

# Excessive Mobile Usage, Stress, and Memory among Health Sciences Students at PNU

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The young population, consisting primarily of students, are found to have a strong association with their mobile phones, and find it challenging to spend a day without them. Despite their advantages, excessive phone usage has been linked with harmful consequences. Previous findings stated that there is a relationship between the usage of mobile phones and stressed people. Moreover, adverse effects of using mobile phones and their impact on cognitive functioning has also been reported. This study aims to explore the relationship between excessive mobile phone use, perceived stress levels, and memory among female students (aged 18-26) studying in Health Sciences colleges at Princess Nourah University in Riyadh. The study recruited 340 participants, and multistage cluster sampling was used to determine the size of a representative sample. The study is carried out the within the subject design and used the standardized scales of Problematic Use of Mobile Phones (PUMP), Perceived Stress Scale (PSS), and Digit Span subtest. The findings concluded that there is a strong positive relationship between excessive mobile phone use and perceived stress ( $p < 0.01$ ), but no correlation was found with memory. The results can be useful to develop an e-health promotion program for Saudi health students to enhance the better usage of mobile phones.

**Key words:** *Mobile usage, stress, memory, health sciences students, perceived social support.*

## Introduction

Mobile phones are a powerful and convenient communication device with a wide range of applications that has brought people closer. This technology provides a variety of features, including social networking, internet access, e-mails, and other numerous features, that has made people dependent and more attached to their phones (Vaidya, Pathak & Vaidya, 2016). People's dependence on their mobile phones has become a paramount concern leading to over usage and, even in some cases, internet addiction (Parasuraman, Sam, Yee, Chuon, & Ren, 2017).

Studies revealed that younger individuals appeared to be excessive smartphone users (Andone et al., 2016), whereas college students spend much time on their phones (Alhazmi, 2018). A study showed an excessive mobile phone usage among medical students in Oman reported 50% of the students were using the internet on their cell phones for more than 4 hours a day (Siddiqi, Jahan, Moin, Al-Shehhi & Al-Balushi, 2017). Students' attachment to their mobile phones could be a problem for them, as the excessive usage has been linked with physical harm (Billieux, Maurage, Lopez-Fernandez, Kuss & Griffiths, 2015), negative psychological impacts on sleep, and academic performance (Gupta, Garg & Arora, 2016). Excessive phone usage could also produce vulnerability to stress (Vahedi & Saiphoo, 2018; Boumosleh, 2017).

Saudi Arabia is ranked third globally in terms of cell phone usage and expects subscriptions to reach 6 billion by the year 2020 (Alhazmi *et al.*, 2018). A cross-sectional study was conducted by Hegazy and his colleagues (2016) to investigate the relation between mobile phone use and health complaints in Saudi Arabia. Medical students from King Abdulaziz University (KAU) aged from 19-25 years (N=472) participated in the study. The results found a significant difference in gender concerning mobile phone use. Females were higher in mobile phone usage compared to males. Excessive use of the mobile phone was found to be linked with health problems such as sleep disturbance, headache, depression, nervousness, vision, and musculoskeletal issues. Another study confirmed the association of unhealthy lifestyle adaptation with the excessive usage of mobile phones (Alosaimi, Alyahya, Alshahwan, Al Mahyijari & Shaik, 2016).

Physiological and psychological changes often accompany stress, thus, it can impact both physical and mental health (Selye, 1974). Individuals who deal with stress for an extended period can trigger many health problems to occur. Chronic stress may play a significant role in the occurrence of severe health issues, including heart diseases, diabetes, and mental disorders such as depression and anxiety disorders (NIH, nd). Excessive use of mobile phone can be considered as a problematic behaviour and generally is conceptualized as an addictive behaviour (Billieux, et al., 2015), where there is a desire to repeat a behaviour despite the

negative consequences on one's life, in order to get a rewarding sensation from a stimuli (Roberts, Yaya, & Manolis, 2014). Recent studies on the relationship between mobile phone use and psychological stress have increasingly become researchers' interest (Samaha & Hawi, 2016). Particularly, investigating the association between mobile phone use and stress within psychological well-being (Vahedi & Saiphoo, 2018). A meta-analytic review summarized that it is difficult to determine the link between mobile phone use and stress accurately.

