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Anthropometry, Neck Posture and Smartphones: Exploring Interrelationships in Young College Students

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Abstract

Introduction: Smartphone addiction is increasingly common among young adults and tied to musculoskeletal problems, but we know little about how it connects to posture, body measurements, and composition. This study explores those links in university students. **Methods:** A cross-sectional study was done with 51 healthy students (18-25 years old) at SGT University. They completed the Smartphone Addiction Scale (SAS), Neck Disability Index (NDI), and a health assessment, plus measurements of craniovertebral angle (CVA) using Kinovea software, anthropometrics (like skinfolds, neck circumference, and shoulder width), and body composition via bioelectrical impedance analysis (BIA). We used Pearson correlations to spot relationships ($p < 0.05$). **Results:** Students had moderate SAS scores (27.88 ± 8.31), mild neck disability (7.71 ± 6.40), and average CVA of 54.79 ± 5.44°. Higher smartphone addiction linked to more body fat (r = 0.302, p = 0.031). Health scores dropped with higher BMI (r = -0.769, p < 0.001), body fat rate (r = -0.674, p < 0.001), body fat mass (r = -0.631, p < 0.001), and measures like neck circumference (r = -0.307, p = 0.029), shoulder width (r = -0.366, p = 0.008), and upper arm girth (r = -0.376, p = 0.007)—but rose with better hydration (r = 0.554, p < 0.001). Poorer posture (lower CVA) is related to higher body fat (r = -0.468, p = 0.043) and narrower shoulders (r = 0.461, p = 0.047). Smartphone addiction didn't strongly connect to posture, body measurements, or most metabolic factors. **Conclusion:** In young adults, body fat levels drive health and posture more than smartphone habits alone, though addiction does boost fat gain. Targeting sedentary habits and body composition could help prevent issues.

Keywords: Smartphone, Addiction, Anthropometry, Neck Posture.

Resumen

Introducción: La adicción a los teléfonos inteligentes es cada vez más común entre los adultos jóvenes y está relacionada con problemas musculoesqueléticos, pero se sabe poco sobre su conexión con la postura, las medidas corporales y la composición corporal. Este estudio explora estas relaciones en estudiantes universitarios. **Métodos:** Se realizó un estudio transversal con 51 estudiantes sanos (de 18 a 25 años) en la Universidad SGT. Completaron la Escala de Adicción a los Teléfonos Inteligentes (SAS), el Índice de Discapacidad Cervical (NDI) y una evaluación de salud, además de mediciones del ángulo craneovertebral (CVA) utilizando el software Kinovea, mediciones antropométricas (como pliegues cutáneos, circunferencia del cuello y ancho de los hombros) y composición corporal mediante análisis de impedancia bioeléctrica (BIA). Se utilizaron correlaciones de Pearson para identificar las relaciones ($p < 0.05$). **Resultados**: Los estudiantes obtuvieron puntuaciones moderadas en la SAS (27.88 ± 8.31), discapacidad cervical leve (7.71 ± 6.40) y un CVA promedio de 54.79 ± 5.44°. Una mayor adicción a los teléfonos inteligentes se relacionó con una mayor grasa corporal (r = 0.302, p = 0.031). Las puntuaciones de salud disminuyeron con un mayor IMC (r = -0.769, p < 0.001), porcentaje de grasa corporal (r = -0.674, p < 0.001), masa grasa corporal (r = -0.631, p < 0.001) y medidas como la circunferencia del cuello (r = -0.307, p = 0.029), el ancho de los hombros (r = -0.366, p = 0.008) y la circunferencia del brazo (r = -0.376, p = 0.007), pero aumentaron con una mejor hidratación (r = 0.554, p < 0.001). Una peor postura (menor CVA) se asoció con una mayor grasa corporal (r = -0.468, p = 0.043) y hombros más estrechos (r = 0.461, p = 0.047). La adicción a los teléfonos inteligentes no se relacionó significativamente con la postura, las medidas corporales ni la mayoría de los factores metabólicos. **Conclusión:** En adultos jóvenes, los niveles de grasa corporal influyen en la salud y la postura más que el uso del teléfono inteligente por sí solo, aunque la adicción sí contribuye al aumento de grasa. Abordar los hábitos sedentarios y la composición corporal podría ayudar a prevenir problemas.

