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RESEARCH ARTICLE

Effect of Mobile Gaming on Neck Range of Motion, Balance, Vertigo, and Headache in College Going Students

Dr Charchita Jain[1], Dr Shantanu Sharma[2], Dr Niraj Kumar Chavda[3], Dr Marvel Poptani[4], Dr Manoj Kumar Mathur[5], Dr Anuja Choudhary[6] and Dr Shashank Banarwal[7]

[1,3]Consultant Physiotherapist, Kanishka Physiocare Physiotherapy Centre, Jaipur,
[2]Professor, Nims College of Physiotherapy and Occupational Therapy, NIMS University Rajasthan, Jaipur,
[4]Assistant Professor, Vaidyanath Institute of Physiotherapy, Maharashtra,
[5,6]Associate Professor, Nims College of Physiotherapy and Occupational Therapy, NIMS University Rajasthan, Jaipur,
[7]Assistant Professor, Nims College of Physiotherapy and Occupational Therapy, NIMS University Rajasthan, Jaipur

*Corresponding Author
Dr Charchita Jain
(charchitajain1999@gmail.com)

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Abstract: Mobile gaming has become a routine activity among young adults, raising concerns about its potential effects on musculoskeletal function and related symptoms. This cross-sectional study was conducted at NIMS University on 113 college students aged 18–27 years who reported playing mobile games for at least three hours daily. Cervical range of motion was measured using the inch tape method, and additional outcomes included the Neck Disability Index, Vertigo Symptom Scale-Short Form, and Berg Balance Scale. Data analysis involved descriptive statistics such as means, standard deviations, frequencies, and percentages. The findings showed a mean cervical flexion of 4.5 ± 1.01 cm with minor limitations in flexion and rotation. According to the Neck Disability Index, 68.14 % of students reported no disability, 26.55 % reported mild disability, and 5.3 % reported moderate to severe disability. Vertigo symptoms were present in 91.15 % of participants, though only 2.65 % experienced severe episodes. Headaches of varying intensity were noted in 67.26 % of students, and 9.73 % exhibited forward head posture. Functional balance was largely preserved, with 98.23 % showing low fall risk on the Berg Balance Scale. Overall, prolonged mobile gaming appears to be associated with early signs of cervical mobility restriction, mild neck disability, vertigo, and headaches, highlighting the importance of ergonomic awareness and preventive strategies to reduce long-term health consequences.

Keywords: Mobile gaming, college students, cervical range of motion, vertigo, balance.

INTRODUCTION

Smartphones are advanced handheld devices widely used for communication, entertainment, education, gaming, and internet access. Their portability and multifunctionality have made them essential in daily life, especially among young adults, with college students using them for 5–6 hours a day on average [1]. Excessive smartphone use affects posture, reduces physical activity, disrupts sleep, and increases stress and anxiety [2]. It also impacts social behavior, relationships, and academic performance, with gaming addiction showing effects similar to substance dependence [3]. Mobile gaming has become a significant part of students lives due to the easy availability of smartphones and the engaging nature of interactive entertainment. Many students use gaming to relax and relieve stress from academic workloads. However, excessive gaming is linked to anxiety, depressive symptoms, reduced life satisfaction, and decreased physical activity [4]. Prolonged smartphone use for gaming also causes postural problems, neck pain, and limited cervical movement. Maintaining a forward head posture while looking at screens puts abnormal stress on the cervical spine. Extended screen time and intense visuals can also lead to headaches, dizziness, and mental fatigue [5]. The college phase is a critical period when students often develop sedentary habits and poor posture. If not corrected, these habits may lead to long-term health issues affecting daily life and academic performance [6]. Mobile gaming offers several benefits, such as enhancing reflexes, problem-solving, decision-making, and other cognitive abilities like hand-eye coordination and spatial awareness [7]. It can help reduce stress [8] encourage social interaction through shared experiences, and stimulate imagination and creativity, especially in games that allow players to design or explore virtual worlds [9]. Some games even support learning in subjects like math, language, and history [10]. However, excessive gaming can also have drawbacks, including anxiety, depression, eye strain, sleep loss, and reduced self-control, as well as social isolation and financial issues caused by frequent in-game purchases [11].

Prolonged mobile gaming with poor posture places excessive strain on the neck muscles, leading to pain, stiffness, and reduced range of motion. Constant forward head posture while looking at small smartphone screens overworks muscles such as the levator scapulae, sternocleidomastoid, and trapezius, causing fatigue and discomfort [12]. Over time, this abnormal posture can result in rounded shoulders, spinal misalignment, and even serious musculoskeletal issues like degenerative disc disease, nerve compression, and myofascial trigger point formation [13]. These trigger points may refer

pain to the head and shoulders, contributing to tension headaches, dizziness, and impaired balance. The repetitive stress on the cervical spine not only affects posture but can also disrupt coordination and overall physiological function [14]. FHP is a postural deviation where the head shifts anteriorly, increasing strain on cervical muscles and spine [15]. It is commonly seen with prolonged use of smartphones, computers, or reading habits and has become more prevalent among younger individuals [16]. FHP, often termed "text neck," can cause neck pain, muscle fatigue, upper back strain, and headaches due to tightness in the levator scapulae, sternocleidomastoid, and trapezius muscles [17]. Proper posture is essential to prevent discomfort and maintain balance [18].

