Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 21s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

The Effect of Smartphone Addiction on Trunk Muscles Performance in Adolescents: A Transverse Study

Hamada Elsayed Ayoub[1], Aya Ebrahim Elkomy[2], Khaled Ahmed Olama[1], Hebatallah Mohamed Kamal[1], Ahmed Salim Mohamed[2]

[1]Department of Pediatric Physical Therapy, Faculty of Physical Therapy, Cairo University, Egypt.
[2]Department of Pediatric Physical Therapy, Faculty of Physical Therapy, Alsalam University, Egypt.

***Corresponding Author:** Aya Ebrahim Elkomy

Email ID: ayaelkomy66@gmail.com

Cite this paper as: Hamada Elsayed Ayoub, Aya Ebrahim Elkomy, Khaled Ahmed Olama, Hebatallah Mohamed Kamal and Ahmed Salim Mohamed, (2025) The Effect of Smartphone Addiction on Trunk Muscles Performance in Adolescents: A transverse study. *Journal of Neonatal Surgery*, 14 (21s), 1280-1285.

ABSTRACT

Background: Smartphones are widely used among people worldwide but it's over use can cause smartphone addiction, which was found to cause musculoskeletal problems, as very little number of studies was held to investigate its side effects on the muscles of the trunk.

Aim: this research aimed to evaluate the consequences of smartphone addiction on performance of trunk muscles.

Methods: Sixty- six adolescent aged 17 and 18 years, were recruited in the research and sorted in addict group (thirty-three participant 17 males and 16 females)or non- addict (control) group (thirty- three participant 17 male and 16 female) according to their score in Smartphone Addiction Scale –Short Version the Arabic version , Isokinetic dynamometer was used for assessment of performance of the muscles of the trunk (trunk flexors and extensors) by evaluating: peak torque per body weight, time to peak torque and agonist to antagonist ratio

Results: there were no significant statistical differences between the addict and non-addict group in peak torque per weight of the body, time to peak torque and agonist to antagonist ratio for trunk flexors and trunk extensors

Conclusion: from the obtained results, smartphone addiction has no effect on the performance of flexor and extensor muscles of the trunk in adolescents.

Keywords: *Addiction, Adolescents, isokinetic dynamometer, Smartphone, Trunk muscles*

1. INTRODUCTION

The rise of smart mobiles and their subsequent broad acceptance have revolutionized the communication and information landscape, resulting in a shift in the principles, passions, and aspirations of many people worldwide, because of this, issues with addiction and excessive use have been brought up globally [1]

Smartphones have many benefits like they allow users to communicate with others through texting, calling, or sending emails. they can also access the internet, enjoy entertainment options like games and music, and even save time when shopping for necessities online [2]

Users are vulnerable to overindulgence on smart mobiles due to their devices' portability, light weight, ease of use, and quick information processing speed. In the realm of technological addictions, addiction of smartphones is classified as a "behavioral addiction," and research revealed that these pathological addictions have detrimental effects on both physical and mental health. [3]

According to psychologists, an addiction or excessive use of smartphones can have negative consequences on one's ability to think clearly, sleep well, he can also experience depression, have trouble focusing, and perform poorly in school[4]

Because portable smartphones are flexible and can be used without a desk, people who use them often adopt bad postures, especially when sitting down unsupported. This can result in serious musculoskeletal issues such as shoulder and neck pain, lumbar discomfort, lower and upper back pain, and even pain in the upper extremities [5,6]

The activation of the trunk muscles maintains the spine's steadiness during movement and aids in postural control, especially in dynamic situations or challenging postural tasks (such as running, climbing, or descending stairs). Moreover, the trunk muscles may influence balance by regulating head movements, which also impacts the vestibular functions [7,8]

The isokinetic dynamometry is extensively acknowledged as a reliable instrument for assessing muscle performance and is often utilized as a benchmark for other assessments of the strength. It allows for the measurement of muscle activity with an modifying resistance and a constant angular velocity, which allows for the generation of maximum force over a specified range of motion [9], it is a universally accepted technique for determining the strength of the upper, lower, and trunk muscles, are essentially founded on the principle of assessing strength under constant linear velocities [10]. So, the aim of this study was to evaluate the results of smart mobile addiction on performance of trunk muscles. .