Palabras Clave: Teléfono Inteligente, Adicción, Antropometría, Postura Del Cuello.

Introduction

Use of smartphone is now a part of daily activities of young population all over world especially in young generations. From study to communication, smartphone became an essential part of life in students. Not only that young generations had especially students also engaged with Smartphone for their amusement during leisure time (Heitmayer & Lahlou, 2021)

This has raised concerns about smartphone addiction, a behavioural-pattern defined by excessive use, reduced self-control, and negative physical and psychosocial consequences. Among these consequences, musculoskeletal and postural issues are a great concern for the health professionals. (Faber *et al.,* 2022) Young populations are fundamentally susceptible to postural-adaptations which is linked to continuous smartphone use. (Vannajak *et al.,* 2025). A flexed neck posture, rounded shoulders, and biomechanically abnormal spinal alignment results due to prolong uses of smartphones (Xie, 2016) Craniovertebral angle, cervical loading, and overall postural balance may be affected by these positions during the continuous uses of smartphones. Such changes further cause neck pain, reduced functional capacity, and long-term musculoskeletal strain, making postural alignment an important area for consideration. (Ling *et al.,* 2018). Neck pain, reduced functional capacity, and long-term musculoskeletal strain may be the outcome of such changes which is an important area for consideration. (Ling *et al.,* 2018). Posture and smartphone usage habits are also related with anthropometric parameters like limb lengths, neck circumference, and shoulder width (*Bragança et al.,* 2016). Awkward postures while using smartphone for long durations causes stress. Yasshwi *et al.,* (2025) reported that smartphone addiction often ignore body measurements like height, limb length etc. which may result in posture issues or other physical issues.

Level of overall health and daily habits are significantly affected by Fat %, Muscle mass, hydration and baseline metabolism (Yasshwi *et al.,* 2025). Sleep, less movement are also hampered due to scrolling endlessly on smartphone (Wasie, 2024). These changes result in reduction of muscle stamina, interfere with balance and posture.

Although different studies have done previously on smartphone addiction, posture, or body composition in isolation, but limited research has evaluated their combined associations within a single population. Analysing the relationship of smartphone addiction with postural alignment, anthropometry, and body composition can provide an integrated picture of its physical health implications. This is particularly important for young adults, a group at a critical stage for establishing long-term health behaviours. On top of that, stuff like endless social media scrolling or mobile gaming causes continuous stressful forward posture of neck and maintaining a stiff position. This results in excessive muscle and joint stress.

Therefore, this study aims to study and analyse the associations between smartphone addiction, postural alignment parameters, anthropometric measures, and body composition in young adults. Diving into these links, our study wants to offer practical proof for catching problems early, clever ways to prevent them, and custom physio tweaks to head off the muscle, joint, and metabolic damage from nonstop phone habits.

Materials and Methods

Study Design

A cross-sectional observational study was conducted to examine the associations between smartphone addiction, neck disability, health assessment score, body composition, and metabolic and weight management parameters among university students.

Study Population and Setting

The study population comprised of 51 healthy adult students enrolled at SGT University. Participants of both sexes, (gender) aged 18–25 years, were recruited from various academic programs. Students with a history of musculoskeletal disorders of the cervical spine, neurological conditions, recent trauma or surgery, chronic systemic illness, or those currently undergoing physiotherapy or medical treatment affecting posture or body composition were excluded.

Sample Selection

Participants were recruited using a convenience sampling method. Subjects were informed about the study and a written informed consent was obtained from all the participants. The study protocol was approved by the Institutional Ethics Committee of SGT University, and the study was conducted in line with the principles of Declaration of Helsinki.

Data Collection Procedure

Participants were requested to avoid any strenuous physical activity, caffeine, and heavy meals for at least 4 hours before to assessment. Measurements were conducted in a controlled environment. Body composition analysis was performed with participants standing barefoot on the analyzer platform (Bioelectric Impedance Analyser), maintaining an upright posture, and wearing light clothing. Anthropometric measurements were done using skinfold callipers followed by measurement of craniovertebral angle. Following body composition assessment, participants completed the Smartphone Addiction Scale, Neck Disability Index and health assessment scoring under supervision to ensure completeness and accuracy of responses.