Figure 1: forward head posture

Excessive smartphone use, particularly for gaming, has been linked to headaches, dizziness, sleep disturbances, and even memory problems [19]. Poor posture during gaming especially FHP causes muscle tension in the cervical spine, leading to migraines or tension-type headaches [20]. Small screens, visual strain, and poor ergonomics intensify these symptoms, while prolonged late-night gaming reduces sleep quality and increases fatigue [21]. Over time, continuous gaming without adequate breaks can make headaches more frequent and persistent, often accompanied by neck discomfort and impaired focus [22]. While mobile gaming can provide entertainment and stress relief, it may also lead to vestibular issues such as vertigo, a spinning or dizzy sensation caused by prolonged gameplay [23]. Fast-moving visuals, dynamic 3D graphics, and extended screen time can overwhelm the vestibular system, especially when visual input conflicts with inner-ear signals [24]. Poor posture, particularly FHP, adds stress to the cervical spine, limiting neck mobility and further disturbing balance regulation [25]. Together, these factors can intensify dizziness, discomfort, and impaired daily functioning during or after gaming sessions. Balance depends on coordination between the visual, vestibular, and somatosensory systems, but extended mobile gaming can disrupt this interaction [26]. Poor posture, such as slouching or forward head posture, may alter body alignment and reduce the vestibular system's ability to maintain stability [27]. Repetitive inactivity during gameplay can weaken proprioception and coordination, while fast-paced visual stimuli may momentarily affect spatial awareness. Fatigue or strain in neck and back muscles further contributes to postural imbalance, increasing the risk of falls or coordination problems over time [28]. The sedentary nature of prolonged mobile gaming can lead to several long-term health risks. Extended periods without movement may contribute to weight gain, poor blood circulation, and an increased likelihood of cardiovascular issues [29]. Reduced physical activity also decreases muscle strength and flexibility, making injuries and postural problems more common. Over time, this inactivity can result in joint stiffness, muscle wasting, and reduced overall fitness, including lower cardiovascular endurance [30].

This study aims to see how prolonged mobile gaming affects neck movement, vertigo, headaches, and balance in college students, to understand its physical and vestibular health impact. It will check how mobile gaming influences cervical ROM, neck discomfort, dizziness, and the severity of headaches, along with its relation to balance performance. Many students spend hours on mobile games without realizing how forward-bent posture can cause stiffness, pain, dizziness, and poor balance. These problems are often ignored but can disturb daily life, concentration, and studies. While phone use has been studied, little attention is given to gaming-specific effects in young adults. This research is important to find whether mobile gaming habits are linked to neck issues, vertigo, headaches, and balance problems, helping create awareness for healthier use and guiding physiotherapists for early care. The study assumes there may or may not be a link, but aims to confirm if mobile gaming truly affects these health parameters.

METHODOLOGY:

The present study was designed as a cross-sectional study conducted at NIMS University, Jaipur, Rajasthan, during the period from November 2024 to April 2025. The study population comprised college-going students, both males and females, with a total of 113 participants. Participants were recruited through a purposive sampling technique. The inclusion criteria were college-going students of NIMS University in the age group of 18 to 27 years, who reported a

minimum mobile gaming frequency of at least three hours, irrespective of gender. Students with recent neck injuries or trauma, neurological disorders such as vestibular dysfunctions, orthopedic conditions including postural deviations, cervical radiculopathy, or myofascial pain syndrome, and those under medication like muscle relaxants, antidepressants, antiepileptics, or sedatives were excluded. In addition, individuals with a history of chronic headache disorders and non-gamers were not considered for the study.

Procedure:

Cervical ROM was assessed using the tape measure method with participants seated upright in a neutral position, feet flat on the floor, shoulders relaxed, and hands resting on the thighs. For cervical flexion, the distance between the chin and the sternal notch was measured as participants actively bent the head forward. For extension, the same landmarks were used while participants extended the neck backward without moving the trunk. Right and left lateral flexion were assessed by measuring the distance between the mastoid process and the acromion process as participants brought the ear closer to the shoulder without lifting the shoulder. Right and left cervical rotation were measured by recording the distance between the tip of the chin and the acromion process on the respective side as participants rotated their head. All movements were performed actively, with the mouth closed for consistency, and each measurement was taken three times, with the mean value recorded for accuracy.

