Is cell phone use associated with neck pain and disability in skills of daily activities in young adults?

Há relação entre uso do celular com dor cervical e incapacidade nas habilidades das atividades diárias em adultos jovens?

Felipe Maatalani Benini[1], Julia Franco Guidi[1], Maria Thereza Campagnolo[1], Maria Célia Cunha Ciaccia[1], Flavia Renata Dantas Alves Silva Ciaccia[1], Vera Esteves Vagnozzi Rullo[1]

ABSTRACT

BACKGROUND AND OBJECTIVES: Some authors correlate incorrect head and neck postures during cell phone use with cervical pain. The objective, therefore, is to correlate the constant use of cell phones with discomfort in the cervical region and the repercussion on daily activities in college students.

METHODS: Cross-sectional study carried out between July 2019 and March 2020 using the questionnaires "Smartphone Addiction Inventory Instrument", "Neck Disability Index" and "Young Spine Questionnaire", and also a questionnaire about demographic and socioeconomic data. The nutritional status of the participants was also evaluated and the degree of anteriorization of the head was measured in relation to the spinous process of the seventh cervical.

RESULTS: The average age of the participants was 18.47±0.65 years. There was a significant statistical association between Smartphone dependence and cervical pain, and adolescents with Smartphone use dependency had the highest percentages of doctor visits for cervical pain. There was no association between smartphone dependence and absence from school or not playing sports due to pain in the spine; nutritional status; the angle of the neck and the father or mother having pain in the spine. Students with smartphone use dependency had the highest percentages of mild to moderate disability in the skills of daily activities.

CONCLUSION: Dependence on cell phone use, in this study, is related to cervical pain and disability in the skills of daily activities.

Keywords: Adolescent, Cell phone, Neck pain, Screen time.

Felipe Maatalani Benini – https://orcid.org/0000-0003-4684-7605;
Julia Franco Guidi – https://orcid.org/0000-0001-5228-6571;
Maria Thereza Campagnolo – https://orcid.org/0000-0003-4333-5284;
Maria Célia Cunha Ciaccia – https://orcid.org/0000-0003-3761-5060;
Flavia Renata Dantas Alves Silva Ciaccia – https://orcid.org/0000-0002-4866-5621;
Vera Esteves Vagnozzi Rullo – https://orcid.org/0000-0002-4754-6612.

1. Santos School of Medical Sciences, Lusiada University Center, Department of Pediatrics, Santos, SP, Brazil.

Correspondence to:
Felipe Maatalani Benini
E-mail: felipem.benini@gmail.com

RESUMO

JUSTIFICATIVA E OBJETIVOS: Alguns autores correlacionam com dor cervical posturas de cabeça e pescoço durante o uso do celular consideradas incorretas. Objetivou-se, portanto, verificar a associação do uso constante de celular com desconforto na região cervical e repercussão nas atividades diárias em estudantes universitários.

MÉTODOS: Estudo transversal realizado entre julho de 2019 e março de 2020 através da aplicação dos questionários *Smartphone Addiction Inventory Instrument, Neck Disability Index e Young Spine Questionnaire*, além de um questionário contendo dados demográficos e socioeconômicos. Foi avaliado, ainda, o estado nutricional dos participantes e mensurado o grau de anteriorização da cabeça em relação ao processo espinhoso da sétima vértebra cervical.

RESULTADOS: A média etária dos participantes foi 18,47±0,65 anos. Houve associação estatística significativa entre o uso de celular com dor cervical. Os adolescentes com tempo prolongado de uso do celular foram os que apresentaram maior frequência de consulta médica por dor na região cervical. Não houve associação entre uso de celular e ausência na escola ou não praticar esporte devido a dor na coluna, o estado nutricional, o ângulo do pescoço e o fato de pai ou mãe ter dor na coluna. Os adolescentes com dependência de celular foram os que tiveram maior frequência de incapacidade leve a moderada nas habilidades das atividades diárias.

CONCLUSÃO: A dependência do celular apresentou, neste estudo, uma relação com dores na coluna cervical e incapacidade nas habilidades das atividades diárias.

Descritores: Adolescente, Dor cervical, Telefone celular, Tempo de tela.

