

# Ergonomic Evaluation of Workstation of University Administrative Staff in Rawalpindi and Islamabad



Shanza Fatima<sup>1</sup>, Afnan Farooqi<sup>1</sup>, Aroosa Fazal<sup>1</sup>, Rukhma Zaheer<sup>1</sup>, Zara Khalid<sup>1</sup>, Anam Rehman<sup>1</sup>

## Abstract

**Background:** Workstation ergonomic designs, if inappropriate, can lead to exposure to risk factors of work-related musculoskeletal disorders. The objective of this study was to evaluate workstation ergonomic risk factors of university administrative staff.

**Methods:** A descriptive cross-sectional study was conducted on administrative staff workers in the universities of Rawalpindi and Islamabad from July 2021- June 2022. Nonprobability convenient sampling was employed to recruit a sample size of 351 university admin staff employees aged 20 to 60 years, both male and female, who work on computer for 6-8 hours. Data was collected through a self-structured demographic form and Rapid Office Strain Assessment (ROSA) tool. Data was entered and analyzed on SPSS v.21. The results were expressed as descriptive statistics and reported in averages. The qualitative variables were reported as frequencies and percentages.

**Results:** The study comprised of 107 (30.5%) females and 244 (69.5%) males with a mean age of  $34.80 \pm 9.118$  years. Results showed that the mean total ROSA score was  $6.07 \pm 1.195$ . Categorizing the risk level, 242 (68.9%) fell in high risk and only 30 (8.5%) were classified in low-risk and those in the warning zone were 79 (22.5%). The highest at risk score was observed for keyboard and lowest for chair height of workstation. Total ROSA score was highest in administrative accounts department with a mean of  $6.47 \pm 1.080$ .

**Conclusion:** The university administrative staff were at considerably higher risk of developing work-related musculoskeletal disorders due to poor ergonomic computer workstations. The highest score was observed for keyboard placement, followed by back support. Moreover, individuals working in the administrative accounts department were at the highest ergonomic risk.

**Keywords:** Ergonomics, musculoskeletal disorders, university

<sup>1</sup> Foundation University College of Physical Therapy, Foundation University Islamabad

**Correspondence:**  
Shanza Fatima  
shanzaniazi90@gmail.com

## Introduction

A computer workstation is described as an ergonomically designed area that accommodates a desktop computer and all of its peripherals (1). As the workplace is regularly updated by introducing technological advances in knowledge and communication, a change in the worker's work style and professional practice has also been observed. Inappropriate conditions related to computer work usually result in the development of musculoskeletal disorders, which include injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. Whereas work-related musculoskeletal disorders (WMSD) are conditions in which there is a significant contribution of the work environment in the development of the condition and/or the extended time duration of work contributes to the progressive worsening of symptoms. These are regarded as considerable issues of work related health problems and are also related significantly to workplace ergonomics (2, 3).

The International Ergonomics Association (IEA) defines ergonomics as a discipline that deals with the understanding of the relationship and interaction between workers and other elements of the working environment. It has three different domains including physical, organizational and cognitive ergonomics. The physical domain covers elements related to physical activity like, human anatomy, anthropometry, physiological and biomechanical characteristics. This domain consists of work related settings and equipment, for instance keyboard, mouse, hand tools, workstations, visual display units (VDUs) and lighting that are fitted according to the workers. The organizational domain deals with the development of socio-technical systems, as well as the organizational structures, policies and processes; for example work pace, work-rest cycle and worker' decision making and participation capacity. The cognitive domain is concerned with mental processes, like perception, motor response, memory and reasoning (4).

Ergonomic principles house a broad spectrum of work related factors that facilitate employers to make the right fit, i.e. to shape the work per employee's requirements instead of forcing the worker to change according to the job. Neglecting proper ergonomics increases the probability of developing several musculoskeletal disorders (MSDs), like lower back pain and so forth (5). Many studies have shown the associations between computer work and MSDs, with 12-month prevalence rates of MSDs in the neck being 55–69%, back 31–54%, and upper extremities 15–52% (3). An association is also observed in sitting computer workstations with non-neutral shoulder posture and increased muscle activity in shoulder region (6). Additionally, the vertical level of the monitor is also seen as an indirect risk factor related to neck pain (7).

