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BURDEN IN THE NECK, SHOULDER AND HANDS OF EMPLOYEES IN COLLEGE OF HEALTH SCIENCES WHILE WORKING AT THE COMPUTER

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Abstract. *Problems with pain, paresthesia, and weakness of the neck, shoulder, and arm muscles are common among people who have sedentary jobs and use computers at work, and are the reason for absences from work due to sick leave. These problems point to the need for different personal and ergonomic adaptations of the workplace, whether it is about offices/classrooms, or working at a computer in the office. The research began in the summer semester of the 2024/25 school year. with the consent of the head of the department of the College of Health Sciences and the approval of the Ethics Committee. It included 71 full-time teachers and 24 respondents from the service of full-time non-teaching staff who use a computer in their work. The research used an adapted version of the Maastricht Upper Extremity Questionnaire – MUEQ. The aim of the work is to recognize the problems and to possibly propose and organize the training of employees in protective positions and movements that can ease the discomfort and reduce the burden. The results show that the most common symptoms are fatigue and exhaustion in the hands (48% of teaching and 63% of non-teaching staff), while paresthesias and weakness are somewhat rarer, but present in a significant number of respondents. Statistically significant differences in the distribution of pain between the groups were not confirmed, but it was observed that non-teaching staff spend more time at the computer and more often report weakness and fatigue in the hands. Only 28% of respondents use ergonomic aids or preventive positions. Conlusion is that upper extremity complaints are significantly present among employees in higher education, with insufficient application of ergonomic strategies. The obtained findings point to the need to organize education on protective positions and movements, as well as to improve the ergonomic design of the workplace, which would reduce the workload and improve the health and work ability of employees.*

Key words: *pain in the shoulder, neck, arms; protective positions and movements; ergonomic adjustment*

Introduction

Musculoskeletal disorders and diseases affecting the upper extremities that are not the result of trauma are common in the general population. Prevalence rates range from 2 to 53%, while 12-month prevalence rates range from 2 to 41%, depending on the context, definition, and classification used. The upper extremity disorders (UEMDs) include cervical disc disease, myelopathy, rotator cuff syndrome, lateral and medial epicondylitis, carpal tunnel syndrome, ulnar nerve entrapment syndrome, osteoarthritis (OA), myofascial pain syndrome, and other conditions. Neck pain is one of the most common musculoskeletal complaints, affecting approximately half of the adult population during a one-year period. It is considered as a major public health problem, both in terms of health and general well-being of the individual and society, and can affect the quality of life and working conditions of patients. Among occupational groups, office workers, especially intensive computer users, are at high risk of developing neck pain. Increasing computer-based tasks at the workplace may cause poor working postures and repetitive movements, especially in head and neck area [1]. Although the shoulder is recognized as the third most common site of musculoskeletal pain after low back pain and knee pain, the ICD-10 system does not provide specific criteria for separate diagnoses of shoulder pain [2]. The glenohumeral shoulder joint has the largest range of motion in the human body, which makes it unstable compared to other joints and can lead to a wide range of pathologies. Shoulder pain due to shoulder disorders follows lower back pain in frequency of musculoskeletal pain [3]. A wide range of complaints in the form of pain, paresthesia, muscle weakness, overexertion and fatigue in the neck and upper extremities that are not the result of an injury is difficult to accurately classify. Some researchers (Van Eerd et al.) found 27 different classification systems for the working population that differed in the disorders they included, in the labels used to identify the disorders and in the criteria used to describe them [4]. Rotator cuff tendinopathy is the most common type of tendinopathy, and a major cause of shoulder pain. The pathology is complex and diverse and manifests as a disordered arrangement of fibers and destruction of fiber structures, together with an increase in the number of cells in some parts and a decrease in other parts of the diseased tissue, and cartilaginous metaplasia, ossification, increased blood vessels and fat infiltration may also be present [5]. Glenohumeral degenerative joint disease affects up to 20% of the elderly population. According to the current literature, only a consensus regarding the reliability, presentation and correct classification of glenohumeral arthritis, especially in the early stages of the disease, will allow us to make an appropriate therapeutic choice [6]. Frozen shoulder also known as adhesive capsulitis, is a painful condition characterized by progressive loss of shoulder mobility. The American Shoulder and Elbow Society produced a consensus in which it is defined as a condition characterized by progressive functional restriction of both active and passive shoulder movements and without significant radiographic alterations of the glenohumeral joint [7]. The prevalence of primary frozen shoulder is estimated to range between 2% and 5% in the general population. Diabetes mellitus (with no difference between type 1 and type 2) and thyroid diseases can be considered the main risk factors for developing secondary frozen shoulder in between 10% and 38% patients. The incidence is higher

in patients aged between 40 and 65 years and affects predominantly women and the non-dominant shoulder [8]. Musculoskeletal pain is a widespread and health-related expensive problem worldwide. In spite the fact that wrist pain in the UK is the fourth most common site of musculoskeletal pain in the upper limb after the shoulder, hand and elbow, there is still a lack of high quality research investigating its epidemiology. Existing evidence suggests that wrist pain is highly prevalent in groups of manual labourers and sports people [9]. According to Spreeuwers D et al.(2011.) there are eleven categories of work-related specific disorders of the upper extremity: radiating neck complaints; rotator cuff syndrome; epicondylitis (lateral and medial); ulnar nerve compression at the elbow (cubital tunnel syndrome); radial nerve compression (radial tunnel syndrome); flexor–extensor peritendinitis or tenosynovitis of the forearm–wrist region; de Quervain's disease; carpal tunnel syndrome; ulnar nerve compression at the wrist (Guyon canal syndrome); Raynaud's phenomenon and peripheral neuropathy associated with hand-arm vibration; and osteoarthrosis of distal upper extremity joints [10]. In addition to the above, a twelfth category of non-specific musculoskeletal disorders of the upper extremities is also described [11].