2. Methods:

Research design

Tthe study type is a comparative transverse study that started in October 2023 and ended in April 2024,sixty - six normal healthy adolescent of age 17 and 18 years from both genders were recruited for the study from first year University students of faculties of physical therapy, pharmacy and dentistry, Alsalam University, They were sorted according to their (Smart-phone Addiction Scale Short Version) (SAS-SV) scores into two groups: Group (A): smartphone addicts (thirty-three participants 17 males and 16 females) Group (B) (control group): smartphone non- addicts (thirty-three participants 17 males and 16 females)

Before taking the informed consent, the entire process used in the study and its investigational character was explained to the participants, research question: does addiction of the smartphones affect trunk muscles strength in normal adolescents? , hypothesis: null hypothesis there is no affection of smartphone addiction on trunk muscles strength in normal adolescents, isokinetic dynamometer was used for assessing their trunk muscles performance

Conformity criteria:

The subjects included in the study their ages were 17 and 18 years, and their BMI didn't exceed 25 to exclude any trunk muscles affection that may result from obesity (11,12), subjects were excluded if they had marked musculoskeletal disorder, any visual, auditory or neurological disorder, athletes also were excluded since their excessive strength could affect the sample's overall results.

Materials and procedure:

Smartphone addiction scale – short version (SAS-SV) was utilized to assign the subjects into two groups (Smartphone addiction group and control group), it benefited in determining the degree of addiction among subjects, it is formed of 10 questions of 6-point Likert scale where 1 represents strongly disagree and 6 represents strongly agree. The total score was determined through summing up the scores of all the items. It can be utilized to assess smartphone addiction in research settings and the scores range from 10 to 60, with 31 for boys and 33 for girls serving as the cutoff points [13], The Arabic edition of the SAS-SV, whose validity and reliability had been established [14] was used to make sure that participants understood every question in the questionnaire and its meaning.

The trunk module of HUMAC CSMI isokinetic dynamometer (HUMAC 2015 version: 15.000.0210 Computer Sports Medicine) was utilized for the procedure of evaluation, the subject was asked to stand on , After firmly stabilizing the tibial and thigh pads and adjusting the popliteal bad height behind the patient's popliteal fossa, we fastened the waist and chest belts, Each patient followed the identical protocol, which included a movement range from -10 to 70 degrees, while standing with their knees slightly bent [15] , the speed of 60 o / sec were used for the evaluation with five repetitions (since five repeats are typically performed at low speeds) [16] by assessing the following variables: peak torque/ body weight , agonist to antagonist ratio and time to peak torque , Four trials at the speed of 60o / sec were used for warming up and familiarization before the evaluation procedure [17].

Ethical review

This study was accepted by the ethical research committee, at the Physical Therapy faculty, Cairo university, Egypt, under the serial number P.T.REC/012/004453, also this research was registered at clinical trials with ID NCT06120738.

Sample size calculation:

The calculation process was done using the comparison of peak torque as a marker for muscle strength between smartphone addicts and non- addicts' adults. As reported in previous publication [18] the mean ± SD of peak torque in addicts' group was 133.4 ± 28.9 Nm, while in non-addicts group it was 147.7 ± 12.4 Nm. Using the pooled SD, we calculated that the least proper sample size was 33 participants in each group to be capable of rejecting the null hypothesis with 80% power at $\alpha = 0.05$ level using Student's t test for independent samples. The calculation of the sample size was performed using PS Power and Sample Size Calculations Software, version 3.1.2 for MS Windows (William D. Dupont and Walton D., Vanderbilt University, Nashville, Tennessee, USA).