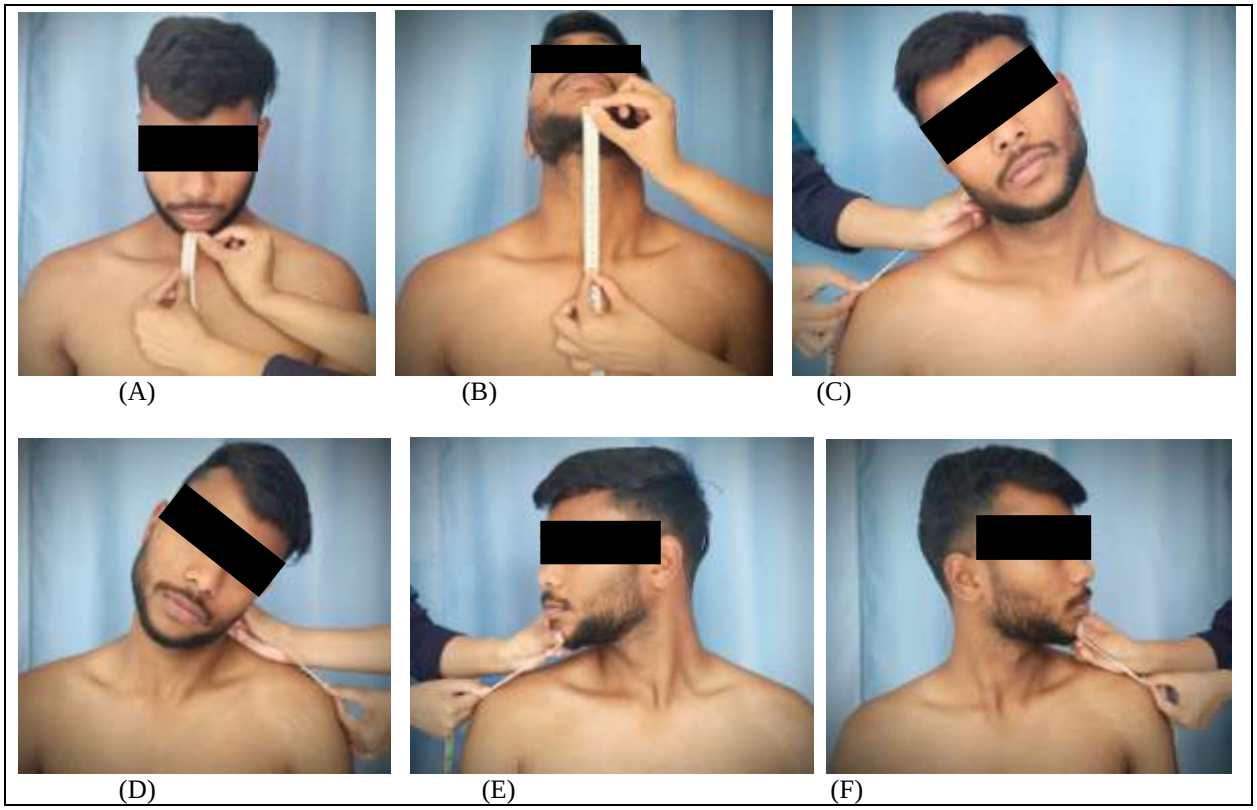

Figure 2: Cervical range of motion assessment using inch tape method – (A) Flexion: chin to suprasternal notch, (B) Extension: chin to suprasternal notch, (C) Right lateral flexion: mastoid to acromion, (D) Left lateral flexion: mastoid to acromion, (E) Right rotation: chin to acromion, (F) Left rotation: chin to acromion.

The NDI was used to assess the level of neck-related disability. It consists of 10 sections covering pain intensity, personal care, lifting, reading, headache, concentration, work, driving, sleeping, and recreation. Each item is scored on a 0–5 scale, and the total score indicates the degree of disability, with higher scores representing greater functional limitation. The VSS-SF was employed to evaluate dizziness and vertigo-related symptoms. This scale comprises 15 questions addressing vestibular, autonomic, and anxiety-related aspects of vertigo, with each question rated on a 0–4 scale, where higher values reflect increased symptom severity. Balance was assessed using the BBS, which includes 14 functional tasks such as sitting, standing, reaching, turning, and single-leg stance. Each task is scored from 0–4, with a maximum possible score of 56, where higher scores indicate better balance and postural control. In addition to these standardized measures, cervical range of motion was recorded using the inch tape method, following clear instructions given to participants to perform each neck movement slowly and comfortably, ensuring safety and accuracy. All assessments were carried out systematically under proper supervision, and the average of repeated readings was taken to minimize error. Data were documented carefully while ensuring the confidentiality of participants throughout the study.