Furthermore, all previous findings proposed that there is a correlation between the usage of mobile phones and stressed people can contradict each other. Stress is considered as one of the issues that could be related to excessive mobile phone use among undergraduate students. Some studies concluded that stress is linked to excessive use of mobile phones (Samaha & Hawi, 2016), whereas others concluded that mobile phone use might cause stress (Vahedi & Saiphoo, 2018). However, there is a lack of studies that show the relationship between stress and excessive mobile phone usage in Saudi Arabia.

Excessive use of mobile phones does not only impact a person psychologically, but it can also affect cognitive functioning. Memory is one of the essential cognitive functions in the brain that consist of three ways in processing the information: sensory, short term/working memory, and long-term memory. The brain regions which are included in the memory process are the hippocampus, frontal lobe, parietal lobe, and in long term memory. Different areas in the brain are responsible for storing the information (Yaribeygi, Panahi, Sahraei, Johnston & Sahebkar, 2017). The process of formulating the memory starts when the information is perceived in the frontal area in the brain, then it is encoded, consolidated and retrieved from the hippocampus or other areas in the brain (Lindau, Almkvist & Mohammed, 2016). Recent studies have concluded the possible adverse effects on health from using mobile phones, in terms of the brain's cognitive functioning and memory processing (Prathibha, Hamed, & Tharoor, 2016). An experimental study was conducted to assess how mobile phone usage can cause memory impairment (Kalafataki, Bekiaridis-Moschou, Gkioka & Tsolaki, 2017). It was found that mobile phone use had a negative impact on the memory performance of the participants who were healthy and without mild cognitive impairment after they used their phones for 5 minutes. The study also concluded that age was negatively correlated with memory performance. A cross-sectional study (Jamal, Sedie, Haleem, & Hafiz, 2012) was conducted to investigate the usage of mobile phones and their consequences among female medical students in Medina, Saudi Arabia. The conclusion of the study showed that there are significant results with the associated health risk related to memory among excessive mobile phone users.

The current study is grounded on the attachment theory of Bowlby (1969). Attachment is developed in infancy, and an attachment figure is needed (e.g., mother) to survive, not only physically, but also mentally, and emotionally. When infants are separated from their

attachment figure, they exhibit distress and discomfort (Mannion, 2018). In adulthood, the attachment system plays a role in a different kind of relationships, for example, friendships or to develop an attachment toward non-human figures or objects. According to this theory, individuals' attachment to non-human objects such as mobile phones, provide emotional support and reduce their feeling of distress, and they exhibit discomfort and distress as they are separated from their mobile phones (Shadi & Hassan, 2017).

The lack of research studies that have been conducted in the area of clinical health psychology among allied health students in Saudi Arabia has caused a lack of clarity in the findings and shortage of knowledge. The objective of this research is to study the previously mentioned variables, which are mobile phone use, stress level, and memory among female health sciences college students in Saudi Arabia. Therefore, the following hypotheses were formed:

H1: There is a significant relationship of excessive mobile phone usage on stress levels and (working) memory.

H2: Excessive use of the mobile phone will cause poor memory, and high-stress level among health sciences students.

## **Methodology**

### ***Research Design***

This research is descriptive by using a within-subject design. The study aimed to assess the relationship between the three variables, which are mobile phone usage, stress, and working memory/short term memory, using standardized questionnaires. The study was conducted at Princess Nourah University, and data was collected from health sciences colleges.

