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The Dominance of Computer Workstation Ergonomics in School-Aged Students: A questionnaire-based study

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Abstract: Background: Computers in educational settings have been commonly used in the last few years. Correspondingly, a lot of musculoskeletal complications have been detected resulting from poor ergonomics. This study aimed to investigate the dominance of computer workstation ergonomics during educational sitting in preparatory and secondary school students. **Methods:** Three hundred students (175 males and 125 females) from preparatory and secondary schools of Elewaa official language school were included and asked to fill out a self-assessment questionnaire. The dominance of computer workstation ergonomics during educational sitting between students was collected along with demographic data. **Results:** A significant difference between males and females in all demographic data and low dominance of computer workstation ergonomics in an office chair, keyboard and mouse, work surface and accessory were detected while dominance of break between participants was noted. The hot desking part of the questionnaire was not applicable for all participants. **Conclusion:** The results emphasise the importance of addressing and prioritizing ergonomics to support students' physical health and academic success

Keywords: *computer workstation ergonomics, musculoskeletal complications, self-assessment checklist, physical health*

1. INTRODUCTION:

In recent years, the widespread use of computers in educational settings has significantly impacted the learning experience of school-aged students. As technology continues to advance, it becomes crucial to address the potential health implications associated with prolonged computer use, particularly in relation to workstation ergonomics (1). Ergonomics, the science of designing and arranging workspaces to optimize human well-being and performance, plays a vital role in ensuring the comfort and safety of individuals during computer-based activities (2).

Prolonged exposure to poor ergonomics in school-aged students can lead to a wide range of musculoskeletal complications. Improperly designed or poorly adjusted computer workstations can contribute to discomfort and strains on various parts of the body, including the neck, shoulders, back, and wrists. Students may experience neck and shoulder pain due to prolonged forward head posture and elevated shoulder positions while using computers. Inadequate back support and improper sitting posture can lead to lower back pain and spinal misalignment. Additionally, incorrect positioning of the hands and wrists, such as excessive wrist extension or deviation, can result in musculoskeletal disorders like carpal tunnel syndrome and repetitive strain injuries. These musculoskeletal complications not only cause discomfort but can also hinder students' concentration, productivity, and overall academic performance. Therefore, it is essential to address and prioritize proper ergonomics in school settings to mitigate the risk of musculoskeletal issues among school-aged students (3).

Musculoskeletal complications resulting from poor ergonomics in school-aged students can have a significant impact on their overall well-being and academic performance. Some of the complications that result from poor ergonomics includes: neck and shoulder pain (4), low back pain (5), wrist and hand issues (6), fatigue and reduced concentration (5,6).

Addressing these musculoskeletal complications requires a comprehensive approach to ergonomics in school settings (5). This includes providing adjustable furniture and equipment, promoting proper posture and ergonomic habits, encouraging regular breaks and physical activity, and raising awareness among students, teachers, and parents about the importance of maintaining healthy ergonomics during computer use (4,5). By prioritizing good ergonomics, schools can create a conducive learning environment that supports students' physical health and well-being, allowing them to thrive academically and reduce the risk of long-term musculoskeletal issues (5).

The appropriate use of computer in school age students can support their proper development (7). Ergonomic factors have a considerable impact on musculoskeletal discomfort, with specific complaints associated with particular defective ergonomics. Ergonomic considerations help alleviate neck, shoulder, and arm pain, while improved workstation design can avoid musculoskeletal problems (8). Mental Workload (MWL) is an important concept in ergonomics that focuses on determining how busy an operator is and the complexity of the activities they undertake (9).

Moreover, computer use in the office has increased steeply since the mid-1980s, with desktops, laptops, and tablets serving as critical tools for communication and project management. The COVID-19 pandemic has driven many workers to work from home, demanding ergonomic assessments with virtual technology. One study highlighted the need for ergonomic workstations, particularly in remote situations, to treat musculoskeletal complications and increase safety, especially in the context of virtual workstation evaluations (10). Furthermore, a survey of 146 employees and computer users from various nations discovered that the Self-Assessment Checklist was a useful tool for people working from home, helping them to maintain comfort, well-being, and safety, and optimize performance (11). Accordingly, this study aimed to investigate the dominance of computer workstation ergonomics among school-aged students and examine its impact on their health and well-being. Moreover, this study seeks to shed light on the current state of ergonomics in educational settings and its impact on student's physical and mental health.