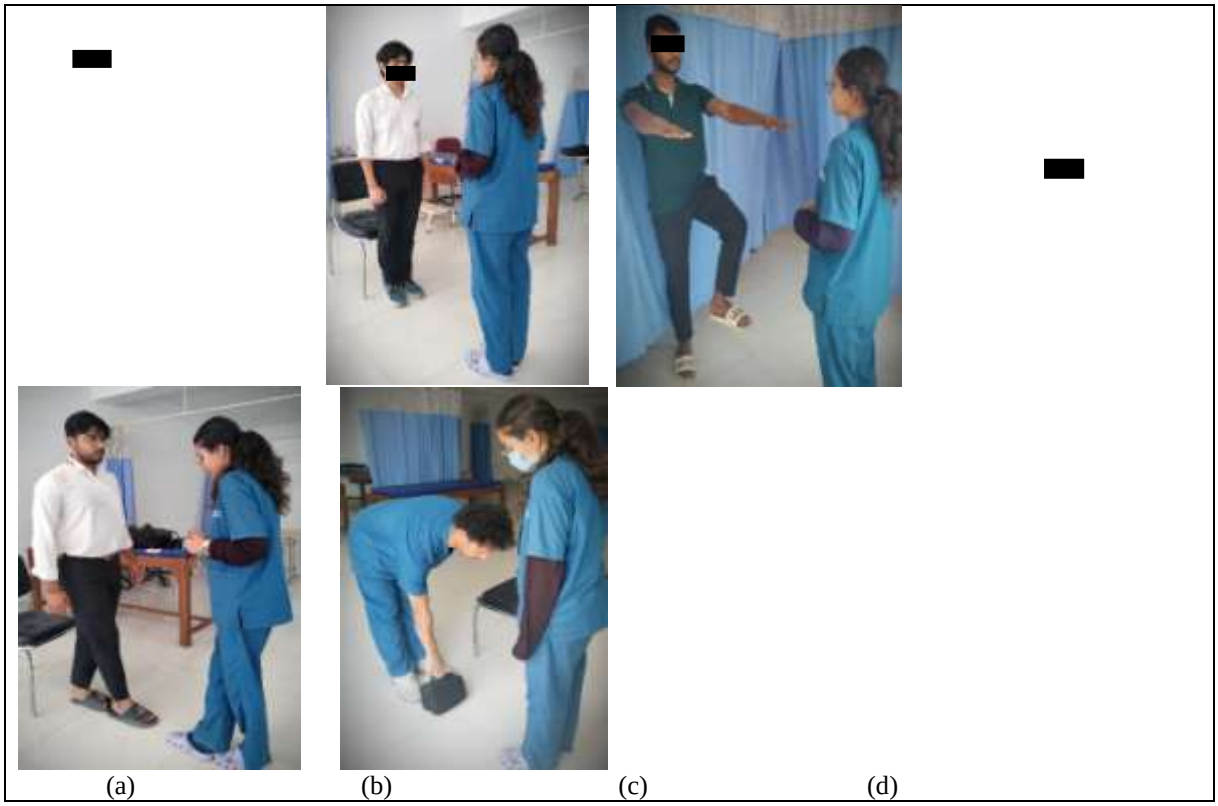

Figure 3: Balance assessment using BBS – (a) Standing unsupported, (b) Standing with eyes closed, (c) Standing on one leg, (d) Picking up object from floor.

RESULT

Descriptive statistical methods were used for analyzing the collected data. For continuous variables such as cervical ROM, vertigo scores, balance scores, and NDI values, the mean and standard deviation were calculated to understand the overall trend and variability in the results. For categorical data, including severity levels of vertigo, neck disability, and headache symptoms, frequencies and percentages were computed. This helped in identifying how many participants fell under each category. The analysis was done entirely using Microsoft Excel, as it provided a simple and reliable way to organize, calculate, and display the results. The findings were then presented in the form of tables, bar charts, and graphs, which helped in clearly showing the patterns and distribution across the different variables. This descriptive approach helped in summarizing the data and drawing meaningful observations related to the objectives of the study.

Table:1 Age And Gender Distribution Of Participants

VARIABLES	MEAN ± SD	MIN - MAX	RANGE	FREQUENCY
AGE	23.50 ± 2.05	19 – 27	8	113
GENDER	**Male**		**Female**	
	76		**37**	

Table 1 shows the study included 113 participants, with a mean age of 23.50 ± 2.05 years, primarily young adults. The minimum age was 19 years, and the maximum was 27 years. The gender distribution was 76.25% males and 33.74% females, with a higher representation of males. The study's accompanying pie chart visually demonstrates this gender distribution. The total age range was 8 years.

Table:2 Descriptive Statistics Of Cervical ROM, NDI, Vertigo, BBS

VARIABLES	MEAN ± SD	MIN - MAX
Cervical ROM (cm)		
FLEXION	4.5 ± 1.01	1 – 6.5
EXTENSION	20.63 ± 1.69	16 – 25
LF (RT)	13.15 ± 1.69	9.2 – 18.5
LF (LT)	13.38 ± 1.78	9 – 18
LR (RT)	12.61 ± 1.46	9 – 16.5
LR (LT)	12.61 ± 1.47	9 – 17
NDI	0.09 ± 0.11	0 – 0.54
VERTIGO	4.53 ± 4.33	0 – 31
BBS	50.79 ± 3.6	38 – 56

Table 2 shows the study found that prolonged mobile gaming may lead to restricted neck movements, potentially causing headaches, vertigo, and postural imbalance. The mean NDI score was low, suggesting minimal or no disability. Vertigo symptoms varied greatly among mobile gamers, with a wide range of severity. Balance scores were averaged at 50.79, with the highest possible score being 56. The study suggests that mobile gaming may contribute to mild functional limitations in some individuals.

Table:3 Severity Wise Classification Of NDI, Vertigo, Headache, BBS, FHP Among Participants

	NO OF PARTICIPANTS	PERCENTAGE
NDI		
No Disability	77	68.14%
Mild	30	26.55%
Moderate	5	4.42%
Severe	1	0.88%
VERTIGO		
No Vertigo	10	8.85%
Mild	73	64.60%
Moderate	27	23.89%
Severe	3	2.65%
HEADACHE (ACC. TO NDI)		
No Headache	37	32.74%
Slight	50	44.24%
Moderate Infrequent	15	13.27%
Moderate Frequent	6	5.30%
Severe	3	2.65%
All Time	2	1.76%
HEADACHE (ACC. TO VSS-SF)		
Never	27	23.89%
A Few Times	53	46.90%
Several Times	23	20.35%
Very Often	6	5.30%
Quite Often	4	3.53%
BBS		
Low Fall Risk	111	98.23%
Moderate	2	1.77%
FORWARD HEAD POSTURE		
Non FHP	102	90.26%
FHP	11	9.73%

Table 3 represent the study found that mobile gaming has minimal impact on neck function, with a majority of participants experiencing no disability. Most mobile gamers experience mild vertigo, with mild symptoms being common. Headaches are rare but common, with most experiencing occasional headaches. Most students have good balance and postural stability, minimizing fall risk. Most college students maintain normal head posture, with a small proportion showing postural deviation.