While designing workstations, the physical and psychosocial factors must be assessed in order to boost efficacy. Symptoms like pain, numbness and tingling in numerous body regions like wrists, shoulders, back and legs and eyestrains occur because of improper seating, lack of breaks throughout work and improper viewing distance. Workplace organization, correct seat height, a good working posture, proper usage of armrest and backrest, straight alignment of the wrist and elbow and their positions while typing may play a role in avoiding countless musculoskeletal complaints (8).

This holds especially true for office workers in whom long operating hours and continuous sitting at a table on daily basis routines demands such a workstation which ensures the worker's safety, comfort and total well-being (9). It is observed that over three-fourths of the waking hours of sedentary workers is spent sitting with half of the sitting time accompanied by screen usage. Women are considered more sedentary than men, thus putting them at higher risk of developing work-related health problems (10).

Although vital to most enterprises and companies, ergonomics is still a newly introduced construct in Pakistan. Due to this lack of general awareness regarding ergonomics, most of the time work-related health and safety is neglected and therefore, resentfully takes a backseat. Owing to the lacking in organizational systems and absence of awareness among the staff as well as employers, cases of work-related problems and injuries usually go unrecognized and unreported. The employees are not completely knowledgeable regarding their rights, and have very small information relating to workstation ergonomics and are hence not trained to face or manage most occupational hazards that have a possible effect on their health (8). Since data regarding ergonomic workstation evaluation for MSD risk factors in Pakistan is limited, hence this study was conducted to evaluate the workstation ergonomic risk factors in administration offices of universities located in Rawalpindi and Islamabad.

## Methodology

A descriptive cross-sectional study was conducted over a duration of 1 year from July 2021 to July 2022. Ethical approval for the study was obtained from IRC Foundation University Islamabad. Data was collected from administrative staff of various universities located in Rawalpindi and Islamabad after taking permission and

approvals from the concerned authorities of the universities. Sample size was calculated using Raosoft, with a population size of 4050, keeping 95% confidence interval, 5% margin of error and 50% response rate, which came out to be 351 participants. Non-probability purposive sampling was employed. The inclusion criteria comprised of university administration staff aged 20 to 60 years, both males and females and those office workers using computers for 6-8 hours per day, whereas individuals using assistive devices/equipment or those with major neuromuscular disorders were excluded from the study.

We clarified the purpose of our study to the participants including its significance and took informed consent from each individual. A self-structured demographic form was filled by the participants, followed by their workstation evaluation using Rapid Office Strain Assessment Tool (ROSA). It is a picture based posture checklist used to quantify the hazards associated with the use of computers in a workplace, and suggest a certain degree of changes based on the risk associated with work. The highest score being 10 indicates an increased risk of work related musculoskeletal disorders. ROSA tool has a score sheet which comprises of four sections. It is subdivided into seat pan height and depth, phone and monitor, backrest and armrest and keyboard and mouse. The results of the chair subsection and the peripherals subsection (including phone, keyboard and mouse) are then compared. These estimates are obtained by adding values of identified risk factors. A score greater than 5 indicates that the assessment of workplace is of higher risk and measures for ergonomic improvement must be taken. Final score of 5 can be used as an action level to indicate when an immediate change is required. This tool is a reliable means for risk factor identification related to complaints and discomfort when using computers. High inter and intra-observer reliability (ICC of 0.88 and 0.91, respectively) have been exhibited by ROSA final scores. Photographs of the workstations were also recorded and confidentiality of the participants was maintained during whole procedure (11).

### Data Analysis Procedure:

Data was entered and analyzed on SPSS (Statistical Package of Social Sciences) v.21.0. Quantitative variables were reported in the form of mean and SD. Qualitative variables were reported in the form of frequencies and percentages. The results of ergonomic risk factors of workstations were expressed as descriptive statistics and reported in the form of averages.

## Results

In this study the gender distribution was 107 (30.5%) females and 244 (69.5%) males. Administrative staff workers from 9 universities of Rawalpindi & Islamabad participated in this study. Furthermore, Participants included in the study were from various departments of universities, among which 143 (40.7%) belonged directly to administration, 90 (25.6%) were from student affairs, 58 (16.5%) from accounts department, 35 (10.0%) from exam cell and 25 (7.1%) from finance department.

The mean score for total working days per week was  $5.09 \pm 0.37$  days/week, whereas the mean for total working hours per day on computer was  $7.11 \pm 1.69$  hours/ day. The average total working hours per day were  $8.16 \pm 1.67$  hours/ day.