Statistical analysis

The study involved an independent variable which is the tested groups that had two levels; addict group A and non-addict group B. I addition, the study involved three dependent variables which are peak torque, agonist-antagonist ration, and time till peak torque. Normality test of data using Shapiro Wilk's test was used, that reflect the data was normally distributed for measured variables scores, so parametric statistical tests in the shape of mixed design analysis of variance (MANOVA) were used to compare between the tested variables. SPSS for Windows was used for the statistical analysis, version 20 (SPSS, Inc., Chicago, IL). The alpha level was set at 0.05.

3. Results:

Demographic features of the subjects:

The mean + SD of age, weight and height of group A (addicts of smartphones) and group B (non-addicts) were explained in. (Table 1) which indicates lack of statistical significant difference

Table 1: Mean ±SD of age (in years), weight (in KG) and height (in CM) of the groups.

	Group A	Group B	t- value	p-value	Significance
Age (years)	17.85 ± 0.36	17.9± 0.29	-0.75	0.458	**NS**
Weight (kg)	59.27 ± 8.45	58.84 ± 6.42	0.23	0.816	**NS**
Height (cm)	167.58 ± 9.87	167.24 ± 9.59	0.14	0.890	**NS**

I Effect of addiction of smartphone on peak torque/ body weight

Trunk flexors

Comparing the mean and SD of peak torque /body weight of trunk flexors for groups A and B showed no statistical significant change between them as explained in (table 2).

Table (2): Mean values ±SD of trunk flexors and trunk extensors peak torque / body weight (expressed in N.m) of the two groups.

Peak torque (N.m)	Group A Mean ±SD	Group B Mean ±SD	Mean difference	f-value	P-value
Trunk flexors at 60°/s	185 ± 46	185.8 ± 49	-0.8	0.01	0.949
Trunk extensors at 60°/s	264.6 ± 82	277 ± 96	-12.4	0.33	0.568

Trunk extensors

Comparing the mean and SD of peak torque /body weight of trunk extensors for groups A and B showed no statistical significant change between them as explained in (table 2).

II- smart mobile addiction effect of on agonist to antagonist ratio:

Comparing the mean and SD of agonist to antagonist ratio for groups A and B showed no statistical significant change between them as explained in (table 3).

Table (3): Mean values ±SD of agonist and antagonist ratio at 60o /s of the two groups.

Agonist/ antagonist ratio	Group A Mean ±SD	Group B Mean ±SD	Mean difference	f-value	P-value
At 60°/s	75.7 ± 22	69.5 ± 20	6.2	1.39	0.243

III- smart phone addiction effect on time to peak torque:

A- Trunk flexors:

Comparing the mean and SD of time to peak torque of trunk flexors for groups A and B showed no statistical important difference between them as clarified in (table 4).

B- Trunk extensors:

Comparing the mean and SD of time to peak torque of trunk extensors for groups A and B showed no statistical significant difference between them as clarified in (table 4).

Table (4): Mean values ±SD of time to peak torque of trunk flexors and trunk extensors at 60o/s (expressed in seconds) of the two groups

Time to Peak torque (sec)	Group A Mean ±SD	Group B Mean ±SD	Mean difference	f-value	P-value
Trunk flexors at 60°/s	0.52 ± 0.2	0.47 ± 0.2	0.05	0.66	0.419
Trunk extensors at 60°/s	0.4 ± 0.15	0.37 ± 0.1	0.03	0.62	0.433

4. Discussion

This research was performed to assess the effect of smart mobile addiction on trunk muscles performance, according to the results there were no significant change in the tested variables in comparison between the two teams, this agrees with Hussien et al (2023) [19] who investigated the effect of smart mobile addiction on the thickness and cross section of lumbar muscles (multifidus and lumbar erector spinae) (which reflects strength) using the ultrasonography method, and the results showed no connection between addiction of smartphones and morphological changes of these muscles.