2. RESEARCH QUESTION:

Is computer workstation ergonomics adequately addressed and prioritized in the school-aged student population?

3. METHODS:

3.1. Population:

Three-hundred students of preparatory and secondary schools from Ellewaa official language school were included.

3.1. Data collected:

Demographic data along with the questionnaire were collected.

3.2. Assessment questionnaire

Demographic data including weight, height and age were recorded. The questionnaire was completed for each student through the researchers. The Computer Workstation Ergonomics Self-Assessment Checklist (12) was designed to help individuals evaluate their workstation setup for optimal comfort and performance. The checklist consists of several items related to different aspects of ergonomics, including the office chair, keyboard and mouse, worksurface, breaks, accessories, laptop usage, and considerations for "hot desking" situations. For each item, the self-assessment checklist provides a series of questions to assess the current setup, along with suggested actions if improvements are needed. The questions are answered with "Yes," "No," or "N/A" (Not Applicable). After completing the checklist, individuals are encouraged to discuss any concerns or requirements with their Division of Occupational Health and Safety (DOHS) ergonomics specialist. The completed assessments were submitted to the DOHS ergonomics specialist for further evaluation and guidance. Scoring methods were not explicitly mentioned in the checklist. Instead, the focus was on identifying any areas that need improvement and taking suggested actions to address them. The checklist served as a tool to raise awareness and prompt individuals to consider various ergonomic factors in their workstation setup. By using this self-assessment checklist, individuals could identify potential areas of improvement and make necessary adjustments to their computer workstation ergonomics, ultimately promoting better comfort, performance, and overall well-being.

The response with yes to any question reflects the presence of computer work-station ergonomics so the total response with yes to the total responses reflects the dominance of computer work-station between participants.

3.2. Statistical analysis

The data was collected and analyzed using SPSS Version 18. Mean and standard deviation were calculated for continuous data. A frequency table was used to demonstrate males and females distribution through the sample as well as for the total response of the questionnaire. T-test was used to compare between both genders. P-value < 0.05 was considered significant.

3.6. Sample size calculation:

Based on the results of the previous study[11], use G-Power version 3.1.9.4 to calculate the sample size. χ^2 tests Variance: The difference from the constant (one sample case) was selected with an alpha error of 0.05 and a power of 0.95. Ratio var1/var0 of 0.6666667. The minimum sample size was calculated to be 162. Our sample includes 300 participants.

3.7. Ethics:

This study protocol has been approved by the Cairo University, Faculty of Physical Therapy, under the number (P.T.REC/012/003063). Parents' or guardians' informed consent was acquired.

4. RESULTS:

Table (1) and figure (1) illustrate the demographic data of our sample including weight, height and age and their distribution among males and females in this sample. Comparison between males and females found significant age difference (p-value=0.001), weight (p-value=0.001) and height (p-value=0.001).

Table 1: Demographic data

Variable	Gender (N)	Mean	St. dev.	p-value
Age	Males (175)	13.04	0.83	0.001
	Females (125)	14.6	1.55	
Weight	Males (175)	151.5	4.76	0.001
	Females (125)	154.78	2.97	
Height	Males (175)	43.43	6.85	0.001
	Females (125)	51.66	8.84	