The workstation evaluation of ergonomic risk of admin employees through ROSA tool showed that the level of risk of developing WRMSD due to workstations, 242 (68.9%) fell in high risk and only 30 (8.5%) were classified in low-risk and 79 (22.5%) were at the warning zone. (Figure 1)

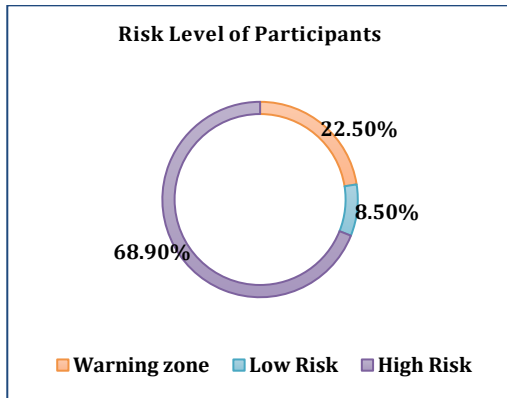


Figure 1: Risk of developing WRMSD based on workstation evaluation

The mean ROSA score of the individual sections of workstations was as follows: chair height of participants (1.99±0.92), pan depth (2.58± 0.61), arm rest (3.11± 0.88), back support (3.49± 0.77) distance and height of monitor (3.44± 1.17), telephone (2.09± 1.20), mouse (3.48± 0.86) and keyboard (3.86± 1.40). Overall, the highest score was observed for keyboard and lowest for chair height of workstation. (Table 1)

Table 1: ROSA scores of individual sections of workstations

Workstation sections	Mean Score	Std. Deviation
Chair height	1.99	0.92
Pan depth	2.58	0.61
Arm rest	3.11	0.88
Back support	3.49	0.77
Monitor position	3.44	1.17
Telephone position	2.09	1.20
Mouse position	3.48	0.86
Keyboard position	3.86	1.04

Additionally, Almost half (50%) of the participants complained of work related pain and discomfort while half of them did not experience any such problems. Out of the 175 (49.9%) individuals who reported pain or discomfort in any body region, majority i.e. 72 (20.5%) individuals were experiencing low back pain, followed by shoulder pain in 42 (12.0%) and neck pain in 37 (10.5%) subjects. Pain or discomfort was also reported in eyes by 10 (2.8%) individuals. (Figure 2)

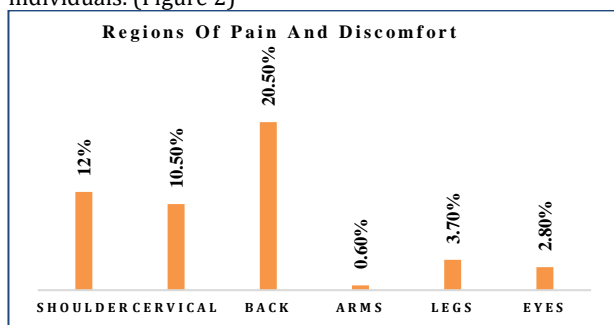


Figure 2: Regions of pain and discomfort among participants

A significant relationship was observed in development of WRMSDs and BMI of the participants. As per the categories of BMI, the frequency (%age) of subjects in underweight category was 44 (12.5%), in healthy weight was 189 (53.8%). Around 88 (25.1%) participants were lying in over weight category whereas 30 (8.5%) were classified as obese subjects. The ergonomic risk score was highest among obese participants having BMI (30.0-34.9) and mean ROSA score was 6.13±1.33.

Among individual departments functioning in universities, total ROSA score was found to be the highest in workstation of individuals working in accounts department with mean of 6.47±1.08. Workstations of subjects in examination departments had lowest mean ROSA scores of 5.91±1.24. (Table 2)

Table 2: Workstation evaluation scores among various departments in universities

Department	Mean ROSA score	SD	Risk levels
Student affairs	5.97	1.10	Warning zone - high
Accounts	6.47	1.08	High
Finance	6.00	1.29	High
Exam Branch	5.91	1.24	Warning zone- high
Administration staff	6.03	1.24	High

Accounts department depicted higher score as their ergonomic risk score for chair was 6.33±1.20 which was higher than the other departments, and the lowest chair score was of student affairs i.e. 5.59±1.44. Monitor and peripherals position score for finance department was highest that was 5.48±1.38 and lowest risk score was observed for exam department which was 4.17±1.20.

