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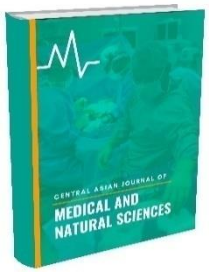

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Smartphone Use and the Occurrence of Spine Musculoskeletal Disorders Among Students at a University Institute in the City of Bafoussam, Cameroon: A Cross-Sectional Study

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Key words: Smartphone, spine, musculoskeletal disorders, University Institute, Bafoussam, Cameroon.

Abstract: **Background:** Excessive use of smartphones can cause musculoskeletal disorders of the spine (MSDs). The objective was to determine the impact of smartphone addiction in the occurrence of MSDs in students of the University Institute and Strategic Estuary (IUEs /INSAM) of the city of Bafoussam.

Method: We conducted a cross-sectional study among students of IUEs /INSAM Bafoussam. Data on the demographics, physical activity was collected. Smartphone Assessment Score-Short Version (SAS-SV) was used to determine smartphone addiction and the Nordic questionnaire to determine the occurrence of MSDs. Data was analyzed using SPSS version 25 software. Associations were ascertained by a logistic regression analysis.

Results: We enrolled 636 participants; the median age was 22 years (Inter-quartile rate (IQR) 16- 37); 69.8% participants were females. About 314 of the respondents practiced physical activity (49.4%) and 567(89.2%) owned smartphones. The prevalence of spinal MSDs in the past 12 months was 67%, with the cervical spine being the most affected (38%). The prevalence of smartphone addiction was 65.1%. Female gender (adjustable odd ratio (aOR): 1.88; confidence interval (CI): 1.29-2.63; p=0.001), smartphone ownership (aOR: 1.75; CI: 1.036-2.98; p=0.037), and smartphone addiction (aOR: 2.32; CI: 1.62-3.33; p=0.00) were significantly associated with occurrence of spinal MSDs. Physical activity (aOR: 0.56; CI: 0.39-0.80; p=0.002) was associated with a lower occurrence of MSDs in smartphone users.

Conclusion: Smartphone addiction is quite high among University students in Bafoussam and is a risk factor for MSDs and regular physical activity is associated to a lower occurrence of these MSDs. There is need to take measures for smartphone addiction prevention and safe withdrawal among University students in Bafoussam.

Introduction

The use of technology has increased rapidly especially among young people in recent years, and it has reshaped the lifestyle of children and adolescents. In line with the developing economy, the use of smartphones has grown tremendously and have become an integral part of everyday life [1]. Moreover, today's college students are in an era of multiplication of smartphones companies, which have become a necessity in their lives [2]. Due to the convenience of smartphones, the abuse of smartphones has increased significantly. Furthermore, the confinement adopted by many countries during the COVID-19 pandemic increased the abuse of smartphones [3]. Several studies have reported that smartphone overuse can cause physical health problems in individuals, such as musculoskeletal pain, blurred vision, headache [3]. Moreover, excessive use of smartphones is associated with numerous adverse outcomes, including poor academic performance, academic procrastination [4], depression, anxiety, and poor sleep quality [5].

Smartphone addiction is a disorder involving compulsive overuse of the mobile devices, usually quantified as the number of times users access their devices and/or the total amount of time they are online over a specified period [6]. Globally, the major challenge with addressing the growing level of smartphone addiction is its high social acceptance despite the fact that there is clear evidence of smartphone addiction manifestations and withdrawal symptoms [6,7,8,9]. Furthermore, the use of smartphone has been reported to be high among students due to their increasing popularity and convenience [9,10-14].

With the globalization of technology, Africa is now more open to the new technological world. Therefore, the younger population often constituted by students may be glued to their smartphones, which could lead to musculoskeletal disorders (MSDs). Furthermore, the current state of literature in the subject matter is insufficient to inform on the consequences of smartphone addiction. Thus, the objective of this study was to investigate the use of smartphones and the occurrence of spine MSDs among students at the University Institute and Strategic Estuary, Cameroon (IUEs/INSAM). More specifically, we determined the prevalence of smartphone addiction, the prevalence of spine MSDs and finally the association between smartphone addiction and the occurrence of MSDs.