To date very little number of researches investigated the status of trunk muscles in case of smartphone addiction , on the contrary many studies was directed to investigate cervical area pathologies as a result of addiction of smartphone and almost all of them disagrees with our outcomes, [3,20] , these outcomes could be justified by the work of Alsalameh et al.(2019) [21] who discovered that cervical pain due to smartphone addiction is more common than the pain in the lower back among students which reflects that affection of cervical area could be more than lower back area

A gab of literature was found while investigating effect of smartphone addiction on trunk flexors, so we had to explore common problems with addiction of smartphone and relate it to trunk flexors, more than one study related the forward head posture to addiction of smartphone [22,23] , a postural problem like the forward head could result in inability of the abdominal muscles to recruit properly during their action [24] ,also because all the fascia of the body is connected, consideration should be taken about the trunk in neck pathologies as their fascia are connected together.

In a study conducted by Singh and Agarwal (2020) to investigate the effect of the posture of the neck on the abdominal muscles, it found that the strength of muscles of upper abdominal strength is related with forward head but no relation was detected between strength of lower abdominal muscles and forward head [25], also another study by Asgaonkar and Moharkar ,(2023) investigated trunk flexors and extensors strength in forward head postures and found correlation between forward head severity and trunk extensors strength [26] , both studies could be justified with our results that our subjects were having no musculoskeletal problems that could affect trunk flexors or extensors strength

Also the current results could be justified by the sample age (17 and 18 years) which could be not old enough to affect the strength, also the result could be affected by the degree of addiction as the scores of addicted participants could be considered moderately addicted and it is suggested by Fathalla,(2019) that higher scores of SAS SV indicates problematic use of smartphones [27]

A study was performed by Adachi et al, (2020)[28]. using EMG to assess rhomboidis major, upper , middle and lower trapezius, lumbar erector spinae and lumbar multifidus while using smartphones in poor postures, it showed higher activity of erector spinae of lumbar region and maltifidus and decreased activity in other muscles which could justify the outcomes of our studies as the performance of the back muscles didn't decrease than their peers from control group as lumbar erector spinae and multifidus are important for stabilization in poor positions

A close result was obtained by Choi et al, (2019) [29] who also used EMG to assess lower back muscles while walking with and without smartphones and it showed higher activity while using smartphone as lower back muscles may tend to exert extra activity to overcome slouchy posture that may occur while using smartphones

Another study was conducted by Yoon et al.(2015) [30] , who assessed the immediate impact of smart mobile usage while walking using treadmill on lumbar curvature and lumbar repositioning error (which indicates proprioception deficit) , he concluded that lumbar curvature is not changed however, he found that the repositioning error is higher after walking than before it, this could be justified by that the back muscle could undergone fatigue post walking (specially that the assessment was held immediately post walking and muscles didn't have time to rest) due to their high activity in trunk stabilization at the time of walking using smartphone as it was concluded in the above mentioned studies [28,29] , that study was contradicted by another study by Wahba et al (2019). [31] , which used the isokinetic dynamometer of biodex to assess proprioception in patients with chronic low back pain and it didn't find an association between use duration of smartphones and deficit of lumbar proprioception , this research was limited by the lack of relevant studies to support the results

5. Conclusion:

From the obtained outcomes, there is no evidence that smartphone addiction could affect the trunk muscles peak torque per body weight, agonist to antagonist ratio or time to peak torque among adolescents, However, these results cannot forbid us from raising awareness of its problematic use among people because of its numerous side effects.

6. Author's contribution:

AE: investigation, resources, data curation, writing original draft, visualization, funding acquisition, manuscript finalization

KO: methodology, data curation, supervision, project administration, manuscript finalization

HK: conceptualization, methodology, validation, data curation, writing – review and editing, supervision, project administration, manuscript finalization

HA: conceptualization, methodology, formal analysis, data curation, writing – review and editing, supervision, manuscript finalization

AS: conceptualization, review and editing, manuscript finalization

7. Funding:

This research did not have any funding from financing organizations in the public, commercial or not for profit sectors

REFERENCES

[1] Panova T, Carbonell X. Is smartphone addiction really an addiction? J Behav Addict. 2018;7(2):252-259.