Table 3: ROSA chair and monitor & peripherals score with respect to departments

Department	Chair score Mean ± SD	Monitor & Peripherals Mean ± SD
Student affairs	5.59 ± 1.44	5.08±1.15
Accounts	6.33±1.20	5.16±1.37
Finance	5.76±1.30	5.48±1.38
Exam Branch	5.86±1.28	4.17±1.20
Administration staff	5.76±1.35	4.95±1.45

### Discussion

This descriptive cross-sectional study was conducted among the university administrative staff to determine the ergonomic risk factors of workstations in offices of university staff.

In this study, workstations of university administrative staff were evaluated using Rapid Office Strain

Assessment (ROSA) tool, the results of which showed that 68.9% of the participants were at high risk (ROSA total score > 5) of developing MSDs, almost 22.5% of the individuals required immediate changes (ROSA total score= 5) in their workstations as a precaution, whereas only 8.5% of the participants fell under the low-risk category (ROSA total score < 5). In accordance with our results, a study by Umar A. et al. in 2019 conducted on bank employees in Faisalabad, reported that nearly 90% of the participants had ROSA scores greater than 5 showing that majority of the sample was at higher risk of ergonomic hazards (12). In contrast to our results, a study conducted by Hagshenas B. et al in 2018 among the office staff of a communication service company in Tehran showed that 24% of their subjects were at high risk, 29.25% were at low risk of developing MSDs, and 45.8% of the participants required immediate change and improvements in workstations (13). These differences could be due to the fact that the office setups in cities of Pakistan might not be as ergonomically efficient as those of Iran. Moreover, most of the participants in our study were deprived of comfortable chairs and/or workspace. Similarities such as prolonged sedentary sitting posture and computer usage among the administrative staff of our study and bank employees of aforementioned study depict homogenous work environments (12).

On the evaluation of workstations, the results of current study found the mean total ROSA score to be 6.0, with an average chair score of 5.0, and monitor and peripherals score of 4.0. The interpretation of which was that in a complete workstation, mostly the chairs were poorly designed ergonomically, ultimately placing the individuals at higher risk of developing discomfort. A study by Kahya E. et al in 2021 on workstations of employees in the manufacturing sector showed contrasting results; the ROSA score was 3, the average chair score was 3.30, and the mean monitor and peripherals score was 2.18. The differing results of both the studies can be explained based on the differences in the nature of jobs of both populations. Our study focused on university admin staff who work for prolonged hours on desktop computer workstations, while the above-mentioned study targeted manufacturing sector employees (14).

The ROSA score of individual sections in our study shows that the highest scores are in the keyboard section followed by back support, mouse, and finally, the monitor section revealing that the wrist, the back, and the neck are at higher risk of MSDs than other regions of the body. This is supported by results from a study conducted by Arya N. et al in 2020, who found that majority of the employees had chairs that did not have adequate lumbar supports, leading to pain in the lower back of the workers. The absence of palm support on the keyboard surface caused pain in the wrist and palm of the hand of the employees. More than half of the employees reported that the armrest was poorly designed. It was also observed that the majority of the subjects worked in a slightly bent posture with a forwarded neck for long hours, which lead to pain in the upper extremities of the body (15). Another study suggested that computer usage for prolonged duration affects the body adversely and may give rise to development of postural abnormalities such as forward-head posture, rounded shoulders and, kyphosis in the thoracic spine (upper). Changes in the neck range of

motion and muscle endurance of the area have also been observed (7). The results of another study stated that prolonged sustained static and awkward postures, non-ergonomic design of chair, keyboard and mouse placement and non-availability of foot rest were the most common causes of musculoskeletal issues faced by office workers (16).

It is a well-established fact that occupational dangers exist due to a high prevalence of lack of safety measures awareness, and bad ergonomics in the work environment. The performance of a task without the ergonomic consideration, leads to the catalysis of different types of stress, which has a hazardous influence on employees' normal physiology and anatomy (17). According to our study results, about 49.9% of the participants complained of pain and discomfort due to their job nature while 50.1% stated that their work was not a cause of any pain and discomfort. A study on Turkish office workers who were also computer users, reported that about 82.7% of the subjects complained of work-related pain and discomfort. The results indicated that sedentary work has a positive correlation with the development of work-related MSDs (18).

