (4.4)	2 (16.7)	0 (0.0)	101	
REU	14 (8.2)	34 (12.5)	8 (11.8)	2 (16.7)	2 (50.0)	31	0.001*
PSU	11 (6.5)	14 (5.1)	7 (10.3)	1 (8.3)	0 (0.0)	60	
AU	5 (2.9)	20 (7.3)	7 (10.3)	2 (16.7)	0 (0.0)	33	
IMC	0 (0.0)	3 (1.1)	1 (1.5)	0 (0.0)	0 (0.0)	34	
YU	0 (0.6)	3 (1.1)	0 (0.0)	0 (0.0)	1 (25)	4	
GC	1 (0.6)	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	4	
AOU	5 (2.9)	4 (1.5)	2 (2.9)	1 (8.3)	0 (0.0)	3	
FC	1 (0.6)	3 (1.1)	1 (1.5)	0 (0.0)	0 (0.0)	12	
Others						5	
Total	170	273	68	12	4	527	
Year	28 (16.5)	52 (19.0)	14 (20.6)	1 (8.3)	2 (50.0)		
1^{st} – 2^{nd}	30 (17.6)	48 (17.6)	13 (19.1)	4 (33.3)	1 (25.0)	97	
3^{rd} – 4^{th}	16 (9.4)	37 (13.6)	7 (10.3)	1 (8.3)	1 (25.0)	96	
5^{th} – 6^{th}	16 (9.4)	41 (15.0)	10 (14.7)	3 (25.0)	0 (0.0)	62	
7^{th} – 8^{th}	19 (11.2)	38 (13.9)	9 (13.2)	0 (0.0)	0 (0.0)	70	
9^{th} – 10^{th}	16 (9.4)	23 (8.4)	7 (10.3)	1 (8.3)	0 (0.0)	66	
11^{th} – 12^{th}	38 (22.4)	31 (11.4)	6 (8.8)	1 (8.3)	0 (0.0)	47	0.238
13^{th} – 14^{th}	4 (2.4)	3 (1.1)	2 (2.9)	1 (8.3)	0 (0.0)	76	
Master	3 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	10	
Ph.D.						3	
Total	170	273	68	12	4	527	

Academic Performance							
Poor	4 (2.4)	9 (3.3)	1 (1.5)	1 (8.3)	0 (0.0)	15	
Good	20 (11.8)	58 (21.2)	22 (32.4)	3 (25.0)	2 (50.0)	105	
Very Good	90 (52.9)	138 (50.5)	27 (39.7)	4 (33.3)	2 (50.0)	261	0.076
Excellent	56 (32.9)	68 (24.9)	18 (26.5)	4 (33.3)	0 (0.0)	146	
Total	170	273	68	12	4	527	
Specialty							
Medical	53 (31.2)	101 (37.0)	27 (39.7)	6 (50.0)	0 (0.0)	189	
Non-Medical	117 (68.8)	172 (63.0)	41 (60.3)	6 (50.0)	0 (0.0)	338	0.044*
Total	170	273	68	12	0	527	

PUMP: problematic use of mobile phones, NDI: Neck disability index, DAU: Dar Al Uloom University, AMU: AlMaarefa University, PSU: Prince Sultan University, IMC: Inaya Medical College, AU: Alfaisal University, REU: Riyadh Elm University, FC: Al-Farabi College, YU: Al Yamamah University, GC: Al Ghad Colleges, AOU: Arab Open University.

Results presented in Table 3 showed that most of the participants studying in DAU had significantly more neck disability as compared to participants studying in other institutions (p=0.001). Moreover, participants studying in non-medical disciplines had significantly more neck disability (p=0.044). However, neck disability was not significantly associated with the year of study (p=0.238) and academic performance (p=0.076).

Table 4: Comparison of PUMP score with Neck Disability Syndrome

Neck Disability Syndrome	n	**PUMP Score** (Mean ± S.D)	p-value
No	170	53.28 ± 15.08	
Mild	273	59.36 ± 14.58**	
Moderate	68	65.76 ± 15.23**	
Severe	12	65.25 ± 14.36	<0.001*
Complete	4	73.75 ± 20.83	

*statistically significant at 5% level of significance

**Tukey's test significant multiple comparisons

A significant difference was observed between the PUMP score and Neck Disability (p<0.001). Post-Hoc analysis showed that the PUMP score significantly varies between participants having mild and moderate (p=0.014) neck disability. However, Post-HOC analysis was not statistically significant for PUMP score and patients having no (p=0.654), severe (p=0.056), or complete neck disability (p=0.308). The results are presented in Table 4.

Discussion

This study found that major of the participants (45.5%) of 527 students were using smart devices for 7 hours and above, followed by (41.2%) who were using it between 4-6 hours, and only 14% of the participants were using them between 1-3 hours. Similar to these results, smartphone addiction is a worldwide phenomenon in a range of 9.3% to 48% of the population [20, 21]. In contrast to our results, in Kingdom of Saudi Arabia, another study was conducted among 2367 subjects; the majority (61%) of the study participants reported that they spend at least 5 hours per day using their smartphones, whereas 27.2% spend more than 8 hours per day[16]. Another cross-sectional study was conducted in Saudi Arabia using an online google survey form included 2435 participants, most of the participants who use a smart device, allocate 5-8 hours per day and represent (31.2%), while who use it for 2-4 hours a day represent (27.1%) [22]. In Jeddah, a cross-sectional study was conducted on 203 sixth-year medical students at the Faculty of Medicine, King Abdul-Aziz University, which reported that the overall prevalence of smartphone addiction was 66 (36.5%) [23]. Another study carried out in a group of King Saud University students to investigated smartphone addiction revealed that addiction percentage among participants was 48% [21]. A mixed-method study that included systematic-review and meta-analysis found that the smartphone addiction magnitude in India ranged from 39-44% [24]. Another study was conducted on a sample comprising of 587 students of the repudiated school. Students were assessed with a specially designed preform, and the smartphone addiction scale (SAS) reported that 53.62% were low users, and 33.3% were high users of smartphones as estimated by Smart Phone addiction scale [25].

Regarding the association between smartphones addiction and neck disability, our study found that neck disability was significantly more in participants who were using the screen for 7 hours and more ($p=0.015$). Similarly, another study was conducted among 100 participants showed that the degree of smartphone influence was significantly correlated with musculoskeletal discomfort in the participants. They found a moderate positive correlation between both Smartphone Addiction Scale (SAS) and the Neck Disability Index (NDI) ($p<0.001$). Moreover, SAS showed a higher score- indicating addiction to smartphone use, along with it, the scores of NDI showing moderate disability (30-48%-moderate disability) [5]. In Riyadh, The result of another study showed

a clear association between addiction to smartphone use and various degrees of neck problems among the participants [6]. In 2016, Sang in Jung conducted a study at Daegu University, South Korea, taken from fifty volunteers using the electronic devices daily. It showed that using a smartphone for a prolonged duration could negatively affect posture; therefore, predisposing the users to vertebral diseases and neck pain [26].

Furthermore, Kim et al. (2015) reported that a longer duration of smartphone usage caused a higher degree of neck pain [27]. Other studies have found that smartphone use could be related to musculoskeletal symptoms, including muscular fatigue and tenderness, as well as a decreased cervical range of motion [28]. In general, smartphone addiction could cause significant neck disability because of the bad posture associated with their use [28].

Conclusion:

The study concluded that the majority of cases using smartphones for 7 hours and above, and there were significant correlations between smartphones usage and neck disability. This finding highlighted the need to increase the awareness of the negative impacts of the prolonged use of smartphones on our health.

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