### **Participants**

The sample was obtained from the health sciences college students at Princess Nourah University (PNU) using openepi calculator (N=347). A confidence level of 95% was selected. Sample size:

$$n = [DEFF * Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p * (1-p))]$$

Multistage cluster sampling was utilized to determine the size of the sample. At the first stage, a 347 sample was found as a representative one. In the second stage, the proportion of the sample was obtained according to the population of colleges, respectively. Thus, College of Health and Rehabilitation Sciences ( $687/2455 * 347 = 97$ ), College of Nursing

(601/2455\*347= 85), College of Pharmacy (586/2455\*347=83), College of Medicine (382/2455\*347= 54), and College of Dentistry (199/2455\*347=28) were planned to be approached to collect the data. However, 375 participants were approached to avoid any threat to internal validity due to attrition. After excluding 35 survey forms which did not meet the inclusion criteria of research, including reporting of psychiatric problems (n=9), incomplete forms or questionnaires (n=15), and scales (n=11), the final number of collected data was N=340. Therefore, the return rate of the survey was 98%.

### ***Inclusion/ exclusion criteria***

The inclusion criteria consist of health sciences students who study at Princess Nourah University within the age range of 18-26 years old and participants who are possessing a smart mobile phone.

According to exclusion criteria, researchers excluded any student reported to be diagnosed with psychiatric problems. Students from the foundation year of Health campus were excluded due to their maturity level differences, age, and educational level.

### **Material**

To collect the participants' socio-demographic information and to assess the relationship between the variables, a sociodemographic questionnaire was utilized. This questionnaire included two standardized scales of Problematic Use of Mobile Phone (PUMP), Perceived Stress Scale (PSS), and one assessment tool of Digit Span (DS) subtest.

### ***Demographic Information Questionnaire***

A brief questionnaire was developed and administered to gather personal information about the participant, including age, education level, and marital status. Some questions were related to education including hours spent on the premises of the university and their studying hours. Lifestyle was measured by asking average hours of sleep. The psychiatric diagnosis was asked for screening purposes and to know mental health. One special question was designed to measure perceived social support. Participants were asked to rate it on a 5-point Likert scale.

### ***Problematic use of mobile phone (PUMP)***

The scale of PUMP was used to measure the problematic use of mobile phones. It contains twenty items. The PUMP was developed based upon interviews of self-identified cellphone

addicts, DSM-4 criteria for substance use disorders, and a review of existing measures evaluating results of extreme internet users. All items are rated on a 5-point Likert scale ranging from strongly disagree to strongly agree (1-5). PUMP scale has been found to be correlated with the perception of excessive mobile phone usage (Merlo, Stone, Bibbey, 2013). There is no cut-off score. A higher score indicates problematic mobile phone use. The 20-items self-report scale has an excellent internal consistency of 0.95 (Merlo *et al.*, 2013). Whereas, in the current study, alpha coefficient 0.75 was found.

### ***Perceived stress scale (PSS)***

Perceived Stress Scale (PSS) is a widely used psychological assessment (Cohen, Kamarck, & Mermelstein, 1983). This self-report instrument consists of 10 questions that can identify the perceived level of stress over the past month. Each participant has rated each question on a scale of (never, almost never, sometimes, fairly often, or very often). For the total score, the sum across all the items will be calculated; however, before this, the scoring of four questions will be reversed (item 4,5,7 and 8). Many studies have examined the validity and reliability of PSS assessment (Andreou, *et al.*, 2011). PSS items are respectively selected to measure and indicate a higher level of stress, which makes this assessment valid. The scale provides three categories of mild (0-13), moderate (14-26) and high (27-40) stress levels. The questionnaire was based on a previously published article and had an internal consistency of 0.85, and test-retest reliability was 0.85 (Alosaimi *et al.*, 2015). However, in this current study, alpha coefficient 0.76 was found.

### ***Digit span***

A Digit-Span is a task that could be used to measure the working and short-term memory's storage capacity. The digit span task exercises the verbal working memory. The task has 7 items, and each item has two trails on both the forward and backward. The maximum score on both forwards and backwards is 14 points. The forward digit span task involves presenting participants with a sequence of random digits, and then the participants are told to repeat the list back (from 1 to 9) within the same order that they heard of measuring their short-term memory. After that, if the participants succeed in the first item, they proceed to the next item which has a longer sequence of numbers. In the backwards digit span condition, participants are presented with a series of random digits (from 1 to 9) and are required to repeat the list backwards verbally to test their working memory (Gignac & Weiss, 2015). A consistency of Digit Span forward was 0.89, and for Digit Span backward, it was 0.59 (de Paula, Malloy-Diniz & Romano-Silva, 2016).