St. dev.: standard deviation; P-value< 0.05 was considered significant

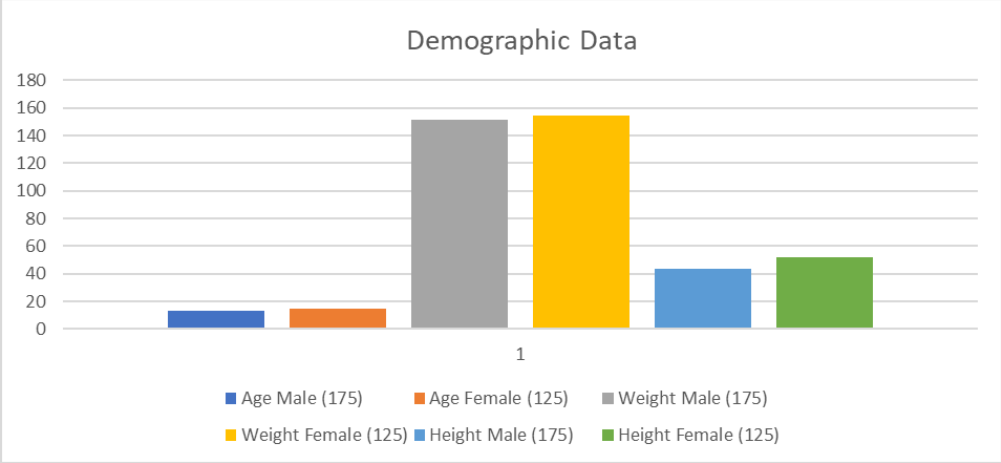

Figure 1: Demographic data of the sample comparison between male and female distribution

Table (2) and Figure (2) show the response of participants to the office chair part of the questionnaire which shows the percentage of yes responses was 22% 13.14% for male and 33.6% for female.

Table 2: Office Chair

Gender N (%)	Response		
	Yes N (%)	No N (%)	N/A N (%)
Males 175 (58.33)	115(13.14)	740(84.57)	20(2.29)
Females 125(41.67)	210(33.6)	390(62.4)	25(4)

N/A: not available

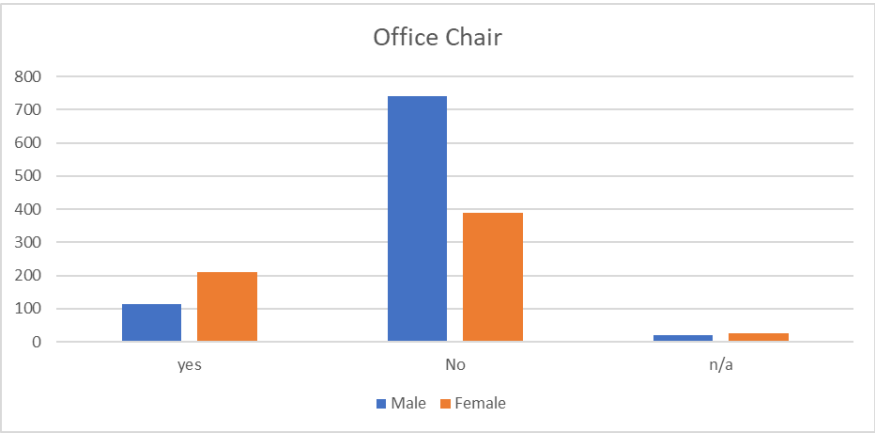

Figure 2: response to office chair part of the questionnaire

Table (3) and figure (3) show the response of participant to key board and mouth part of the questionnaire which shows the response with yes was 13.14% for males and 33.6% for females.

Table 3: Keyboard and mouse

Gender N (%)	**Response**		
	Yes N (%)	**No N (%)**	**N N (%)**
Male 175(58.33)	138(13.14)	888(84.57)	24(2.29)
Female 125(41.67)	252(33.6)	468(62.4)	30(4)