Methods

Study design and setting

We conducted a cross-sectional study from January 17 to February 10, 2022 at the IUES/INSAM in the city of Bafoussam. The IUEs/INSAM is a private university institute in Cameroon. This institute has campuses in several cities of the country (Douala, Yaounde and Bafoussam) and also in other Central African countries. The study was conducted at the Bafoussam site which comprise 4 campuses. Enjoying a great national, international and local reputation, IUEs/INSAM is the most attended private University Institute in the West region of Cameroon. We used in this study an exhaustive sampling technique. All the participants who agreed to participate in our study and responding to the inclusion criteria's where included.

Study population

We enrolled students at the IUEs/INSAM in the city of Bafoussam who gave their informed consent to participate in our study. We excluded students with already identified spine disorders (cervical, dorsal

or lumbar); students who did not correctly answer the questionnaire, especially those who did not answer clearly to questions regarding to the use of smartphone and those regarding the occurrence of spine MSDs. In the proportion of students who owned smartphones, those who had not used the latter for at least one year were excluded. To calculate the sample size, we used the Lorenz formula $n= [Z^2 \times P \times (1-P)] \div d^2$, we considered the prevalence of smartphone addiction of 20.98 % which was obtain among students of University of Dschang in west region of Cameroon in 2020 [15]. Then, the estimated sample size from the Lorenz formula is (n=280). We finally worked with 636 students.

Data collection

A pre-tested questionnaire was used to collect data on demographics (age, sex, field of study, level of study), physical activity practice. Regarding the use of the smartphone and the identification of the level of addiction to the smartphone, we used the Smartphone Addiction Scale-Short Version (SAS-SV) [16], it consisted of 10 questions, each question had 6 items ranging from 1(strongly disagree) to 6 (strongly agree) with a minimum score of 10 and a maximum score of 60. It is a standard questionnaire and used in descriptive studies to assess smartphone addiction. The SAS-SV questionnaire was translated into French for those who could not understand English, this to mitigate influence of language barrier in the study. The assessment of spinal MSDs complaints was done using the Nordic MSDs screening questionnaire which was adapted to our study [17]. Authorizations for the study was issued first from the Regional delegation of Public Health, West Region of Cameroon and then from the administration of IUEs/INSAM. The study's purpose was meticulously explained to the students and consent obtained to participate in the study. Then they were given a self-administered questionnaire to field.

Statistical analysis

The data collected were entered into an Excel spreadsheet and then analyzed using SPSS software version 25. To determine the prevalence of smartphone addiction in our survey, the SAS-SV cut-off scores of ≥31 for males and ≥33 for females were used as proposed by the scale developers [18]. We calculated descriptive statistics as percentages for categorical variables or as means (±standard deviation [SD]) or medians (25^{th} and 75^{th} percentiles) for continuous variables based on distribution. To highlight the association between the variables, we conducted first of all a univariable odd ratio analysis to determine factors associated with spine MSDs. bivariate analysis (odd ratio) was then performed for the factors that were significantly associated with MSDs with the univariate analysis. Therefore, the associated factors were those found to be significant with the bivariate analysis. The statistical significance level was set at P-value <0.05 and at 95 % CI.

Ethical consideration

Students were routinely asked for informed consent to participate in the study. Their records were anonymized and kept confidential. Clearance for the study was obtained from the West Regional Delegation of Public Health (Reference number: 78/L/MINSANTE/SG/DRSPO/CB/CA) and was conducted with the consent and approval of the IUEs/INSAM, Bafoussam management.

Results

Flow of participants

Seven hundred and forty-one students were included in the study and were shared the questionnaires, 651 returned the questionnaire (90 students did not return the questionnaires). Of the 651 who filled the questionnaires, 15 were excluded because of missing information. Therefore, 636 students were finally considered for the study, among which 567 owned smartphones (Figure 1).