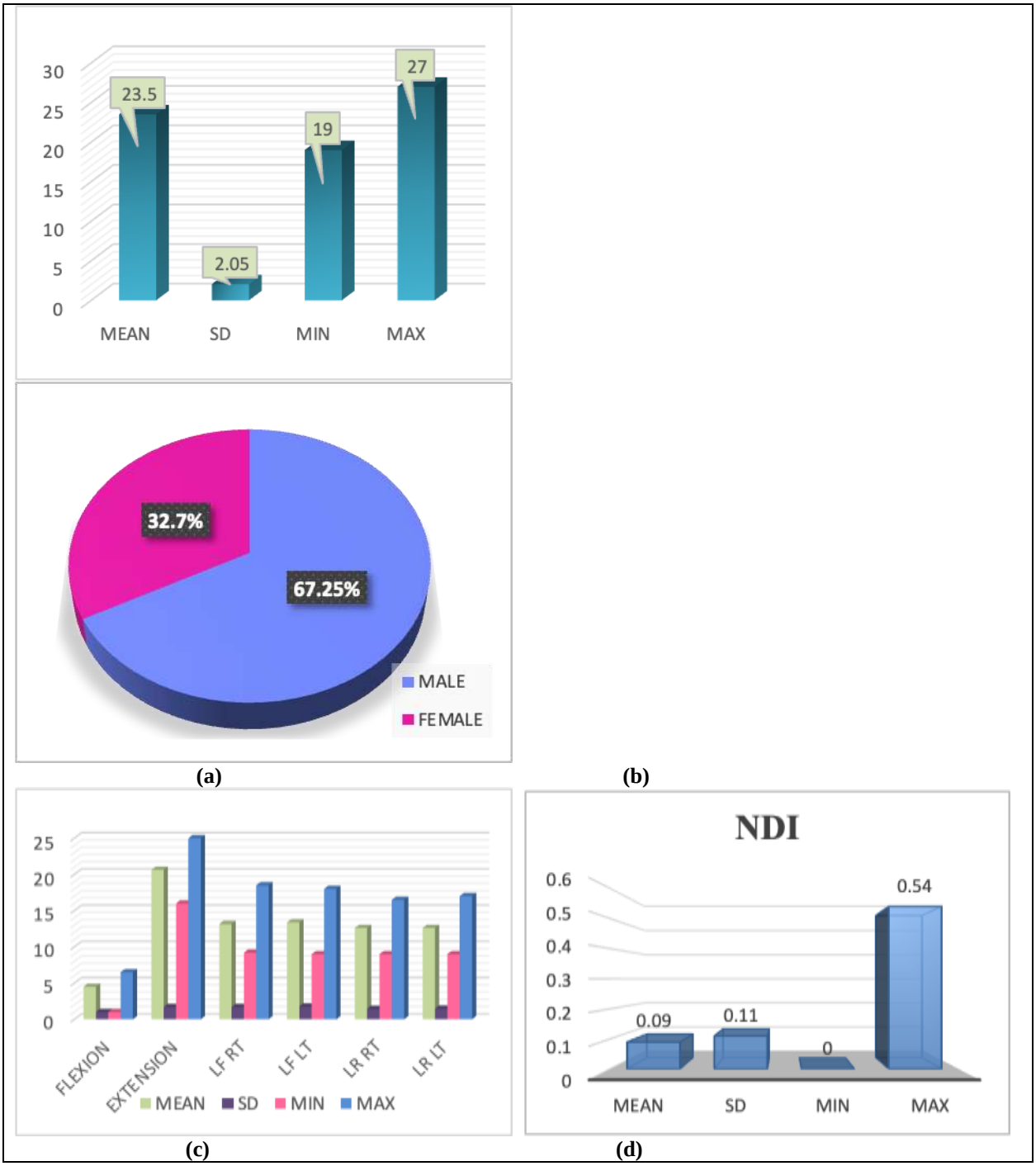

Figure 4: (a) Age distribution, (b) Gender distribution, (c) Cervical ROM, (d) NDI scores, (e) Vertigo scores, (f) BBS scores.