N/A: not available

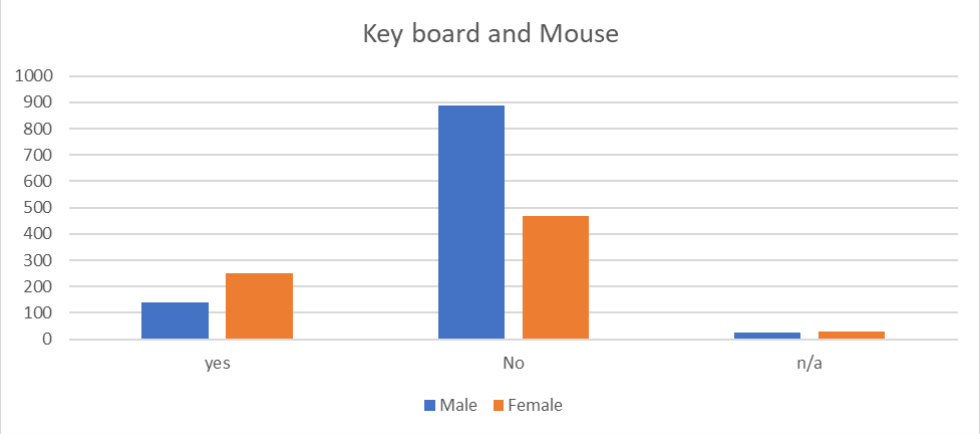

Figure 3: Keyboard and mouse

Table (4) and figure (4) illustrate the response of participants to the work surface part of the questionnaire which shows a percent of 13% for males and 34% for females.

Table 4: Work surface

Gender N (%)	**Response**		
	Yes N (%)	**No N (%)**	**N/A N (%)**
Males 175(58.33)	138(13.14)	888(84.57)	24(2.29)
Females 125(41.67)	252(33.6)	468(62.4)	30(4)

N/A: not available

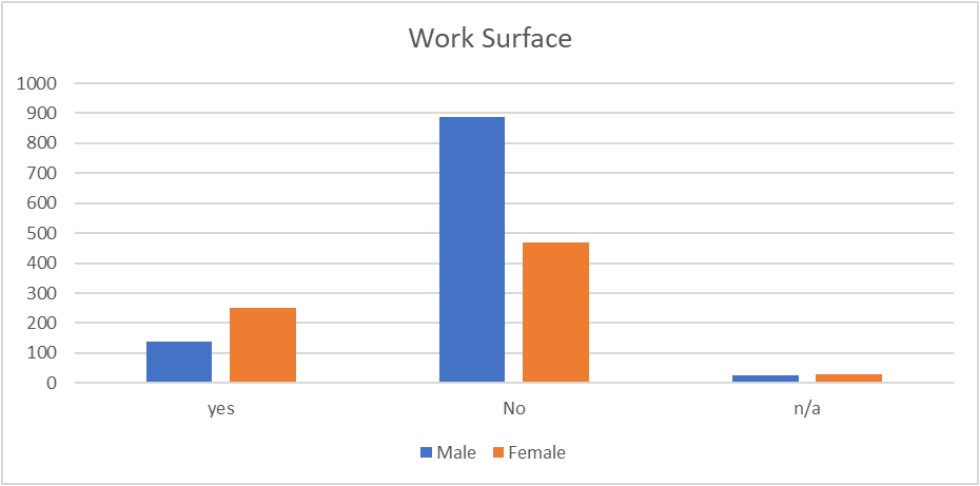

Figure 4: Worksurface

Table (5) and figure (5) show the response of participant to breaks part of the questionnaire which shows the percentage of response yes was 90% for males and 95% for females.

Table (5): Breaks

Gender N (%)	**Response**		
	Yes N (%)	**No N (%)**	**N/A N (%)**
Males 175 (58.33)	314 (89.7)	36(10.3)	0
Females 125(41.67)	237(94.8)	13(5.2)	0