### ***Data Collection and Ethical Considerations***

The study data collection was carried out in accordance with the approved procedure of the ethical committee guidelines of Princess Nourah University (IRB, PNU). All subjects were provided with a consent form to be signed, stating that all information and results will remain confidential and anonymous. Participants were fully informed about the study and were given the opportunity to refuse participation or withdraw from the study at any point. Also, permission has been obtained from the author of the PUMP scale to use the validated Arabic version of the Problematic use of the mobile phone. The other two scales were publicly available to use by authors. In addition, permission has been acquired from the five colleges to contact participants. All participants were approached at the campus. Students were approached individually. Those who agreed were then introduced to the research purpose verbally, and then they were asked to read and sign the consent form and proceeded with the demographic information. Before administering the scales and measurements, the instructions of each instrument were explained to them. Written feedback was provided in case the subjects shared their email address.

### ***Statistical Analysis***

Descriptive statistics in terms of mean, standard deviation, percentile, and frequencies were conducted to describe the characteristic of the studied sample. Statistical analysis of the Pearson Correlation Coefficient was conducted to measure the relationship of problematic use of mobile phone, stress level, and memory. Regression analysis was conducted to measure the predictive association of excessive mobile use to stress level and memory.

## **Results**

### ***Demographic Analysis***

The total number of health sciences students sample that researchers accessed and collected the data was N=340. Participants' demographic information was grouped into three categories. Personal information category including age, marital status, college, the current level of education. Study-related variables and lifestyle were groups together, including hours spent in university, average hours spent in individual studying, and average hours of sleep. The third category was related to the perception of social support.

**Table 1:** Demographic information for the sample of the study n=340

| <b>Variables</b>                      | <b>N (%)</b> | <b>M</b> | <b>SD</b> |
|---------------------------------------|--------------|----------|-----------|
| <b>Age (in years)</b>                 |              |          |           |
| 18-19                                 | 39 (11.5)    |          |           |
| 20-21                                 | 178 (52.4)   | 2.31     | .766      |
| 22-23                                 | 103 (30.3)   |          |           |
| 24-25                                 | 18 (5.3)     |          |           |
| 26 & above                            | 2 (.6)       |          |           |
| <b>College</b>                        |              |          |           |
| Medicine                              | 66 (19.4)    |          |           |
| Dentistry                             | 58 (17.1)    |          |           |
| Pharmacy                              | 74 (21.8)    |          |           |
| Health and rehabilitation             | 71 (20.9)    |          |           |
| Nursing                               | 71 (20.9)    |          |           |
| <b>Program mode</b>                   |              |          |           |
| Annual                                | 126 (37.1)   | 1.629    | .483      |
| Semester System                       | 214 (62.9)   |          |           |
| <b>Current (BS) educational level</b> |              |          |           |
| 3-4                                   | 89 (26.2)    |          |           |
| 5-6                                   | 77 (22.6)    | 2.48     | 1.143     |
| 7-8                                   | 110 (32.4)   |          |           |
| 9-10                                  | 51 (15.0)    |          |           |
| 11-12                                 | 13 (3.8)     |          |           |
| <b>Marital status</b>                 |              |          |           |
| Single                                | 332 (97.6)   |          |           |
| Married                               | 8 (2.4)      |          |           |
| Other                                 | 0            |          |           |

Table (1) presents that overall, the average age of the sample was between 20-21 ( $M=2.31 \pm SD=0.766$ ). With respect to marital status, most of the participants were single (97.6%), whereas, (2.4%) were married. The majority of the participants were from pharmacy college (21.8%), whereas, college of health and rehabilitation and college of nursing had an equal number of participants (20.9%). The rest of the participants were from the college of medicine (19.4%) and the college of dentistry (17.1%). In terms of program mode, students from the college of medicine and college of dentistry study annually (37.1%), whereas other colleges, including pharmacy, nursing, and health and rehabilitation colleges have semester program mode (62.9%).