[2] Abbasi GA, Jagaveeran M, Goh YN, Tariq B. The impact of type of content use on smartphone addiction and academic performance: Physical activity as moderator. Technol. Soc. J. 2021 Feb 1; 64:101521.

[3] Torkamani MH, Mokhtarinia HR, Vahedi M, Gabel CP. Relationships between cervical sagittal posture, muscle endurance, joint position sense, range of motion and level of smartphone addiction. BMC Musculoskelet Disord. 2023;24(1):61. Published 2023 Jan 23.

[4] Luqman A, Masood A, Shahzad F, Shahbaz M, Feng Y. Untangling the adverse effects of late-night usage of smartphone-based SNS among University students. BEHAV INFORM TECHNOL. 2021 Nov 18;40(15):1671-87.

[5] Hanphitakphong P, Keeratisiroj O, Thawinchai N. Smartphone addiction and its association with upper body musculoskeletal symptoms among university students classified by age and gender. J Phys Ther Sci. 2021;33(5):394-400.

[6] Jung KS, Jung JH, In TS, Cho HY. Effects of Prolonged Sitting with Slumped Posture on Trunk Muscular Fatigue in Adolescents with and without Chronic Lower Back Pain. Medicina (Kaunas). 2020;57(1):3. Published 2020 Dec 23.

[7] Duchene Y, Mornieux G, Petel A, Perrin PP, Gauchard GC. The trunk's contribution to postural control under challenging balance conditions. Gait Posture. 2021; 84:102-107.

[8] Freddolini M, Strike S, Lee RY. The role of trunk muscles in sitting balance control in people with low back pain. J Electromyogr Kinesiol. 2014;24(6):947-953.

[9] Habets B, Staal JB, Tijssen M, van Cingel R. Intrarater reliability of the Humac NORM isokinetic dynamometer for strength measurements of the knee and shoulder muscles. BMC Res Notes. 2018;11(1):15. Published 2018 Jan 10.

[10] A ZBM, S Z, Fz BS, Dg B, A C. iisokinetic trunk strength, validity, reliability, normative data and relation to physical performance and low back pain: a review of the literature. Int J Sports Phys Ther. 2020;15(1):160-174.

[11] Al-Shenqiti AM, Emara HA, Algarni FS, Khaled OA. Isokinetic trunk muscle performance in adolescents with different body mass indices. J Taibah Univ Med Sci. 2021;16(4):550-557. Published 2021 Apr 24.

[12] Pajoutan M, Mehta RK, Cavuoto LA. Obesity effect on isometric strength of the trunk extensors. InProceedings of the Human Factors and Ergonomics Society Annual Meeting 2016 Sep (Vol. 60, No. 1, pp. 943-947). Sage CA: Los Angeles, CA: SAGE Publications.

[13] Kwon M, Kim DJ, Cho H, Yang S. The smartphone addiction scale: development and validation of a short version for adolescents. PLoS One. 2013;8(12): e83558. Published 2013 Dec 31.

[14] Sfendla A, Laita M, Nejjar B, Souirti Z, Touhami AAO, Senhaji M. Reliability of the Arabic Smartphone Addiction Scale and Smartphone Addiction Scale-Short Version in Two Different Moroccan Samples. Cyberpsychol Behav Soc Netw. 2018;21(5):325-332.

[15] Park JH, Kim JE, Yoo JI, Kim YP, Kim EH, Seo TB. Comparison of maximum muscle strength and isokinetic knee and core muscle functions according to pedaling power difference of racing cyclist candidates. J Exerc Rehabil. 2019;15(3):401-406. Published 2019 Jun 30.