INTRODUCTION

Nowadays, it is very common to see a person, whatever their age, using a cell phone[1]. During use, one can observe that the device is usually used at waist height, causing the person to bend his/her head downwards, so that there is a constant misalignment of the head support axis and an overload on the cervical spine[2]. This condition led to the creation of the terms "Text Neck" and "Turtle Neck Posture", referring to the effect that the prolonged and repetitive neck flexion position causes to the cervical spine

Is cell phone use associated with neck pain and disability
in skills of daily activities in young adults?

BrJP. São Paulo, 2022 apr-jun;5(2):100-4

while the person uses electronic devices such as cell phones, computers, and tablets[2].

Moreover, using cell phones requires the user to look downward while extending the arms forward in order to read the screen. This causes the head to involuntarily move forward to maintain balance, causing excessive anterior curvature of the lower cervical vertebrae, as well as excessive posterior curvature of the upper thoracic vertebrae, putting pressure on the cervical spine and the muscles of the cervical region[3]. Some authors correlate this incorrect head and neck posture with chronic musculoskeletal pain[4,5]. Other studies also show that the prevalence of neck pain in late adolescence is almost the same as that found in adults, and as high as the prevalence of low back pain[6-8].

In recent years, the general population, especially the young, has been using cell phones in an addictive manner, potentially harmful to health and frequently associated with an increase in the prevalence of pain in the cervical region[7,9]. However, the current literature has heterogeneous information on the subject[1,10], so that the conclusion that incorrect posture results in neck pain remains uncertain and highlights the need for new studies to better understand the topic.

Due to the increasing number of smartphone users, especially among young people who are in the growth leap phase, associated with the scarce current literature on the subject, a study to evaluate the repercussions caused using cell phones on posture and pain in the cervical region is necessary. Thus, the present study's objective was to verify the association of constant cell phone use with discomfort in the cervical region and with repercussions in daily activities among young university students.

METHODS

The project was approved by the Ethics Committee on Human Research of the Lusíada University Center (CAAE: 14122919.6.0000.5436). After the approval, first-year undergraduate students were invited to participate in the study. The Free and Informed Consent Term (FICT) was presented, and, after approval, the application of the questionnaires and anthropometric measurements began.

The STROBE Guideline (Strengthening the Reporting of Observational studies in Epidemiology) was used to guide the conduct of the study and the manuscript preparation[11].

This is a cross-sectional observational study conducted from July 2019 to March 2020. University students from the Lusíada University Center in the city of Santos, SP, were invited to participate.

University students between 18 and 20 incomplete years, duly enrolled in the first year of the Medical, Physical Therapy, and Nursing courses were included in the research. These courses were initially selected from among the nine higher education courses offered by the mentioned educational institution for being the three courses with the largest number of students in the age group of interest established in the inclusion criteria. The afore mentioned courses contained a total of 162 students in the studied age range. Of this total, 26 students

refused to participate in the research, resulting in a sample of 136 pre-selected student participants.

All students interested in participating and who met the inclusion criteria were conducted to a room offered by the university exclusively for data collection. The exclusion criteria were applied: university students with previously diagnosed back problems (e.g., scoliosis and lordosis). None of the 136 pre-selected students presented exclusion criteria, thus the final research sample totaled 136 participants.

After signing the FICT, data collection began. The variables measured in this study were: dependence of college students on the use of smartphones, disability and pain in the cervical region, head anteriorization angle, and body mass index. The following instruments were applied for data collection: Smartphone Addiction Inventory (SPAI), Neck Disability Index (NDI), and Young Spine Questionnaire (YSQ). In addition, anthropometric measurements were obtained (weight, height and body mass index - BMI) and measurement of head anteriorization of the participating students.

The SPAI, developed to assess the dependence of Taiwanese college students on the use of smartphones, is composed of 26 items that validate five factors: time spent, compulsiveness, interference with daily activities, craving, and interference with sleep. The Brazilian version of SPAI (SPAI-BR) has been validated and is reliable for detecting smartphone dependence in Brazilian college students between 18 and 35 years old[12]. Based on the values of sensitivity (79.05%), specificity (75.66%), positive predictive value (64.29%), negative predictive value (86.70%) and accuracy (76.87%), the presence of nine positive responses or more was established as the cut off point for determining dependence[13].