N/A: not available

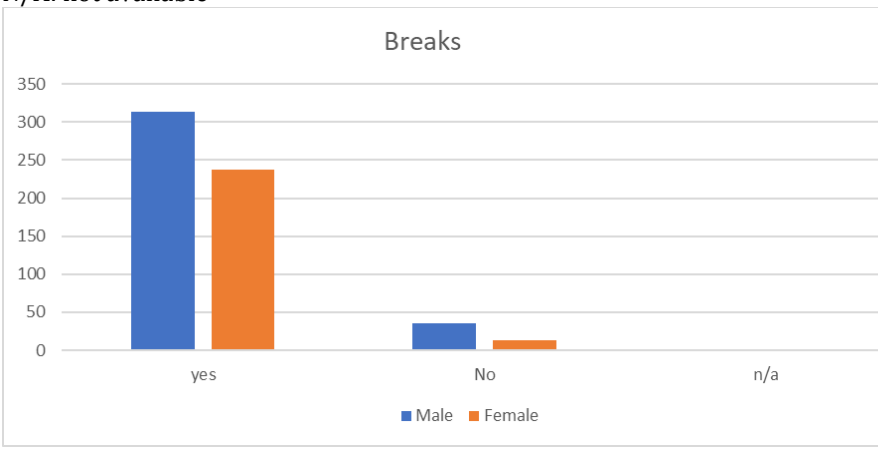

Figure 5: Breaks

Table (6) shows the response of participant to the accessories part of the questionnaire which shows the percent of total response with yes was 19.6% for males and 32.3% for females.

Table 6:Accessories

Gender N (%)	**Response**		
	Yes (%)	**No N (%)**	**N/A N (%)**
Males 175 (58.33)	103(19.6)	418(79.6)	4(0.8)
Females 125 (41.67)	121(32.3)	249(66.4)	5(1.3)

N/A: not available

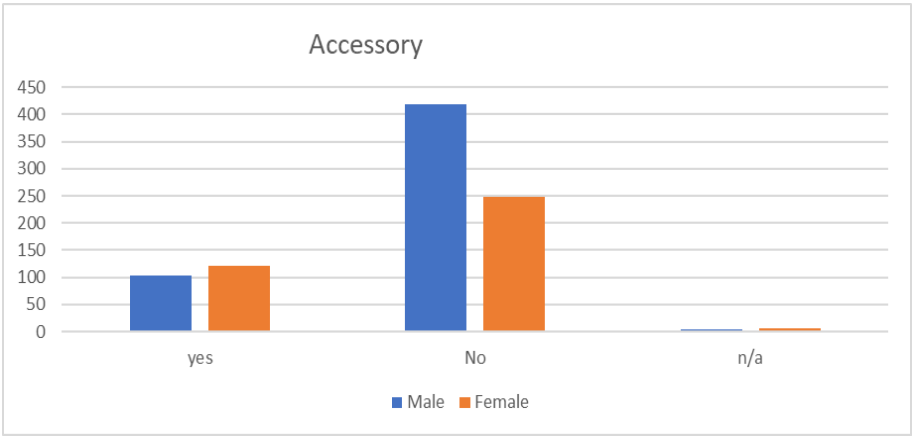

Figure 6: Accessory

Table (7) and figure (7) show the response of participant to hot desking part of the questionnaire which shows the percent of total response with yes 0% for males and 0% for females.

Table 7: Hot desking

Hot desking					
Gender	**Yes**	**No**	**N/A**	**Total**	**Yes/Total per cent**
Males	0	0	175	175	0
Females	0	0	125	125	0
Total	0	0	300	300	0