### *Variables of Study and Lifestyle*

**Table 2:** Variables related to study and lifestyle

| <b>Variables</b>                 | <b>N(%)</b> | <b>M</b> | <b>SD</b> |
|----------------------------------|-------------|----------|-----------|
| <b>Hours spent in university</b> |             |          |           |
| 4 or less                        | 13 (3.8)    |          |           |
| 5-9                              | 248 (72.9)  | 2.19     | .483      |
| 10 and above                     | 79 (23.2)   |          |           |
| <b>Individual studying hours</b> |             |          |           |
| 0-3                              | 60 (17.6)   |          |           |
| 3-5                              | 137 (40.3)  | 2.244    | .734      |
| 5 and above                      | 143 (42.1)  |          |           |
| <b>Sleeping hours</b>            |             |          |           |
| 3 or less                        | 1 (.3)      |          |           |
| 4-7                              | 183 (53.8)  | 2.54     | .648      |
| 7-8                              | 128 (37.6)  |          |           |
| 9 and above                      | 28 (8.2)    |          |           |

The minimum

hours spent at University for the study were less than 4 hours (4%). The maximum number exceeded 10 hours (23%). The majority's response to 5-9 hours (72.9%). Most participants responded that they spend more than 5 hours for individual study at home (42%). To assess the participant's sleeping hours, there was a question within the demographic information about the sleeping hours. The majority (53%) reported 4-7 hours of sleep that is lower than the healthy pattern of sleep.

### *Perceived Social Support*

**Table 3:** Rating of Perceived Social Support

| Range of perceived Social Support |        |          |         |           |           |            |
|-----------------------------------|--------|----------|---------|-----------|-----------|------------|
|                                   | 0*     | 1        | 2       | 3         | 4         | 5**        |
| N (%)                             | 1 (.3) | 14 (4.1) | 2 (9.4) | 67 (19.7) | 89 (26.2) | 137 (40.3) |
| <i>M</i>                          | 3.88   |          |         |           |           |            |
| <i>SD</i>                         | 1.177  |          |         |           |           |            |

\*No support

\*\* Highest level of support

Table 3 is presenting perceived support from the family. It has been ranged in scale from 0-5 (no support - high level of support), and the participants were asked to rank according to their opinions. Most of the participants (40%) rated the highest perceived family support. Besides, the average score was  $M=3.88$  and  $SD=1.177$ .

**Relationship of PUMP scores with stress and memory**

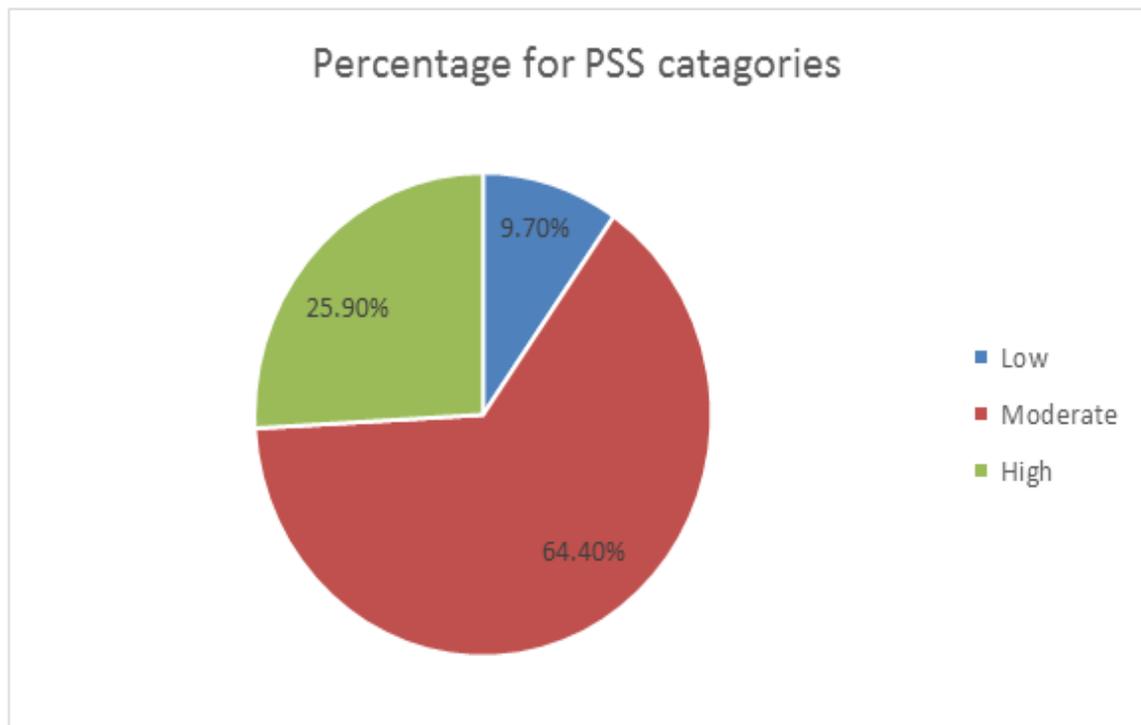
**Table 4:** Correlation matrix and Descriptive variables among female health sciences students.