Next, the NDI was applied. This instrument was created to provide information on how the pain in the cervical region has affected the ability to perform daily activities[14]. It is divided into 10 items, four related to subjective symptoms (pain intensity, headache, concentration, and sleep), four related to daily activities (lifting things, working, driving a car, and having fun), and two related to personal care and reading. Each of the items is scored from zero to five points[14]. Disability was classified as: absent (total score between zero and 4 points); mild (total score between 5 and 14 points); moderate (total score between 15 and 24 points); severe (total score between 25 and 34 points); and complete (total score above 34 points)[15].

Evaluation of pain in the cervical region was performed with a body map and complemented with the following questions based on the YSQ[15]: "Have you had neck pain in the past week?" (Response options were "yes" or "no"); "How often have you had neck pain?" (Response options were "very often", "frequently", "once in a while", "rarely", or "never"). For bivariate analysis, the variables were dichotomized into: very often, frequently, once in a while versus rarely or never.

The YSQ contains questions assessing back pain and its consequences. The items were tested for content comprehension and concordance between the questionnaire scores and interview findings from the target respondents. These preliminary

results suggest that the YSQ is feasible, has content validity, and is a well-comprehended questionnaire for use in studies of children aged 9 to 11 years[16].

Anthropometric measurements of weight and height were collected to calculate the BMI for age, following the steps determined by the World Health Organization[17]. To measure the anteriorization of the head in relation to the spinous process of the seventh cervical vertebra (C7) ACC7 D/E, an angle formed by crossing two lines (line 1: line drawn between the right external acoustic meatus and the spinous process of C7; line 2: horizontal line perpendicular to the plumb line and passing through the spinous process of C7) was considered. This measurement indicates the degree of head anteriorization in relation to C7[18,19]. This measurement was performed by two evaluators who asked the research participant to type a message on their cell phone. In case of disagreement on angle values between raters, a third rater would redo the measurement analysis.

Statistical analysis

The following tests were used for the analyses: Mantel-Haenszel's X^2 test; Fisher's exact test; and Chi-square trend test.

The analysis of the existence of a linear relationship among the variables was performed by the Mantel-Haenszel X^2 Square Test, while the bivariate analyses were evaluated by the Fisher's exact test (cases in which the sample size was small) and the Chi-Square trend test (cases in which the variables studied were ordinal categorical). 136 students, who presented complete data, contributed to the analysis. The significance level adopted for the results was 5%. The Epi Info program - version 6 (November 1996) was used for data analysis.

RESULTS

The mean age of the participants was 18.47 years with a standard deviation of 0.65. Table 1 shows that there was no statistically significant association between smartphone use dependence and color, gender, or paid work.

Table 1. Relationship between dependence on cell phone use with demographics and paid work

| Variables | Dependence on cell phone use | | | |
	Yes n (%)	No n (%)	p-value	n (%)
Gender[1]			0.206	
Female	54 (54.0)	46 (46.0)		100 (100.0)
Male	15 (41.7)	21 (58.3)		36 (100.0)
Ethnicity[1]			0.918	
White	51 (51.0)	49 (49.0)		100 (100.0)
Black/Brown	18 (50.0)	18 (50.0)		36 (100.0)
Paid work[2]			0.174	
No	62 (49.2)	64 (50.8)		126 (100.0)
Yes	7 (70.0)	3 (30.0)		10 (100.0)
Total	69 (50.7)	67 (49.3)		136 (100.0)

1 = Mantel-Haenszel X^2 Test; 2 = Fisher's exact test.

Table 2 shows statistically significant association between smartphone use dependence and cervical spine pain. Students with the dependence were those with the highest frequency of medical consultation for cervical spine pain. There was no association between dependence on smartphone use and absence from school or lack of sports practice due to back pain, nor was there an association between this dependence with anthropometric data and cervical region angle. Smartphone dependence was also not associated with the presence of back pain among fathers and mothers. Finally, students with this dependence were those with the highest frequency of mild to moderate disability in daily activity skills.