Body Composition and Metabolic & Weight Management Parameters

Anthropometric Measurements

Physical Characteristics: Height and weight was measured with a stadiometer and electronic weighing scale following the methods approved by International Society for the Advancement of Kinanthropometry (ISAK) in ISAK manual (Esparza-Ros, 2024)

Skinfold Thicknesses: Skinfold Thicknesses of Triceps and Biceps were measured using a Harpenden skinfold caliper (Baty International, UK) following the methods described in ISAK manual (Esparza-Ros, 2024). Measurements were taken on the dominant side of the body.

Circumferences and Breadth: Neck-circumference (NC) and Upper Arm Girth were measured using an Anthropometric Tape (CESCORF, Brazil). Shoulder width (biacromial breadth) was measured with Large Sliding caliper (CESCORF, Brazil). Upper-Arm length (UAL) was measured with a Segmometr (CESCORF, Brazil). All measurements were recorded in centimeters according to standardized anthropometric protocols to ensure accuracy and reliability. (Esparza-Ros, 2024)

Body composition and metabolic parameters: Body composition was assessed using a body composition analyzer based on bioelectrical impedance analysis (BIA), with a maximum capacity of 200 kg, GS6.5C+ Body Building Weight Test System (Model Number: NC-bca-114). All measurements were performed with standardized protocol. (Ayvaz *et al.,* 2011)

Craniovertebral Angle

Postural alignment of the cervical spine was assessed using the craniovertebral angle (CVA) with the help of Kinovea motion analysis software. Standardized lateral-view digital photographs of the participants were taken in a relaxed standing position. Anatomical landmarks like the spinous process of the seventh cervical vertebra (C7) and the tragus of the ear were identified and marked before taking the image. The craniovertebral angle is the angle formed between the line passing through the C7 and a line joining C7 to the tragus of the ear. Images taken were analyzed using Kinovea software to calculate the CVA. A smaller craniovertebral angle indicated increased forward head posture, whereas a larger angle indicated better cervical alignment. This method is more reliable and valid for the assessment of cervical posture in young adult populations. (Zárate-Tejero *et al.,* 2024)

Smartphone Addiction

Smartphone Addiction Scale (SAS) was used to assess the Smartphone addiction of the participants. The scale consists of multiple items rated on a Likert scale evaluating various aspects such as daily-life disturbance, withdrawal, tolerance, and overuse. Higher scores indicate higher levels of smartphone addiction. (Kwon et al., 2013)

Neck Disability

Neck Disability Index (NDI) was used to assess the Neck-related functional impairment. The NDI is a validated self-reported questionnaire scoring method that measures intensity of pain and neck pin impact on daily activities. Higher score reflects greater disability (MacDermid *et al.,* 2009).

Statistical Analysis

IBM SPSS 31 was used for Statistical Analysis. Descriptive statistics (Table 1) summarize the demographic variables and outcome measures. Pearson correlation coefficients were used to analyse associations between smartphone addiction, neck disability scores, and body composition and metabolic parameters. Statistical significance was set at $p < 0.05$.

Results

The descriptive statistics (Table 1) revealed that the participants had a mean Smartphone Addiction Scale score of 27.88 ± 8.31, indicating a moderate level of smartphone use behavior. The average for Neck Disability Index score was 7.71 ± 6.40, suggesting mild neck related disability in the sample. Average values with standard deviations for Anthropometric measurements are depicted in Table 1. The mean age of participants was 21.22 ± 2.36 years, with an average height of 166.04 ± 9.26 cm and body weight of 64.30 ± 14.95 kg, resulting in a mean BMI of 23.06 ± 4.08 kg/m².

Body composition analysis shows a mean body fat rate of 23.61 ± 9.36%, skeletal muscle mass of 25.82 ± 6.27 kg, and body fat mass of 16.31 ± 10.26 kg. The mean water rate was 57.20 ± 6.02%, with total water content of 37.43 ± 8.29 kg. Mean protein content was 9.31 ± 2.69 kg, and the average basic metabolic rate was 1530.61 ± 236.38 kcal/day. The mean target weight was 59.96 ± 9.43 kg, while muscle control values showed considerable variability (1.86 ± 3.24). The average for health assessment score was 68.29 ± 11.37, indicating an overall moderate to good health-status. The craniovertebral angle had a mean value of 54.79 ± 5.44 degrees. (Refer to Table 1)