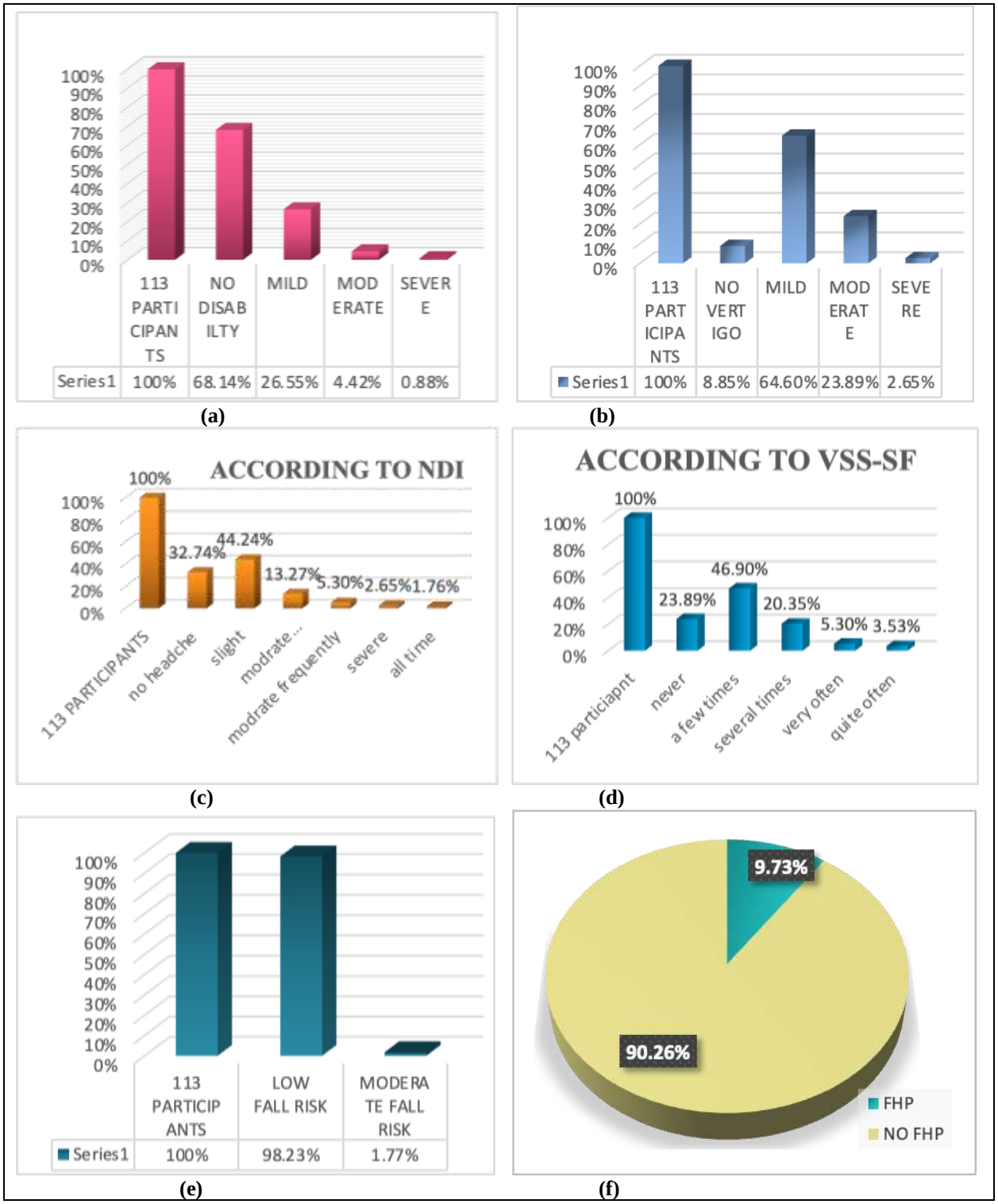

Figure 5: (a) Distribution of Neck Disability Index scores (b) Distribution of Vertigo Severity (VSS-SF) (c) Headache distribution according to NDI (d) Vertigo frequency according to VSS-SF (e) Distribution of fall risk according to BBS (f) Prevalence of Forward Head Posture

DISSCUSION:

The present study investigated the impact of prolonged mobile gaming on cervical ROM, balance, vertigo, and headache symptoms among college-going students aged 18–27 years, and the findings indicate that extended mobile gaming can cause subtle yet clinically relevant postural and sensorimotor changes. Cervical ROM assessment in six directions (flexion, extension, lateral flexion, and rotation) revealed slight restrictions, particularly in flexion, with mean values such as flexion 4.5 ± 1.01 cm and extension 20.63 ± 1.69 cm, which suggest early musculoskeletal stress due to FHP and prolonged static neck positioning. These findings are in

line with Bose et al. [31], who observed decreased cervical mobility in smartphone users due to postural strain, and Ali et al. [32], who highlighted the association between mobile gaming and muscular tightness. Reduced ROM, though not severe in this study, points towards the beginning of cervical dysfunction that may progress with continued exposure, consistent with Alshahrani et al. [33] who reported compromised proprioception in heavy smartphone users. NDI results showed a mean score of 0.09 ± 0.11, with 26.55% participants reporting mild and 5.3% moderate-to-severe disability, reinforcing findings by Lalaji et al. [1] and Khan et al. [34], who established a link between smartphone addiction and neck dysfunction. The mechanism may involve altered cervical curvature and increased disc loading as explained by Hansraj et al. [35]. Vertigo symptoms were highly prevalent, with 91.15% participants experiencing some degree of vertigo and a mean VSS score of 4.53 ± 4.33, supporting Youssef et al. [36] and Wah et al. [37], who attributed visual-vestibular mismatch, postural strain, and sensory overload from prolonged screen exposure as contributing factors. The occurrence of moderate-to-severe vertigo in a subset of participants despite being neurologically healthy suggests subclinical vestibular dysfunction, a finding echoed by Soylemez et al. [38]. Headache symptoms were also frequently reported, with 68.15% participants experiencing some form of headache according to NDI and over 75% reporting headache frequency in VSS-SF, consistent with Demirci et al. [39] and AlZarea et al. [21], who associated smartphone overuse with tension-type and cervicogenic headaches due to muscle strain and neural tension. The co-occurrence of FHP, reduced ROM, vertigo, and headache among participants reflects the complex interplay between cervical biomechanics, proprioception, and vestibular inputs, as emphasized by Ahmed et al. [40] and AlAbdulwahab et al. [41]. Balance assessment using the Berg Balance Scale revealed a mean score of 50.79 ± 3.6, suggesting overall good stability, yet subtle impairments in a few participants highlight early proprioceptive compromise, supporting Park et al. [42] and Alshahrani et al. [33]. FHP was clinically observed in 9.73% participants and strongly correlated with reduced ROM, vertigo, and headaches, aligning with Ali et al. [32]. Gender analysis suggested females reported slightly higher vertigo and disability, a finding supported by Youssef et al. [36] and Lalaji et al. [1], possibly due to different postural habits and sensitivity to musculoskeletal discomfort. Altogether, these results indicate that prolonged mobile gaming, though seemingly harmless, exerts cumulative strain on cervical structures, alters proprioceptive balance control, and induces headaches, thereby affecting both musculoskeletal and vestibular health in young adults. Clinically, this underscores the importance of early screening and preventive strategies such as posture education, neck exercises, and screen time management to mitigate dysfunction [1]. Limitations of this study include the use of visual observation for FHP rather than objective tools, lack of precise data on gaming duration and type of games, and reliance on supplementary tools for headache assessment. Future research should adopt longitudinal or interventional designs, integrate objective postural and proprioceptive measures, and examine the role of ergonomic correction and physiotherapy-based interventions in reducing these symptoms. Despite limitations, this study contributes valuable evidence that mobile gaming has measurable musculoskeletal and sensorimotor consequences, highlighting the urgent need for awareness and preventive action among college students.