Table 2. Relationship between dependence on cell phone use, back pain, and disability in daily living skills

| Variables | Cell phone use dependence | | | |
	Yes n (%)	No n (%)	p-value	n (%)
Neck pain[1]			**0.001***	
Once in a while/ frequently	56 (60.2)	37 (39.8)		93 (100.0)
Never/once or twice	13 (30.2)	30 (69.8)		43 (100.0)
Mid-back pain[1]			**0.025***	
Once in a while/ frequently	47 (58.8)	33 (41.2)		80 (100.0)
Never/once or twice	22 (39.3)	34 (60.7)		56 (100.0)
Low back pain[1]			0.401	
Once in a while/ frequently	46 (53.5)	40 (46.5)		86 (100.0)
Never/once or twice	23 (46.0)	27 (54.0)		50 (100.0)
Absence from school due to pain[1]			0.128	
Once in a while/ frequently	15 (65.2)	8 (34.8)		23 (100.0)
Never/once or twice	54 (47.8)	59 (52.2)		113 (100.0)
Does not practice sport due to pain[1]			0.401	
Once in a while/ frequently	7 (41.2)	10 (58.8)		17 (100.0)
Never/once or twice	62 (52.1)	57 (47.9)		119 (100.0)
Visit the doctor/ physical therapist[2]			**0.048***	
Once in a while/ frequently	4 (26.7)	11 (73.3)		15 (100.0)
Never/once or twice	65 (53.7)	56 (46.3)		121 (100.00)
Father with pain[1]			0.474	
No	13 (44.8)	16 (55.2)		29 (100.0)
Yes	56 (52.3)	51 (47.7)		107 (100.0)

Table 2. Relationship between dependence on cell phone use, back pain, and disability in daily living skills – continuation

Variables	Cell phone use dependence			
	Yes n (%)	No n (%)	p-value	n (%)
Mother with pain[1]			0.446	
No	10 (43.5)	13 (56.5)		23 (100.0)
Yes	59 (52.2)	54 (47.8)		113 (100.0)
Nutritional evaluation[1]			0.762	
Thin/eutrophic	57 (51.4)	54 (48.6)		111 (100.0)
Overweight/obese	12 (48.0)	13 (52.0)		25 (100.0)
Neck angle[3]			0.877	
≥35 e < 55	15 (53.6)	13 (46.4)		28 (100.0)
≥55 e < 65	28 (49.1)	29 (50.9)		57 (100.0)
≥65	26 (51.0)	25 (49.0)		51 (100.0)
Daily living skills[1]			**0.016***	
Absent disability	26 (40.0)	39 (60.0)		65 (100.0)
Mild/moderate disability	43 (60.6)	28 (39.4)		71 (100.0)
Total	69 (50.7)	67 (49.3)		136 (100.0)

In bold: values with statistical significance. 1 = Mantel-Haenszel X2 test; 2 = Fisher's Exact test; 3 = Chi-Square Test for Trend

DISCUSSION

Cell phone use dependence has been associated with spinal pain, especially in the cervical region, due to prolonged or repetitive flexion while using the device. Pain in the cervical, dorsal and lumbar regions of the spine has been indicated as a cause of inability to perform daily activities of individuals in recent years[20]. There is evidence that young people who report persistent pain have a higher risk of developing chronic pain in adulthood, highlighting the importance of detecting it early[21].

In the present study, there was an association between cell phone dependence and pain in the cervical and mid-back region. This relationship was in agreement with the study[22], which states that the use of electronic devices, such as cell phones, is a risk factor for neck pain. According to the study[23], the anteriorized head posture results in increased compressive loads over the cervical spine and tissue deformities. Authors[24] have also evidenced anteriorization of the head posture and reduction of the craniovertebral angle in people with pain in the cervical region when compared to asymptomatic ones.

Anteriorization of the head position is pointed out as one of the major causes of pain in the cervical region[25]. Study[26] highlighted the probable relationship of smartphone use for prolonged periods with the risk of orthopedic problems due to projecting the neck forward and downward. This may result in a biomechanical imbalance and an overload in different areas of the body, leading to the appearance of pain in regions such as the head, neck, and back muscles.

Other studies are not in agreement regarding the smartphone dependence and pain in the cervical region association.