Socio-demographic characteristics of participants

We enrolled 636 students from IUEs/INSAM in the study. The median age was 22 years (IQR:16-37). Table 1 shows that 69.8% of the study population were females. Students of level 1 were more represented 256/636 (40.2%) and level 4 was least represented 63/636 (9.9%). About 314 of the respondents practiced physical activity (49.4%) against 322 (50.6%) who did not. Of the 636 participants, 567 (89.2%), owned smartphones, against 69 (10.8%) who did not possess a smartphone (Table 1).

Prevalence of spine musculoskeletal disorders (MSDs)

The prevalence of spine MSDs in the last 12 months was 67%, with the cervical spine as the most affected region (38%). A prevalence of MSDs of 51.9% had been encountered in the spine during the last 7 days, with cervical spine as the most affected region during this period (54.5%) as shown in Table 1.

Prevalence of smartphone addiction

Of the 636 participants, 414 (65.1%) were smartphone addicted. Among those addicted, students aged less than 22 years were more represented 249 (60,1%) and Level 1 students were more concerned with smartphone addiction (41.5%, 172/414) as shown in Table 2.

Factors associated with the occurrence of spine musculoskeletal disorders (MSDs)

The unadjustable odd ratio calculation showed significant association with female gender, smartphone ownership and smartphone addiction. Also, the practice of physical activity was associated with lower occurrence of MSDs. Bivariate analysis was then performed, the result showed that female gender (aOR: 1.88; 95% CI: 1.29-2.63; p=0.001), smartphone ownership (aOR: 1.75; 95% CI: 1.036-2.98; p=0.037), and smartphone addiction (aOR: 2.32; 95% CI: 1.62-3.33; p‹0.00) were statistically associated with occurrence in spine MSDs during the previous 12 months. On the other hand, the practice of physical activity (aOR: 0.56; 95% CI: 0.39-0.80; p=0.002) was associated with lower occurrence of spinal MSDs among smartphone users (Table 3)

Discussion

The aim of this study was to determine the association between MSDs and smartphone addiction. It should be noted that this study was conducted after the expansion of COVID-19, a period in which barrier measures to counteract the spread of the pathology were put into effect. As a result, the reduction of physical contact pushed young people towards a greater use of smartphones. This being the case, we observed a high prevalence of spinal MSDs in this student population. The occurrence of MSDs in the last 12 months was associated with smartphone addiction, female gender, and smartphone ownership. On the other hand, physical activity was associated with a lower occurrence of MSDs.

The 12-month prevalence of MSDs at IUEs/INSAM was 67%, the most affected region was the cervical spine (38%) and the occurrence of MSDs was significantly associated with female gender, smartphone ownership and smartphone addiction. A study conducted among nursing students at the University of Johannesburg [19] obtained a prevalence of MSDs of 83% with the most affected area being the lower back (81.1%) followed by the neck (65.9%). The occurrence of MSDs was associated with female gender and smartphone use. The difference in the most affected area, which in their study was the lower back, could be explained by differences in the socio-demographic characteristics and uniformity of the population, as their study was exclusively on nursing students. In agreement with our results, a study conducted among students in a high school in Thailand [20] shows the possession of a

smartphone as a risk factor for the occurrence of MSDs. Other studies in accordance to our study have revealed body pain were related to smartphone addiction [21]. Studies from the USA [22] and Korea [23] also reported that excessive smartphone use had adverse effects on students' physical health.

We observed from this study that smartphone users who practiced regular physical activity had lower occurrence of MSDs compared to those who did not practice physical activity. The practice of physical activity would reduce the occurrence of spinal MSDs in smartphone users in this population. The explanation is quite clear because according to several authors, physical activity has an important impact in ameliorating, maintaining and promoting health [24, 25, 26]. Moreover, this result implies the necessity to encourage students, and University authorities to take physical activity seriously and consider it a part of the school program. This would on one hand reduce the addiction to smartphones and on the other hand, reduce the occurrence of MSDs.