N/A: not available

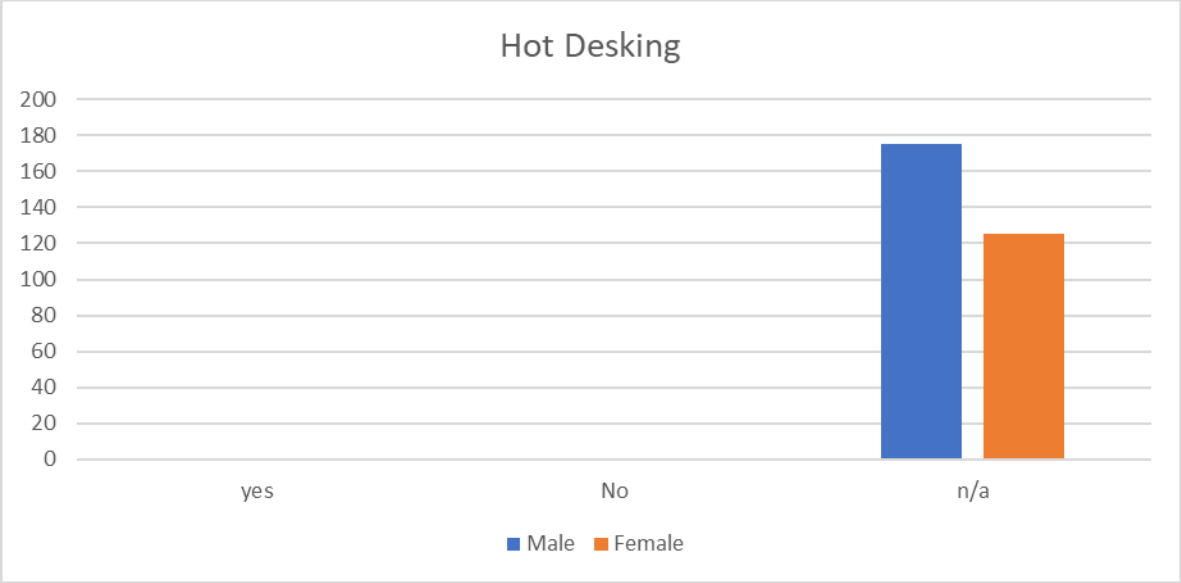

Figure (7): Hot Desking

5. DISCUSSION:

The dominance of computer workstation ergonomics was evaluated among school-aged students and examined its effects on their health and well-being (1). The widespread use of computers in educational settings has significantly impacted the learning experiences of students, making it crucial to address the potential health implications associated with prolonged computer use. Prolonged exposure to poor ergonomics can lead to musculoskeletal complications, including discomfort and strain on various parts of the body. These complications can hinder students' concentration, productivity, and overall academic performance (2).

This study utilized the Computer Workstation Ergonomics Self-Assessment Checklist (12) to evaluate the adequacy of computer workstation ergonomics in the school-aged student population. The checklist covers various aspects of ergonomics, such as office chair, keyboard and mouse, work surface, breaks, accessories, laptop usage, and considerations for "hot desking" situations choice of self-assessment tool to evaluate computer workstation ergonomics in alignment with the work of Emerson (10) Sarsak (11) and Murni (12).

The finding of the study revealed lower presence of response with yes which reflects the dominance of computer workstation ergonomics among school-aged students. For breaks, only high dominance of computer workstation ergonomic was detected while for the hot desking part of the curve, it was not applicable between students of secondary schools.

The findings of the study indicate that there was room for improvement in addressing computer workstation ergonomics among school-aged students and this agrees with the of Bergqvist (1), Punnett and Bergqvist (2) Kraemer (3), Gheysvandi (4), Atia (5), and Abd Elmoneem (6). These findings highlight the need for comprehensive interventions to promote proper ergonomics in school settings. Addressing musculoskeletal complications require a comprehensive approach to ergonomics in educational settings. The data from the questionnaire responses showed that a significant percentage of participants, both males and females, reported different issues related to office chair, keyboards and mice, work surface, breaks, and accessories as noted difference between males' and females' response to self-assessment questionnaire with higher dominance of ergonomics between females compared to males. (13)

6. Conclusion:

This research highlights the importance of addressing computer workstation ergonomics among school-aged students to mitigate the risk of musculoskeletal issues and improve their overall well-being and academic performance. The findings emphasize the need for interventions and awareness campaigns to promote proper ergonomics in educational settings. By implementing comprehensive strategies, schools can create a healthier and more productive learning environment for students.

7. DECLARATIONS

Author Contributions: The authors of this research paper, Taher Salah El-Din Taha, Mohammed Elsayed, Shymaa Mahmoud Maaty, Ehab Ali Abdallah, and Osama Yassin, have made equal contributions to the study. Each author has played a crucial role in the design, data collection, analysis, and interpretation of the findings. Taher Salah El-Din Taha, as the corresponding author, has provided valuable guidance and oversight throughout the research process. Mohammed Elsayed, Shymaa Mahmoud Maaty, Ehab Ali Abdallah, and Osama Yassin have actively participated in the literature review, data collection, and analysis phases. The authors have collaborated closely, sharing their expertise and perspectives, to ensure the accuracy and validity of the study's outcomes. Together, their collective efforts have led to the comprehensive understanding of computer workstation ergonomics among school-aged students and its impact on their health and well-being.