Studies have shown no association between "Text Neck" and neck pain in young adults between the ages of 18 and 21 years[1,27]. In a recent study with adults[10], "Text Neck" showed no association with neck pain. However, the mean age of the participants (27.4 years with a standard deviation of 8.8) is higher than the mean age of the present study (18.47 years with a standard deviation of 0.65), which may justify the discordance of the results.

By encompassing the ages closest to the "puberty leap" for both males and females, a period when the student begins the constant use of cell phones, the spine may be becoming more susceptible to external influences, but neither of the two studies refer to the age at which the research participant began the constant use of the device.

In opposition to other studies[26,28], in the present study, the association between neck pain and cell phone use dependence did not have higher percentages in females than in males. A statistical association between cell phone use dependence and mild to moderate disability in daily activity skills was found. Study[29] showed that neck pain can be observed in students addicted to smartphones, which may subsequently lead to long-term disability.

The present study showed a limitation related to the small number of participants, which may have made it difficult to analyze the correlations found. Moreover, most of the university students participating in the study are enrolled in health courses (medicine, nursing, and physical therapy). This fact raises the question about the previous presence of knowledge on the subject, which may also be interfering in the correlations.

New studies aimed at comparing different university courses could allow for a better analysis of the impact of the use of electronics on these young people, thus validating the hypothesis that students in health courses would have more control over their actions and habits. Furthermore, the scarcity of studies in the literature limits an adequate quantitative comparison. However, based on the results obtained, the assumption of an impact of electronics uses in the lives of college students, which can lead to complications in daily life and consequences in adult life, such as the development of chronic back pain, becomes more and more visible.

CONCLUSION

Cell phone dependence was associated with neck pain and disability for performing daily activities.

AUTHORS' CONTRIBUTIONS

Felipe Maatalani Benini
Statistical analysis, Funding acquisition, Data Collection, Conceptualization, Resource Management, Research, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Validation, Visualization
Julia Franco Guidi
Statistical analysis, Funding acquisition, Data Collection, Conceptualization, Resource Management, Research, Methodology,

Writing - Preparation of the original, Writing - Review and Editing, Validation, Visualization

Maria Thereza Campagnolo

Statistical analysis, Funding acquisition, Data Collection, Conceptualization, Resource Management, Research, Methodology, Writing - Preparation of the Original, Writing - Review and Editing, Validation, Visualization

Maria Célia Cunha Ciaccia

Statistical analysis, Funding acquisition, Data Collection, Conceptualization, Resource Management, Project Management, Research, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Software, Supervision, Validation, Visualization

Flavia Renata Dantas Alves Silva Ciaccia

Statistical analysis, Conceptualization, Resource Management, Project Management, Research, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Software, Supervision, Validation, Visualization

Vera Esteves Vagnozzi Rullo

Funding acquisition, Project Management, Research, Writing - Preparation of the original, Writing - Review and Editing, Software, Supervision, Validation, Visualization