The prevalence of smartphone addiction was 65.1%, with the most addicted students being females (66.9%), students under 22 years of age (60.1%) and level 1 students (41.5%). A study conducted in Switzerland among students in 2015 [27] determined a prevalence of smartphone addiction of 16.9%, another study conducted in 2018 in Korea obtained a prevalence of addiction of 30.9% [28]. This high difference in prevalence rates could be explained by the context in which the different studies were conducted. These studies were conducted between 2015 and 2018 unlike our study which was conducted after the expansion of the COVID-19 pandemic that in view of the restrictive measures imposed (online courses, restriction of outings, closures of public spaces). The latter would have pushed young people to be more glued to their smartphones which could explain this quite high addiction rate to smartphones in our population. Moreover, usual activities have already resumed in Cameroon and most parts of the world after the COVID-19 lockdown. Therefore, measures to safely withdraw students from excessive use of smartphones should be taken to reduce the risk of musculoskeletal diseases in the young population, who are the backbone of any nation. More recent studies in Asia and Europe show a prevalence of smartphone addiction of less than 40% among students [29-32]. Generally, the relatively lower smartphone addiction rate in Europe and Asia could be explained by the fact that they are more technological advanced than us and may have already implemented measures to limit smartphone addiction unlike Cameroon and other countries of the sub-region where the increasing availability and accessibility of smartphones is a new phenomenon for many. Thus, smartphones which was a few years back considered as a tool for high class people is now popularized to the point where almost all respondents owned a smartphone (89.2%) (table 2). In Cameroon, it is usually in high school and after graduation of high school that most students are able to get a smartphone, which is often given to them by their parents or relatives This explain our findings of high prevalence of addiction among level 1 students and those younger than 22 years.

A major limitation of the study is non-specification of the types of physical activities and their frequencies. as well as the fact that we did not assess the physical activity intensity among participants. A second limitation is that we did not look into the other MSDs risk factors like study space ergonomics, body ergonomics during studying, sitting, or using the computer and others, capable of causing spine MSDs among students as well. We look forward to considering these aspects in our subsequent study. Nevertheless, the results obtained from this study are pertinent and call for a particular focus on the problem of smartphone addiction in Bafoussam, Cameroon. Also, the result can inform policy on the use of smartphones especially in school periods.

Conclusion

The addiction to the smartphone is high among students at IUEs/INSAM. Students under 22 years of age (60.1%), in the first year of University (41.5%) and females (66.9%) were most likely to be

addicted to smartphones. Smartphone ownership, being female, and smartphone addiction were significantly associated with the occurrence of MSDs. The practice of physical activity was significantly associated to a lower occurrence of MSDs among smartphones users. Observations from this study will inform preventive actions and smartphone withdrawal strategies among students of IUEs/INSAM-Bafoussam.

What is already know on this topic

Smartphone addiction is a quite high problem in developed countries. It has many sides effects on the health of young student worldwide.

What this study adds

It is the first study in Cameroon to evaluate musculoskeletal side effects of smartphone addiction among students. Furthermore, the study revealed the adverse effect of the COVID-19 confinement on the use of smartphones among students. This study outlines the necessity for strategies to be put in place to safely withdraw students from excessive smartphone use.

Competing interests

The authors declare no competing interests

Authors' contributions

Conception and study design: GHASSI Hyacinte Trésor and Franklin CHU BUH. Data collection: GHASSI Hyacinte Trésor. Data analysis and interpretation: TALLA KENMOGNE Ange Faustine. Manuscript drafting: GHASSI Hyacinte Trésor, ATEMKENG TSADEDEM Faustin, Franlin CHU BUH, TABUNGUIA Ange Ulrich Leroy. Manuscript revision: GHASSI Hyacinte Trésor, ATEMKENG TSADEDEM Faustin, Franklin CHU BUH, DJAM Alain and MOULION TAPOUH Jean Roger. All authors approved final version of the manuscript.

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Tables and figures

Table 1: Summary of the generals' characteristics of the population and spine musculoskeletal disorders prevalence, January to February 2022.

Table 2: characteristics of smartphone addiction among participants, January to February 2022.

Table 3: Factors associated to the occurrence of musculoskeletal disorders, January to February 2022.

Figure 1: Flow diagram of participants, January to February 2022.