Advancing towards the common regions of pain and discomfort among the participants in the current study, majority complained of backache followed by pain and discomfort in shoulder and neck region. These results are in accordance with a study by Basakci C. et al., which indicated that the commonest areas of complaints in subjects using desktop computers were the upper back, neck, lower back, and shoulder. The study also highlighted that pain in these regions had a negative impact on ADLs (19). Another recent study shows a comparison between academic employees and administrative workers. It was found that the administrative employees were 2.5 times more at risk of developing lower back pain than employees of other job nature. A possible reason for these observations may be that employees of other departments have greater chances of taking postural breaks than computer workers (20). Hence, back and the neck are the most susceptible prime areas for developing MSDs especially if the occupation is of sedentary nature and involves prolonged computer usage and poorly designed workstations. Moreover, literature shows that MSDs resulting from the increased workload leads to job restrictions, reduced working time, loss of quality and productivity (21).

The results of current study also showed that the average working days per week of university administrative staff were 5 days, and the average time spent by staff on computers/desktop was approx. 7-8 hours per day. A study by Kaya et al on Turkish office workers also reported the average working days to be 5 and total working hours to be about 8 hours (18). It has been established from literature that individuals who use computers for more than 6 hours are at a risk of developing musculoskeletal problems (22). Similar results were observed by Chandwani A. et al in corporate office workers. In addition, prolonged working hours, with awkward and uncomfortable postures at workstations and without taking proper rest breaks puts the workers at risk of developing MSDs (16).

Researches also confirm that the work environment is not the sole factor that affects the presence

of musculoskeletal disorders; individualized anthropometric characteristics such as age, gender, and BMI are also significant contributors (17). Our study showed that ROSA scores of workstations of obese individuals (BMI  $\geq$  30 kg/m<sup>2</sup>) was the highest, while workstations of underweight individuals (BMI  $\leq$  18.5 kg/m<sup>2</sup>) scored the lowest. Studies claim that there is a significant association between BMI and musculoskeletal discomfort and occupational stress (23). Additionally, a previous study shows that a BMI of  $>$ 25 kg/m<sup>2</sup> (overweight) has an association with the development of MSDs, especially in the areas of the low back which is consistent with other epidemiological studies (17). Furthermore, on gender comparison this study shows that females are general more prone to WRMSDs than males. These results show that individual characteristics do influence an individual's posture, hence, prolonged sitting hours indeed have significant effects on overweight employees; this also leads to lower comfort levels and reduced productivity in the workers (24).

Furthermore, it was observed that the workstations of the accounts department scored the highest on the ROSA evaluation, whereas the exam cell workstations scored the least, although all department's scores indicate immediate changes as most fall under the high-risk category. Studies show that complaints of work-related discomfort and development of MSDs is quite common in accountants (25), and computer-operating workers (IT department). The results indicate a causal relationship between computer workers of different departments of university administrative staff and complaints of discomfort, and musculoskeletal disorders (26).

## Conclusion

This study demonstrated that the university administrative staff were at considerably higher risk of developing MSDs due to poor ergonomic computer workstations. The highest risk score was observed for keyboard placement and lowest for chair height of workstation. Departmental screening of workstations further revealed that individuals working in accounts department were seen to have the highest ergonomic risk, with backache being the most common complaint of the participants.