CONCLUSION:

The present study concludes that prolonged mobile gaming has a measurable impact on cervical health, postural balance, and associated sensorimotor symptoms among college-going students. Although the majority of participants demonstrated cervical range of motion and balance scores within normal or near-normal limits, subtle restrictions and early musculoskeletal strain patterns were observed, which suggest the beginning of functional compromise. A considerable number of participants reported mild to moderate symptoms of neck disability, vertigo, and headache, and these complaints were positively associated with longer screen exposure and forward head posture adopted during gaming. These findings support the alternative hypothesis by indicating that repetitive and sustained faulty postures, especially forward head posture, may contribute to cervical joint stiffness, muscle fatigue, reduced proprioceptive efficiency, and vestibular disturbances over time. While these changes appeared subclinical in many students, the presence of early symptoms highlights the potential for progression into chronic conditions if preventive measures are not implemented. The results emphasize the clinical importance of postural awareness, ergonomic education, and the inclusion of regular physiotherapy screening for young adults who spend extended hours in mobile gaming. Early preventive interventions and lifestyle modifications should be encouraged to minimize the long-term risk of cervical pain, dizziness, headaches, and associated functional limitations, thereby promoting healthier gaming practices and musculoskeletal well-being in the student population.

Abbreviation

NDI: Neck disability index, ROM: Range of motion, FHP: Forward head posture, BBS: Berg balance scale, VSS- SF: Vertigo symptom scale - short form

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Author contribution

All authors contribute equally.

Conflict of interest

The authors declare that there are no conflicts of interest related to this research work. No financial, personal, or professional relationships have influenced the findings, analysis, or conclusions presented in this study.

Ethical approval

Regarding ethical considerations, the local ethical review committee guidelines were followed, and the purpose and goals of the study were explained to the participants. The confidentiality of all information was strictly maintained, and informed consent was obtained. The consent forms were explained to them, and the participants were informed that they could withdraw at any time and that participation was entirely voluntary.

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REFERENCES

1. Lalaji L. Smartphone addiction can cause neck disability in college-going students.
2. Samaha M, Hawi NS. Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. Computers in human behavior. 2016 Apr 1;57:321-5.
3. Mohammadbeigi A, Absari R, Valizadeh F, Saadati M, Sharifimoghadam S, Ahmadi A, Mokhtari M, Ansari H. Sleep quality in medical students; the impact of over-use of mobile cellphone and social networks. Journal of research in health sciences. 2016;16(1):46.
4. Ko YC, Lo CH, Chang YC. The Influence of Smartphone Games on Students' Self-Concept. Applied Sciences. 2021 Aug 12;11(16):7408.
5. Jung SI, Lee NK, Kang KW, Kim K, Lee DY. The effect of smartphone usage time on posture and respiratory function. Journal of physical therapy science. 2016;28(1):186-9.
6. Lee E, Kim Y. Effect of university students' sedentary behavior on stress, anxiety, and depression. Perspectives in psychiatric care. 2018 May 24;55(2):164.
7. Lamb RL, Annetta L, Firestone J, Etopio E. A meta-analysis with examination of moderators of student cognition, affect, and learning outcomes while using serious educational games, serious games, and simulations. Computers in Human Behavior. 2018 Mar 1;80:158-67.
8. Mercer N. Stress Relieving Video Games: Creating a Game for the Purpose of Stress Relief and Analyzing Its Effectiveness.
9. Cheng YH. Effects of playing internet games on imagination. Thinking Skills and Creativity. 2021 Sep 1;41:100924.
10. Bediou B, Rodgers MA, Tipton E, Mayer RE, Green CS, Bavelier D. Effects of action video game play on cognitive skills: A meta-analysis.
11. Sayeed MA, Rasel MS, Habibullah AA, Hossain MM. Prevalence and underlying factors of mobile game addiction among university students in Bangladesh. Global Mental Health. 2021 Jan;8:e35.
12. Kohan EJ, Wirth GA. Anatomy of the neck. Clinics in plastic surgery. 2014 Jan 1;41(1):1-6.
13. Kim DH, Kim CJ, Son SM. Neck pain in adults with forward head posture: effects of craniovertebral angle and cervical range of motion. Osong public health and research perspectives. 2018 Dec;9(6):309.
14. Tapanya W, Sangkarit N. Smartphone Usage and Postural Stability in Individuals With Forward Head Posture: A Nintendo Wii Balance Board Analysis. Annals of Rehabilitation Medicine. 2024 Jul 24;48(4):289-300.
15. The effect of forward head posture on muscle activity during neck protraction and retractionKyeong-Jin Lee 1, Hee-Young Han 1, Song-Hee Cheon 1, So-Hyun Park 1, Min-Sik Yong 1,*
16. Hakami I, Sherwani A, Hadadi M, Alzahrani R, Albukhari A, Omar Y, Alsaedi K, Aljadani F, Ali N, Khan M, Alasmari R. Assessing the Impact of Smartphone Use on Neck Pain and Related Symptoms Among Residents in Jeddah, Saudi Arabia: A Cross-Sectional Study. Cureus. 2024 Jul 11;16(7).
17. Fernández-de-las-Peñas C, Cuadrado ML, Pareja JA. Myofascial trigger points, neck mobility, and forward head posture in episodic tension-type headache. Headache: The Journal of Head and Face Pain. 2007 May;47(5):662-72.
18. Latif SH, Kamel RM, Draz AH. Effect of smartphone extensive usage and gender on cervical angle. Current Science International. 2018;7(4):762-7.
19. Demir YP, Sümer MM. Effects of smartphone overuse on headache, sleep and quality of life in migraine patients. Neurosciences Journal. 2019 Apr 1;24(2):115-21.
20. Kim DH, Kim CJ, Son SM. Neck pain in adults with forward head posture: effects of craniovertebral angle and cervical range of motion. Osong public health and research perspectives. 2018 Dec;9(6):309.
21. AlZarea BK, Patil SR. Mobile phone head and neck pain syndrome: proposal of a new entity. Headache. 2015;251(63):313-7.
22. Roy S, Iktidar MA, Chowdhury S, Pulock OS, Pinky SD, Sharif AB. Increased screen time and its association to migraine and tension-type headache: a cross-sectional investigation among Bangladeshi students. BMJ Neurology Open. 2024 May 8;6(1):e000656.
23. BAL N. Effect of digital screen usage on the visual-vestibular system interaction.