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Table 1: Summary of the generals' characteristics of the population and spine musculoskeletal disorders prevalence

	Number (n=636)	Percentage (%)
Gender		
Female	444	69.8
Male	192	30.2
Level of study		

1	256	40.2
2	223	35.1
3	94	14.8
4	63	9.9
Physical activity		
Yes	314	49.4
No	322	50.6
Smartphone ownership		
Yes	567	89.2
No	69	10.8
MSDs prevalence in the past 12 months		
Yes	426	67
No	210	33
Region affected		
Cervical neck region	242	38
Dorsal region	31	5
Lumbar region	19	3
More than one region affected	344	54
MSDs prevalence in the last 7 days		
Yes	330	51.9
No	306	48.1
The region most affected in the last 7 days		
Cervical neck region	347	54.5
Dorsal region	41	6.4
Lumbar region	17	2.7
More than one region affected	231	36.4

MSDs: Musculoskeletal Disorders

Table 2: characteristics of smartphone addiction among study participants

Variable	**Addiction**	
	Effective (N=414)	**Percentage (%)**
Sex		
Female	277	66.9
Male	137	33.1
Age		
[16-22 years]	249	60.1
[above 23 years	165	39.9
Level of study		
1	172	41.5
2	148	35.7
3	56	13.5
4	38	9.2

Table 3: Factors associated to spine musculoskeletal disorders

Variables	Total N=636(%)	Spine MSDs (+) n=426 (66 .98 %)	Spine MSDs (-) n=210 (33.02%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Sex							
Female	444(69.81)	319(74.88)	125(59.52)	2.02(1.42-2.88)	‹0.00	1.88(1.29-2.63)	0.001
Male	192(30.19)	107(25.12)	85 (40.48)	1		1	
Age							
[16-22 years]	393(61.79)	259(60.80)	134(6.81)	0.87(0.621.23)	0.46		
[23 years-[	243(38.21)	167(39.20)	76 (36.19)	1			
Physical activity							
Yes	312(49.06)	183(42.96)	129(61.43)	0.47(0.33-0.66)	‹0.00	0.56(0.39-0.80)	0.002
No	324(50.94)	243(57.04)	81 (38.57)	1		1	
Smartphone ownership							
Yes	567(89.15)	392(92.02)	175 (83.33)	2.30(1.39-3.81)	‹0.00	1.75(1.036-2.98)	0.037
No	69 (10.86)	34 (7.98)	35 (16.67)	1		1	
smartphone addiction							
Yes	414(65.09)	304(71.36)	110 (52.38)	2.26(1.60-3.19)	‹0.00	2.32(1.62-3.33)	‹0.00
No	222(34.91)	122 (28.64)	100 (47.62)	1		1	

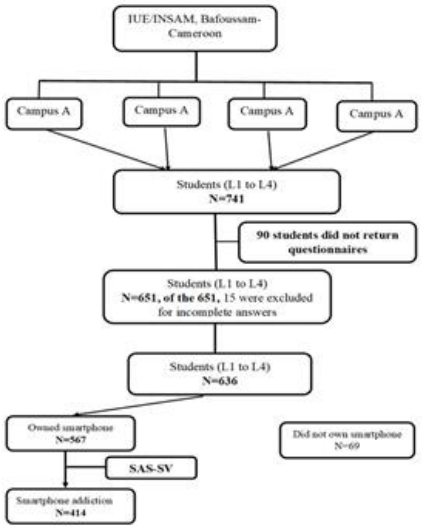

Figure 1

Figure 1: Flow Diagram

The STROBE statement — **checklist of items that should be addressed in reports of cohort studies**

The STROBE statement — **checklist of items that should be addressed in reports of cohort studies**			
	Item No	**Recommendation**	**Reported on manuscript page**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3

Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	NA
Data sources/ measurement	11*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	NA (we worked with patients who were received at the center responding to our criteria's)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	13	(*a*) Describe all statistical methods, including those used to control for confounding	NA
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were	6

		addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	NA
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	16 (Table I)
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) Summarise follow-up time (eg, average and total amount)	NA
Outcome data	15*	Report numbers of outcome events or summary measures over time	NA
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 97·5% CI's confidence interval). Make clear which confounders were adjusted for and why they were included	NA
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	18 (Table III)
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from	14

		similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12