## References

- Asaolu AO, Itsekor V. Ergonomic computer workstation considerations for library staff. *International Journal of Academic Library and Information Science*. 2014;2(3):22-6.
- Bernard BP, Putz-Anderson V. Musculoskeletal disorders and workplace factors; a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. 1997.
- Rodrigues MSA, Leite RDV, Lelis CM, Chaves TC. Differences in ergonomic and workstation factors between computer office workers with and without reported musculoskeletal pain. *Work*. 2017;57(4):563-72.
- Hoe VC, Urquhart DM, Kelsall HL, Zamri EN, Sim MR. Ergonomic interventions for preventing work-related musculoskeletal disorders of the upper limb and neck among office workers. *Cochrane Database of Systematic Reviews*. 2018(10).
- Zaheer A, Khalid R. Ergonomics: A work place realities in Pakistan. *International Posture Journal of Science & Technology*. 2012;2(1).
- Lin MY, Barbir A, Dennerlein JT. Evaluating biomechanics of user-selected sitting and standing computer workstation. *Applied ergonomics*. 2017;65:382-8.
- Paksaichol A, Lawsirirat C, Janwantanakul P. Contribution of biopsychosocial risk factors to nonspecific neck pain in office workers: a path analysis model. *Journal of occupational health*. 2015;57(2):100-9.
- Khan R, Surti A, Rehman R, Ali U. Knowledge and practices of ergonomics in computer users. *JPMA-Journal of the Pakistan Medical Association*. 2012;62(3):213.
- Bokhary K. Impact of Amblyopia Treatment on Vision-Related Quality Of Life. *Optom open access*. 2016;1:e104.
- Baye MY. Sedentary behaviour among urban civil servants in eastern part of Southern Nations, nationalities and peoples' region, Ethiopia. *BioMed Research International*. 2021;2021.
- Chowdhury N, Aghazadeh F, Amini M. Ergonomic assessment of working postures for the design of university computer workstations. *Occupational Ergonomics*. 2017;13(S1):37-46.
- Umar A, Kashif M, Zahid N, Sohail R, Arsh A, Raqib A, et al. The prevalence of musculoskeletal disorders and work-station evaluation in bank employees. *Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin*. 2019;29(02):99-103.
- Haghshenas B, Habibi E, Haji Esmaeil Hajar F, Ghanbary Sartang A, van Wijk L, Khakkar S. The association between musculoskeletal disorders with mental workload and occupational fatigue in the office staff of a communication service company in Tehran, Iran, in 2017. *Journal of Occupational Health and Epidemiology*. 2018;7(1):20-9.
- Kahya E. Assessment of musculoskeletal disorders among employees working office workplaces in the manufacturing sector. *Work*. 2021;69(3):1103-13.
- Arya N, Kwatra S. Workstation assessment and suggestions to optimize comfort level for banks employees in Udham Singh Nagar district. *Pharma Innov J*. 2020;9(8):96-101.
- Chandwani A, Chauhan M, Bhatnagar A. Ergonomics assessment of office desk workers working in corporate offices. *IJHSR*. 2019;9(8):367-75.
- Shariat A, Cardoso JR, Cleland JA, Danaee M, Ansari NN, Kargarfard M, et al. Prevalence rate of neck, shoulder and lower back pain in association with age, body mass index and gender among Malaysian office workers. *Work*. 2018;60(2):191-9.
- Kaya Aytutuldu G, Birinci T, Tarakci E. Musculoskeletal pain and its relation to individual and work-related factors: a cross-sectional study among Turkish office workers who work using computers. *International Journal of Occupational Safety and Ergonomics*. 2022;28(2):790-7.
- Basakci Calik B, Yagci N, Oztop M, Caglar D. Effects of risk factors related to computer use on musculoskeletal pain in office workers. *International Journal of Occupational Safety and Ergonomics*. 2022;28(1):269-74.
- Shahwan BS, D'emeh WM, Yacoub MI. Evaluation of computer workstations ergonomics and its relationship with reported musculoskeletal and visual symptoms among university employees in Jordan. *International Journal of Occupational Medicine and Environmental Health*. 2022;35(2).
- Khandan M, Vosoughi S, Poursadeghiyan M, Azizi F, Ahounbar E, Koohpaei A. Ergonomic assessment of posture risk factors among Iranian Workers: An alternative to conventional methods. *Iranian Rehabilitation Journal*. 2018;16(1):11-6.
- Borhany T, Shahid E, Siddique WA, Ali H. Musculoskeletal problems in frequent computer and internet users. *Journal of family medicine and primary care*. 2018;7(2):337.
- Sethi J, Sandhu JS, Imbanathan V. Effect of Body Mass Index on work related musculoskeletal discomfort and occupational stress of computer workers in a developed ergonomic setup. *Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology*. 2011;3(1):1-7.
- Khohli D, Singh LP. A Study on the Impact of Prolonged Sitting on Computer Workstation Users' Well-Being and Productivity: Punjab State Perspective. *Productivity with Health, Safety, and Environment: Select Proceedings of HWWWE 2019*: Springer; 2022. p. 35-45.
- Dimitrova T, Zlatarova Z. Ergonomics assessment of an accountants workplace as a management option for a worksite health prevention. *Health Economics and Management*. 2018;18(2).
- Jovanović J, Šarac I, Jovanović JJ, Jovanović S. Work-Related Health Disorders and Work Ability Among Computer-Operating Workers. *IPSI Transactions on Internet Research*. 2021;17(1):22-8.