24. Warwick-Evans L, Symons N, Fitch T, Burrows L. Evaluating sensory conflict and postural instability. Theories of motion sickness. Brain research bulletin. 1998 Nov 15;47(5):465-9.
25. Carolina Brain Center. Cybersickness: How screen time impacts the visual-vestibular.system.Available.from:https://www.carolinabraincenter.com/cybersickness-how-screen-time-impacts-the-visual-vestibular-system/
26. Manchester D, Woollacott M, Zederbauer-Hylton N, Marin O. Visual, vestibular and somatosensory contributions to balance control in the older adult. Journal of gerontology. 1989 Jul 1;44(4):M118-27.
27. Fu M, Zhang L, Zhao X, Lv Z, Tang P. Association between screen time and self-reported balance disorders in middle-aged and older adults: national health and nutrition examination survey. Aging Clinical and Experimental Research. 2024 Jun 10;36(1):128.
28. Devi KA, Singh SK. The hazards of excessive screen time: Impacts on physical health, mental health, and overall well-being. Journal of Education and Health Promotion. 2023 Nov 1;12(1):413.
29. Harding N, Noorbhai H. Physical activity levels, lifestyle behaviour and musculoskeletal health profiles among seated video gamers during COVID-19. BMJ Open Sport & Exercise Medicine. 2021 Sep 1;7(3):e001194.
30. Çelik İ, Bektaş M. Effects of digital game addiction on cardiovascular health behavior on secondary school students during the COVID-19 pandemic. Journal of Pediatric Nursing. 2023 May 1;70:117-25.
31. Bose S. The relationship between smartphone use duration and cervical dysfunction in university students. J Bodyw Mov Ther. 2023;37:152–157. https://www.allstudyjournal.com/article/1344/7-1-21-494.pdf
32. Ali M, Ashraf N, Khan S, Zahid A, Naeem M, Rehman A, Latif W. Incidence of forward head posture in mobile gamers: Cross sectional study. Pakistan Journal of Medical & Health Sciences. 2022 May 26;16(04):766-.
33. Alshahrani A, Aly SM, Abdrabo MS, Asiri FY. Impact of smartphone usage on cervical proprioception and balance in healthy adults. Biomed res. 2018;29(12):2547-52.
34. Khan S, Kumari B, Kataria S, Sultan R, Hakim A, Faiz A, Mazhar S, Aslam I. Impact of Smartphone Addiction on Neck Pain Among University Students: Smartphone Addiction and Neck Pain. Journal of Health and Rehabilitation Research. 2024 Sep 22;4(3).
35. Hansraj KK. Assessment of stresses in the cervical spine caused by posture and position of the head. Surg Technol Int. 2014 Nov 1;25(25):277-9.
36. Youssef M, Mansour T, Abdelsalam HA. The relationship between mobile phone use and ear Problems among medical students. Biomedical Research. 2016 Jan 1;27(4):1251-4.
37. Wah SW, Chatchawan U, Chatprem T, Puntumetakul R. Prevalence of static balance impairment and associated factors of university student smartphone users with subclinical neck pain: cross-sectional study. International journal of environmental research and public health. 2022 Aug 28;19(17):10723.
38. Söylemez E, Dağ M, Ilgaz A, Korkmaz B, Topçuoğlu Ü, Koç AD, Ensari S. Excessive smartphone use increases self-reported auditory and vestibular symptoms. Wiener klinische Wochenschrift. 2024 Aug 23:1-7.
39. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. Journal of behavioral addictions. 2015 Jun;4(2):85-92.
40. Ahmed S, Samuel AJ, Mishra A, Rahman MS, Islam MA, Rashaduzzaman M, Roy SK, Akter R, Islam MJ. Mobile game addiction and its association with musculoskeletal pain among students: A cross-sectional study. PloS one. 2024 Aug 26;19(8):e0308674.
41. AlAbdulwahab SS, Kachanathu SJ, AlMotairi MS. Smartphone use addiction can cause neck disability. Musculoskeletal care. 2017 Mar;15(1):10-2.
42. Park YH, An CM, Moon SJ. Effects of visual fatigue caused by smartphones on balance function in healthy adults. Journal of physical therapy science. 2017;29(2):221-3.