Table 1. Descriptive Statistics of the Studied Population

Parameters	Variables	Mean	Std. Deviation
Demographic Details	Age	21.22	2.361
	Height	166.04	9.258
	Weight	64.3	14.948
	BMI	23.06	4.081
Smartphone Addiction	Smartphone Addiction Score	27.88	8.308
Disability	Neck Disability Index	7.71	6.401
Health	Health Assessment Score	68.29	11.374
Posture	Craniovertebral Angle(degrees)	54.79	5.442
Anthropometry	Triceps(mm)	17.25	5.618
	Biceps(mm)	12.7	6.131
	Neck Circumference(cm)	33.71	3.081
	Shoulder Width (cm)	43.88	4.141
	Upper Arm Length (cm)	30.39	2.706
	Upper Arm Girth (cm)	29.41	4.875
Body Composition	Body Fat Rate	23.61	9.362
	Waist Hip Rate%	1	0
	Water Rate %	57.2	6.02
	Skeletal Muscle (Kg)	25.82	6.27
	Body Fat (Kg)	16.31	10.264
	Remove Fat	49.18	10.63
	Water Content	37.43	8.286
	Protein	9.31	2.687
Metabolic & Weight Management Parameters	Target Weight (Kg)	59.96	9.432
	Muscle Control	1.86	3.244
	Basic Metabolic	1530.61	236.377

Table 2. Correlation Analysis of The Data Obesred In The Present Study

Variables		Smartphone Addiction Scale		Neck Disability Index		Health Assessment Score		Cranio Vertebral Angle	
		Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)
Anthropometry	Triceps skinfold measurement	.269	.252	.392	.087	-.356	.124	-.050	.839
	Biceps skinfold measurement	-.094	.692	.119	.618	-.435	.055	.000	.999
	Neck Circumference	-.228	.108	-.158	.269	-.307*	.029	.174	.477
	Shoulder Width	-.257	.069	-.002	.988	-.366**	.008	.461*	.047
	Upper Arm Length	-.228	.107	-.008	.954	-.003	.982	.048	.844
	Upper Arm Girth	-.147	.304	-.215	.129	-.376**	.007	.172	.482
BMI	BMI	.076	.597	-.057	.692	-.769**	.000	-.098	.690
Body Composition	Body Fat Rate	.302*	.031	.151	.292	-.674**	.000	-.468*	.043
	Water Rate %	-.243	.085	-.134	.349	.554**	.000	.319	.183
	Skeletal Muscle (Kg)	-.250	.077	-.203	.153	-.223	.116	.314	.190
	Body Fat (Kg)	.194	.172	.004	.980	-.631**	.000	-.353	.138
	Remove Fat	-.159	.264	-.189	.183	-.276	.050	.270	.263
	Water Content	-.145	.309	-.107	.455	-.371**	.007	.218	.371
	Protein	-.158	.269	-.158	.267	.079	.580	.335	.161
Metabolic & Weight Management Parameters	Target Weight	-.273	.052	-.141	.323	-.199	.162	.343	.150
	Muscle Control	-.075	.602	.061	.673	.093	.517	.228	.347
	Basic Metabolic	-.090	.531	-.011	.940	-.421**	.002	.288	.232

Correlation analysis (Table 2) shows that smartphone addiction was significantly and positively associated with body fat rate. This means that higher smartphone addiction scores were related to greater adiposity. No significant associations were observed between smartphone addiction and anthropometric variables, BMI, or metabolic parameters. Neck Disability Index (NDI) did not show any significant correlations with anthropometric, body composition, or metabolic variables which suggests that perceived neck disability was not strongly affected by these physical characteristics.

A significant negative correlation was observed between Health Assessment score and BMI, Fat %, Fat Mass, BMR and anthropometric parameters like Neck circumference, shoulder width and upper arm length.

A significant positive correlation was observed between health assessment score and water rate percentage which means better health status with improved hydration. Craniovertebral angle (CVA) showed a significant positive correlation with shoulder width and a significant negative correlation with body fat rate, suggesting that postural alignment may be affected by body composition. Overall, the findings highlight the role of body composition and adiposity in health assessment outcomes with limited relationship observed for smartphone addiction and neck disability.

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Discusión

The present study aimed to explore the relationships between smartphone addiction, neck disability,.postural alignment, anthropometric characteristics, body composition, and metabolic parameters in a young adult population. Consolidation of behavioural, musculoskeletal, and physiological variables in this study provides an underlying understanding of how lifestyle-related. Behaviours such as smartphone use may deteriorate physical health indicators.