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Data Availability Statement: The data collected and analyzed for this research paper are available upon request from the corresponding author, Taher Salah El-Din Taha (taher.taha@muc.edu.eg). Due to privacy and ethical considerations, access to the data is subjected to approval from the relevant institutions and may require appropriate agreements regarding data protection and confidentiality. Requests for data access will be reviewed on a case-by-case basis to ensure adherence to ethical standards and legal requirements. The authors are committed to promoting transparency and scientific rigor and are willing to share the data with interested researchers, subject to the necessary permissions and safeguards

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Conflicts of Interest: The authors declare no conflicts of interest related to this research paper on computer workstation ergonomics among school-aged students. We affirm that the study was conducted objectively and without any external influence that could compromise the integrity or impartiality of the findings. Our primary goal is to contribute to the scientific community and promote the well-being of students through accurate and unbiased research. The authors have no financial, personal, or professional interests that could potentially impact the objectivity of the study or its outcomes. We are committed to maintaining transparency and ensuring the highest standards of scientific integrity throughout the research process.

8.References:

1. Bergqvist U, Wolgast E, Nilsson B, Voss M. The influence of VDT work on musculoskeletal disorders. Ergonomics. 1995 Apr;38(4):754–62.
2. Punnett L, Bergqvist U. Visual display unit work and upper extremity muscoloskeletal disorders: a review of epidemiological findings. Solna: Arbetslivsinstitutet; 1997. 161 p. (Arbete och hälsa).
3. Kraemer K, Moreira MF, Guimarães B. Musculoskeletal pain and ergonomic risks in teachers of a federal institution. Rev Bras Med Trab. 2020;18(03):343–51.
4. Gheysvandi E, Dianat I, Heidarimoghadam R, Tapak L, Karimi-Shahanjarini A, Rezapur-Shahkolai F. Neck and shoulder pain among elementary school students: prevalence and its risk factors. BMC Public Health. 2019 Dec;19(1):1299.
5. Atia D, Elsayed N, Abdelmonem A, Mahmoud S, Mahmoud M, Mohamed K, et al. Prevalence of Musculoskeletal Disorders among General and Technical Secondary School Students in Egypt. IJERPH. 2023 Jan 13;20(2):1465.
6. Abd Elmoneem Elsayied H, Amin Sayed M. Occupational Health Program for High Risk of Musculoskeletal Pain among Primary School Teachers. Egyptian Journal of Health Care. 2017 Jun 1;8(2):270–85.
7. Straker L, Maslen B, Burgess-Limerick R, Johnson P, Dennerlein J. Evidence-based guidelines for the wise use of computers by children: physical development guidelines. Ergonomics. 2010 Apr;53(4):458–77.
8. Sauter SL, Schleifer LM, Knutson SJ. Work posture, workstation design, and musculoskeletal discomfort in a VDT data entry task. Hum Factors. 1991 Apr;33(2):151–67.
9. Young MS, Brookhuis KA, Wickens CD, Hancock PA. State of science: mental workload in ergonomics. Ergonomics. 2015;58(1):1–17.
10. Emerson S, Emerson K, Fedorczyk J. Computer workstation ergonomics: Current evidence for evaluation, corrections, and recommendations for remote evaluation. Journal of Hand Therapy. 2021 Apr;34(2):166–78.
11. Sarsak HI. Working from home: Self-assessment computer workstation set-up. World Federation of Occupational Therapists Bulletin. 2022 Jan 2;78(1):59–66.
12. Murni IP, Ardiyanto A. Cross-cultural adaptation and reliability assessment of the Indonesian version of the Computer Workstation Ergonomics: Self-Assessment Checklist. Work. 2024;77(2):711–7.
13. Christensen SWM, Palsson TS, Krebs HJ, Graven-Nielsen T, Hirata RP. Prolonged slumped sitting causes neck pain and increased axioscapular muscle activity during a computer task in healthy participants - A randomized crossover study. Appl Ergon. 2023 Jul;110:104020.