[16] Barczyk-Pawelec K, Piechura JR, Dziubek W, Rożek K. Evaluation of isokinetic trunk muscle strength in adolescents with normal and abnormal postures. J Manipulative Physiol Ther. 2015;38(7):484-492.

[17] Park S, Park S, Min S, Kim CJ, Jee YS. A Randomized Controlled Trial Investigating the Effects of Equine Simulator Riding on Low Back Pain, Morphological Changes, and Trunk Musculature in Elderly Women. Medicina (Kaunas). 2020;56(11):610. Published 2020 Nov 13.

[18] Bernard JC, Boudokhane S, Pujol A, Chaléat-Valayer E, Le Blay G, Deceuninck J. Isokinetic trunk muscle performance in pre-teens and teens with and without back pain. Ann Phys Rehabil Med. 2014;57(1):38-54.

[19] Hussin AM, AbdElmaged SF, El-Azizi HM, Ibrahim MM. Correlation Between Smart Phone Addiction, Back Functional Disability, Core Stability Muscles Endurance and Morphology in Young Adults. Muscles Ligaments Tendons J. 2023 Oct 1;13(4).

[20] So YJ, Woo YK. Effects of smartphone use on muscle fatigue and pain and, cervical range of motion among subjects with and without neck muscle pain. Phys. Ther. Korea".. 2014;21(3):28-37.

[21] Alsalameh AM, Harisi MJ, Alduayji MA, Almutham AA, Mahmood FM. Evaluating the relationship between smartphone addiction/overuse and musculoskeletal pain among medical students at Qassim University. J Family Med Prim Care. 2019;8(9):2953-2959. Published 2019 Sep 30.

[22] Daniel G, Negara AA, Juhanna IV, Tianing NW. The Relation Between Smartphone Use with Forward Head Posture Occurrence in Undergraduate Physiotherapy Student. Phys Ther. J Indonesia. 2022 Dec 15;3(2):44-8.

[23] Akodu A, Ipinnimo O, Osuntoki A. Effect of smartphone application on pain, disability and forward head posture on young adults with excessive usage of a smartphone: A pilot study. South Afr J Public Health. 2023;7(1): e1175-.

[24] Su JG, Won SJ, Gak H. Effect of craniocervical posture on abdominal muscle activities. J Phys Ther Sci. 2016;28(2):654-657.

[25] Singh M, Agarwal S. Effect of neck posture on abdominal muscle strength among university students. Phys Occup Ther J. 2020;13(1):22-28.

[26] Asgaonkar[1] B, Moharkar S. Relation of Trunk Muscles Strength and Endurance to Severity of Forward Head Posturein Young Adults: An Observational Study. National Editorial Board. 2023 Oct;17(4):25.

[27] Fathalla MM. Egyptian Validation of Smartphone Addiction Scale Short Version for Adolescents (SAS-SV). Int J of Psycho-Educ Sci. 2019 Dec;8(3):7-10.

[28] Adachi G, Oshikawa T, Akuzawa H, Kaneoka K. Differences in the activity of the shoulder girdle and lower back muscles owing to postural alteration while using a smartphone. J Med Invest. 2020;67(3.4):274-279.

[29] Choi S, Kim M, Kim E, Shin G. Low back muscle activity when using a smartphone while walking. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting 2019 Nov (Vol. 63, No. 1, pp. 1099-1102). Sage CA: Los Angeles, CA: SAGE Publications.

[30] Yoon JO; BHSc, Kang MH, Kim JS; BHSc, Oh JS. The effects of gait with use of smartphone on repositioning error and curvature of the lumbar spine. J Phys Ther Sci. 2015;27(8):2507-2508.

[31] Wahba MM, Youssef AR, OShokri D. The relationship between lumbar proprioception deficit and smartphone addiction in patients with chronic mechanical low back pain: A cross-sectional study. In: Proceedings of the 20th International Scientific Conference, Faculty of Physical Therapy. April 6-7, 2019; Cairo. Available at http://www.lib.pt.cu.edu.eg.