The descriptive statistics indicate that the study population included young adults with a mean age of approximately 21 years and an average BMI within the normal to borderline overweight range (18-24.9). Despite the relatively young age group, moderate levels of smartphone addiction and mild neck disability were observed. This suggests that prolonged smartphone use and associated postural habits are already prevalent in early adulthood and may further lead to musculoskeletal problems even before more severe disability develops. Gill & Chung, (2025) reported a significant positive relation with Body fat % and Smartphone addiction. They reported that increased adiposity is linked with higher level of smartphone uses. Present study supported the previous studies which stated that excessive smartphone use is often accompanied by sedentary behaviour, reduced physical activity, and prolonged sitting time.

All of these factors contribute to abnormal or deviated body composition. The absence of significant associations between smartphone addiction, BMI and skeletal muscle mass suggests that body fat percentage may be a more sensitive indicator of lifestyle-related behavioural changes when compared to more gross measures such as body weight or BMI.

Surprisingly, the Neck Disability Index did not show significant correlations with anthropometric, body composition, or metabolic variables. This may be due to relatively low mean NDI score which means mild disability levels in the sample. It is possible that structural or physiological changes associated with neck disability become more significant only at higher levels of pain or dysfunction. (Bogduk, 2011) Alternatively, neck disability in young adults may be more strongly influenced by ergonomic factors, duration of device use, and psychosocial stress rather than body composition alone.

The health assessment score was the most strongly associated variable in this study. Its significant negative correlations with Basal Metabolic Index, body fat rate, body fat mass, and basic metabolic rate show that higher adiposity and different metabolic demands are associated with poorer overall health status. The negative association with anthropometric measures such as neck circumference, shoulder width, and upper arm girth further suggests that increases in body size, especially related to fat accumulation are associated with poorer health outcomes. (Frank *et al.,* 2019) Conversely, the positive association between health assessment score and water rate percentage highlights the importance of adequate hydration and lean tissue composition in maintaining better overall health. (Jéquier & Constant, 2010)

Postural alignment which was assessed using craniovertebral angle showed a significant negative association with body fat rate and a positive association with shoulder width. A smaller cranio-vertebral angle (CVA) often means forward head posture which is related to heavy smartphone use and bad setup habits. (Allam, Yousef & Tahoon, 2025) Interestingly, the more body fat someone carries, the worse this gets because extra weight interferes with biomechanics, balance, and muscle strength around the spine. (Izzo *et al.,* 2013) The association with shoulder width may indicate structural or muscular adaptations influencing upper body posture.

The findings of this study emphasize that while smartphone .addiction alone shows limited direct associations with musculoskeletal outcomes, its indirect effects through increased adiposity may have meaningful implications for health and posture. The strong effect of body composition on health assessment scores reinforces the importance of maintaining healthy fat levels and hydration status in young adults. (Bennett & Lim, 2025) These results suggest that interventions aimed at reducing excessive smartphone use should be combined with strategies promoting physical activity, ergonomic awareness, and healthy body composition to prevent long-term musculoskeletal and metabolic problems.

This study focusses on the multi-factorial nature of health outcomes related to modern lifestyle behaviours. Smartphone addiction, body composition, posture, and metabolic health appear to be interconnected, with body fat playing a central role. Early identification and targeted interventions in young adults may help mitigate future risks of musculoskeletal disorders and metabolic dysfunction.

Conclusion

In healthy university students, smartphone use was generally moderate and neck-related disability was mild. Smartphone addiction showed a significant association only with higher body fat rate, while no meaningful relationships were observed with neck disability, anthropometry, or most metabolic parameters. In contrast, body composition emerged as a key determinant of health assessment and posture, with higher adiposity linked to poorer health assessment scores and less optimal postural alignment. Essentially, body composition had a stronger influence on health and posture than smartphone addiction or perceived neck disability in this particular population.

The cross-sectional design limits causal interpretation and the use of convenience sampling from a single university restricts generalizability. Self-reported measures may be subject to response bias, and postural assessment was limited to static measures. Future studies may include larger, more diverse samples, longitudinal designs. Objective smartphone usage tracking, and dynamic postural and functional assessments to better understand long-term effects and underlying mechanisms.

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Informed Consent Statement

All the athletes included in the study provided written informed consent.

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