| Variables | PUMP   | PSS   | DS    |
|-----------|--------|-------|-------|
| PSS       | .250** | -     |       |
| DS        | .000   | .073  | -     |
| <i>M</i>  | 58.12  | 22.46 | 13.74 |
| <i>SD</i> | 12.638 | 6.277 | 2.956 |

\*\* P < 0.01, PUMP: Problematic use of mobile phone; PSS: Perceived stress scale; DS: Digit Span

Table 4 shows that there is a positive relationship between the PUMP scores and the perceived stress level among female health sciences students in PNU ( $r=.250, p>0.01$ ). Thus, this result accepts the first hypothesis statistically, “the students who are excessively using their mobile phones will have a high level of stress”. The participants' scores were compared with the mean score of PUMP ( $M=58.12$ ), and participants who have a higher score than the mean is considered to have an excessive use of mobile phone (50.29%). On the PSS scale, the mean score is 22.46 than is falling in the moderate stress level category. In digit span, the mean score of 13.74 is falling in the average response according to the norms of the test.

**Figure 1.** Pie chart for the categories of Perceived Stress Scale scores levels



Perceived stress scale has three categories, namely, low, moderate, and high. Figure 1 illustrates the percentages for three of the categories. Most of the students are having a moderate level of stress (64%), whereas a high level of stress was reported by 26% of the students.

***Predictive Association of Mobile Phone Usage, Stress, and Memory***

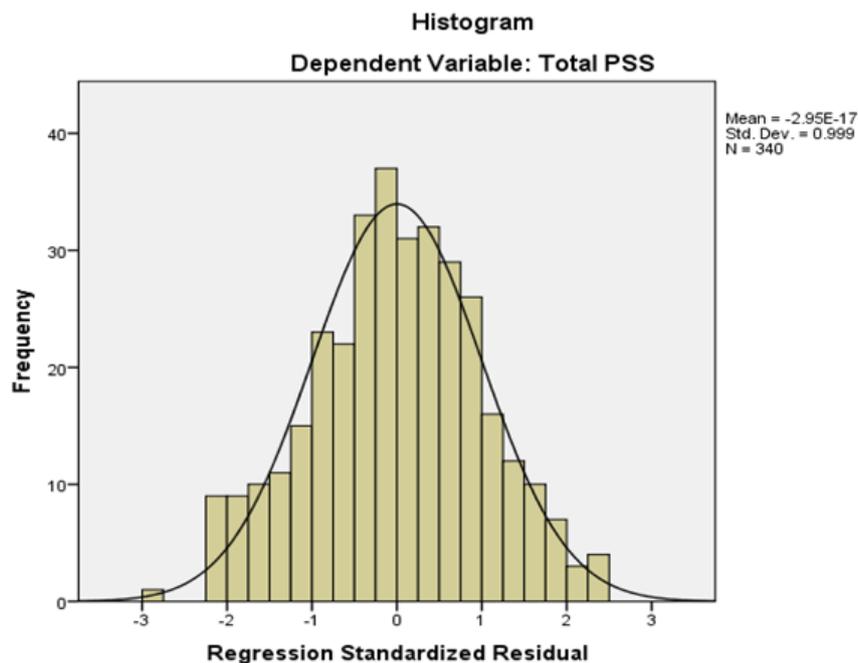
**Table 5:** Statistics of F-value using ANOVA test.