REFERENCES

1. Damasceno GM, Ferreira AS, Nogueira LAC, Reis FJJ, Andrade ICS, Meziat-Filho N. Text neck and neck pain in 18-21-year-old young adults. Eur Spine J. 2018;27(6):1249-54.
2. Cuéllar JM, Lanman TH. "Text neck": an epidemic of the modern era of cell phones? Spine J. 2017;17(6):901-2.
3. Neupane S, Ali U, Matheus A. Text neck syndrome – systematic review. Imperial J Interdiscip Res. 2017(7):141-8.
4. AlAbdulwahab SS, Kachanathu SJ, AlMotairi MS. Smartphone use addiction can cause neck disability. Musculoskeletal Care. 2017;15(1):10-2.
5. Xie YF, Szeto G, Madeleine P, Tsang S. Spinal kinematics during smartphone texting - A comparison between young adults with and without chronic neck-shoulder pain. Appl Ergon. 2018;68:160-8.
6. Lau KT, Cheung KY, Chan KB, Lo KY, Chiu TT. Relationships between sagittal postures of thoracic and cervical spine presence of neck pain, neck pain severity and disability. Man Ther. 2010;15(5):457-62.
7. Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J. 2016;15(6):834-48.
8. Hoy D, March L, Woolf A, Blyth F, Brooks P, Smith E, et al. The global burden of neck pain: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis. 2014;73(7):1309-15.
9. Meziat Filho N, Azevedo e Silva G, Coutinho ES, Mendonça R, Santos V. Association between home posture habits and neck pain in High School adolescents. J Back Musculoskellet Rehabil. 2017;30(3):467-75.
10. Correia IM, Ferreira AS, Fernandez J, Reis FJ, Nogueira LAC, Meziat-Filho N. Association Between Text Neck and Neck Pain in Adults. Spine (Phila Pa 1976). 2021;46(9):571-8.
11. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344-9.
12. Lin YH, Lin YC, Lee YH, Lin PH, Lin SH, Chang LR, et al. Time distortion associated with smartphone addiction: identifying smartphone addiction via a mobile application (App). J Psychiatr Res. 2015;65:139-45.
13. Kawamura T. Interpretação de um teste sob a visão epidemiológica: eficiência de um teste. Arq Bras Cardiol. 2002;79(4):437-41.
14. Vernon H, Mior S. The Neck Disability Index: A study of reliability and validity. J Manipulative Physiol Ther. 1991;14(7):409-15.
15. Falavigna A, Teles AR, Braga GL, Barazzeti DO, Lazzaretti L, Tregnago AC. Instrumento de avaliação clínica e funcional em cirurgia da coluna vertebral. Coluna/Columna. 2011;10(1):62-7.
16. Lauridsen HH, Hestbaek L. Development of the young spine questionnaire. BMC Musculoskelet Disord. 2013;14:185.
17. Agência Nacional de Saúde Suplementar. Manual de Diretrizes para o enfrentamento da Obesidade na Saúde Suplementar Brasileira. Rio de Janeiro, 2017.
18. Penha PJ, João SMA, Casarotto RA, Amino CJ, Penteado DC. Postural assessmentof girls between 7 and 10 years of age. Clinics. 2005;60(1):9-16.
19. Penha PJ, Baldini M, João SMA. Spinal Postural alignment variance according to sex and age in 7- and 8-year- old children. J Manipulative Physiol Ther. 2009;32(2):154-9.
20. Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, et al. Global, regional, and national incidence, prevalence, and Years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;386(9995):743-800.
21. Jones GT, Silman AJ, Power C, Macfarlane GJ. Are common symptoms in childhood associated with chronic widespread body pain in adulthood? Results from the 1958 British Birth Cohort Study. Arthritis Rheum. 2007;56(5):1669-75.
22. Xie Y, Szeto G, Dai J. Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: a systematic review. Appl Ergon. 2017;59(Pt A):132-42.
23. Bonney RA, Corlett EN. Head posture and loading of the cervical spine. Appl Ergon. 2002;33(5):415-7.
24. Silva AG, Punt TD, Sharples P, Vilas-Boas JP, Johnson MI. Head posture and neck pain of chronic nontraumatic origin: a comparison between patients and pain-free persons. Arch Phys Med Rehabil. 2009;90(4):669-74.
25. Edmondston SJ, Chan HY, Ngai GC, Warren ML, Williams JM, Glennon S, et al. Postural neck pain: an investigation of habitual sitting posture, perception of 'good' posture and cervicothoracic kinaesthesia. Man Ther. 2007;12(4):363-71.
26. Areeudomwong P, Oapdunsalam K, Havicha Y, Tantai S, Buttagat V. Effects of shoulder taping on discomfort and electromyographitc responses of the neck while texting on a touchscreen smartphone. Saf Health Work. 2018;9(3):319-25.
27. Saueressig IB, Oliveira VM, Xavier MK, Santos LRA, Silva KM, Araújo RC. Prevalence of musculoskeletal pain in adolescents and its association with the use of electronic devices. Rev Dor. 2015;16(2):129-35.
28. Queiroz LB, Lourenço B, Silva LE, Lourenço DM, Silva CA. Musculoskeletal pain and musculoskeletal syndromes in adolescents are related to electronic. J Pediatr (Rio J). 2018;94(6):673-9.
29. Shah PP, Sheth MS. Correlation of smartphone use addiction with text neck syndrome and SMS thumb in physiotherapy students. Int J Community Med Public Health. 2018;5(6):2512-6.