| Model      | Sum of Squares | df  | Mean Square | F      | Sig.              |
|------------|----------------|-----|-------------|--------|-------------------|
| Regression | 835.208        | 1   | 835.208     | 22.545 | .000 <sup>b</sup> |
| Residual   | 12521.368      | 338 | 37.045      |        |                   |
| Total      | 13356.576      | 339 |             |        |                   |

- a. Dependent Variable: Total PSS
- b. Predictors: (Constant), Total PUMP

Normality test approved the normal distribution of scores on PUMP and PSS, that’s why simple regression analysis was carried out. The coefficient of determination ( $r^2=.063$ ) indicates that variation in PUMP can describe 63% of the change in perceived stress. F-value is higher than zero, the model of regression is fit ( $F=22.54$ ). The normal curve is displayed, suggesting that the errors produced by the estimated regression are normally distributed (Figure 2), providing a good estimate of coefficients.

**Figure 2.** The error distribution of the depended variable (Perceived Stress)



**Relational ship of demographic variables to PUMP, Stress and DS**

**Table 6:** Correlation matrix of main variables and additional variables

| Variables         | PUMP    | DS     | Total PSS | Age    | Studying Hours | Perceived Support |
|-------------------|---------|--------|-----------|--------|----------------|-------------------|
| DS                | .000    | -      |           |        |                |                   |
| PSS               | .250**  | .073   | -         |        |                |                   |
| Age               | -.079   | .143** | -.166**   | -      |                |                   |
| Studying Hours    | -.168** | .002   | .057      | .153** | -              |                   |
| Perceived Support | .012    | -.029  | -.138*    | -.041  | -.032          | -                 |
| Educational Level | -.045   | .145** | -.084     | .635** | .089           | .079              |

\*\*P < 0.01, \*P < 0.05

Table 6 demonstrates that there is a negative correlation between age and stress level ( $r = -.166$ ,  $p = .002$ ), which means that the older the participants, the less stressful they are. There is a negative relationship between stress level and perceived support from family and friends ( $r = -.138$ ,  $p = .011$ ). Students who had reported low-stress level they reported high perceived support from family and friends. There is a negative relationship between PUMP and studying hours ( $r = -.168$ ,  $p = .002$ ), stating that students who use their mobile phones excessively spend fewer hours on study. Regarding the digits span, there is a positive correlation with age ( $r = .143$ ,  $p = .008$ ). Students' memory skills increase with age and with their educational level.

## Discussion

The primary goal of this study was to understand if there is a relationship between excessive use of mobile phones, stress, and memory. Mobile phone use is a widely studied topic regarding its impact on individuals' life. Several studies have stated that mobile phone usage is higher in female students compared to male students (Hegazy *et al.*, 2016).

It was hypothesized that “there is a significant relationship between excessive mobile phone usage, stress level and working memory”. The findings of this study revealed that there was a correlation between PUMP and PSS scale scores. Participants scores on PUMP were found to be related to their scores on PSS, and it showed that their level of perceived stress increases as their use of mobile phones increases. The second hypothesis was describing the predictive association of PUMP and PSS scores. It was found that there is an effect of the problematic use of mobile phones on the stress level for the students. This determines the predictive association, as the students use their mobile phones excessively, they will perceive more

stress. A study by Boumosleh (2017) focused on mental health issues associated with the excessive use of mobile phones, found that students who use their mobile phones excessively are prone to have psychological health problems. Stress is considered one of the issues that could be related to excessive mobile phone usage.

The association between excessive mobile phone use and memory was also investigated. The results of this study indicated that digits span scores were not normally distributed. Thus, no further statistical test was conducted to measure the relationship between the problematic use of mobile phones and memory. In contrast, few other studies have shown that mobile phone usage has some risks on students' performance, for example, attention (Aljohani, 2018). Another study reported the link of excessive mobile use on students' academic performance, attention, and memory impairment (Jamal *et al.*, 2012). A total raw score of DS was considered in the current study. It was found in a normal range. However, there is another concept with the calculation of DS called LDSF (Longest digit span forward), and LDSB (Longest digit span backward) (Pisoni, Kronenberger, Roman, & Geers, 2011) can be used for future study.

Perceived stress scale (PSS) was used to identify the student's perception of stress level, and most participants (64.4%) reported a moderate perceived level of stress. This shows the level of how health care students experience stress, which could be because of stress-related studying or other reasons. In addition to that, the predictive association of PUMP and PSS indicates that the excessive use of mobile phone is becoming a reason for stress. This result is inconsistent with previous findings. A previously conducted study showed that 25% of the participants found that their academic achievement has been affected after they started using mobile phones (Alosaimi *et al.*, 2016).

Although on DS, further analysis was not conducted due to asymmetrical data. The previous studies showed that the approximate average score that participants got was 13 (Gignac & Weiss, 2015), and the participants from the current study got a score of 13.74, which means that the participants' memory abilities in digits span are within the average range compared to previous studies. Moreover, it was assumed that some factors contributed to the impact of the study's results and considered as a limitation in this study. The settings for the test administration had some disruptions, such as sounds, that could easily impact the participants performance. The students' educational level was also found to be positively correlated with memory. As the educational level increases and when the students are going into senior levels, their memory is also found to be enhancing, and their scores are getting better for both forward and backward recalling.

There are other demographic variables that have been found correlated to the three variables (mobile phone usage, stress, and memory). The additional variables (e.g., age, studying hours

and perceived support from family) were used to investigate further information in this study. For instance, studying hours was found to be negatively correlated with excessive mobile phone usage. When the student is engaged in excessive use of the mobile phone, there is a decrease in their studying time. On the other hand, almost half of the participants (42.1%) reported that they spend 5 hours and more a day studying; thus, it was found that their scores in PUMP were low.

For perceived stress, age is found to be negatively correlated. As age increases, students perceived stress is decreased, which means that the student might be more capable as growing up in dealing with life stressors (Andone *et al.*, 2016). Finally, the last important finding is that the students who scored high on perceived support from family and friends was found to be negatively correlated with their perceived stress level. It can be seen as the perceived social support decreases the perceived stress level. A study supporting this finding was conducted by Ahmed, Al-Dahmash, Al-Boqami, and Al-Tebainawi in 2015 to investigate the prevalence of anxiety, depression, and stress was found associated with sociodemographic and clinical characteristics. It was found that as social support increases, the level of stress decreases and vice versa.

There are some limitations to the study. Firstly, the Digit span test needs a quiet environment to be administered that was not available and resulted in poor performance for some participants. Secondly, there were several dropouts, including those who did not complete the whole procedure. Thirdly, there were few studies done in the perspective of female University students within the Saudi population and the Middle East in general. It was also difficult to find reference studies as evidence. Finally, the assessments tools that have been used in this study were all self-administered questionnaires, which can increase the risk of the subjectivity of the results. In future qualitative techniques, lab environment, largest sample size, and relationship of PUMP with other cognitive functions such as attention, concentration, analytical skills can provide more informative data.

## **Conclusion**

To conclude, this research investigated the relationship between mobile phone usage, stress, and memory among female health sciences students at Princess Nourah University. Health sciences students were found to have excessive mobile usage, which is linked with a moderate level of stress. This indicates that its necessary to provide guidance, preventive mental health programs, and adequate counseling sessions for the undergraduate students in the university. The results have also revealed that age and maturity could also be helpful to reduce the perceived stress. Moreover, perceived support of family could also be found to sever as protective measure against stress.



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