The work of the teaching staff in College of Health Sciences takes place partly in classrooms, cabinets and accredited teaching institutions of the department, and partly at home. The use of computers, laptops and video projectors is not always carried out in a position that suits the individual teacher - the chair, table, computer screen, keyboard are placed differently in the classrooms and the setting is not always achievable. Lectures and exercises in the classrooms, cabinets and clinical conditions are a combination of presentations and direct, physical work with students and patients/clients and are not always performed in a sitting position. Working from home consists of preparing lectures and presentations, reading and correcting essays, tests, seminars, bachelor and master theses, writing scripts and textbook literature, working on projects and writing scientific and professional research papers. Working conditions at home depend on many different factors, but also provide opportunities for personal adjustment of the work space. For research purposes, we used an adapted version of the Maastricht Upper Extremity Questionnaire – MUEQ (Eltayeb et al., 2007.) to assess the presence of arm, neck and shoulder complaints in our subjects [12].

The **aim** of the study is to recognize the problems and to possibly propose and organize the training of employees in protective positions and movements that can ease discomfort and reduce the burden.

Material and methods

Study design. The research was conducted as a cross-sectional study with the aim of assessing the prevalence of neck, shoulder and arm difficulties and pain among teaching and non-teaching staff who use computers in their work.

Sample included 95 employees at the College of Health Sciences in Zemun, of which 71 (74.7%) teaching staff and 24 (25.3%) non-teaching staff were included.

Data collection methods. The research was conducted during April and May 2025. All respondents voluntarily filled out the questionnaires, while the objectives of the

research and the purpose of using the obtained data were explained to them. The research did not include photographing, scanning or sending the completed questionnaire via e-mail (which slowed down the collection of the completed questionnaires), but the completed survey form was handed to one of the researchers.

Instrument description. The study used an adapted version of the Maastricht Upper Extremity Questionnaire – MUEQ (Eltayeb et al., 2007.) to collect qualitative data. The MUEQ is a structured questionnaire used to assess upper extremity pain (arms, shoulders, neck) in computer users, with the aim of identifying physical and psychosocial risk factors in the workplace that may contribute to the incidence of these complaints. It consists of 95 items divided into seven main domains: workplace, body and posture during work, job control, workplace demands, quality of breaks, work environment and social support. Each item uses a 5-point Likert scale (from "always" to "never"). This is followed by questions about the type, frequency and complaints of the upper extremities, as well as demographic questions (gender, age, type of work, time spent at the computer).

Results and discussion

The study involved 95 employees at the College of Health Sciences in Zemun, including teachers (74.7%) and non-teaching staff (25.3%). The sample was gender and age diverse: of the total number of respondents, 75 (78.9%) were women and 20 (21.1%) were men. The average age of the respondents was 50.63 ± 7.36 years, with the age range ranging from 34 to 63 years. These demographic data enabled the analysis of the relationship between the characteristics of the respondents and the results of the MUEQ questionnaire, including the identification of potential risk factors for the occurrence of musculoskeletal disorders in the upper extremities.

Table 1. Time spent on the computer by gender and type of employment

Variable	Category	*N*	*M*	*SD*	*Min*	*Max*
Gender	Female	75	5.59	2.39	1.00	12.00
	Male	20	5.90	2.92	2.00	12.00
Type of employment	Teachers	71	4.96	2.30	1.00	10.00
	Non-teaching staff	24	7.21	1.88	5.00	12.00

Note: N – number of respondents; M – arithmetic mean; SD – standard deviation; Min – minimum value; Max – maximum value. The data refer to the average number of hours per day spent on the computer, obtained by self-assessment of the respondents.

The results presented in Table 1 show the average time spent on the computer by respondents, classified by gender and type of employment. The results indicate that non-teaching staff spend more time on the computer compared to teachers, while gender differences seem less pronounced.

Table 2. Prevalence of pain by body region and statistical significance of differences between teachers and non-teaching staff

	Teachers		Non-teaching staff				
Body region	(No/Yes)	% (No/Yes)	(No/Yes)	% (No/Yes)	χ^2	*df*	*p*
Neck	24 / 47	0.33 / **0.67**	5 / 19	0.21 / **0.79**	1.42	1	.23
Shoulder	20 / 51	0.28 / **0.72**	8 / 16	0.33 / **0.67**	0.23	1	.63
Upper arms	50 / 21	0.70 / 0.30	14 / 10	0.58 / 0.42	1.19	1	.27
Elbows	52 / 19	0.73 / 0.27	18 / 6	0.75 / 0.25	0.03	1	.87
Forearms	55 / 16	0.77 / 0.23	18 / 6	0.75 / 0.25	0.06	1	.80
Wrist	42 / 29	0.59 / 0.41	13 / 11	0.54 / 0.46	0.18	1	.67
Hands	40 / 31	0.56 / 0.44	11 / 13	0.46 / 0.54	0.80	1	.37

Note: χ^2 - chi-square test value, *df* - degrees of freedom, *p* - significance level.

Based on the conducted chi-square tests of independence (Table 2), it can be concluded that there are no statistically significant differences in the frequency of pain in the neck, shoulders, upper arms, elbows, forearms, wrists and hands between teaching and non-teaching staff. Our results are consistent with previous research (Plemelj, Mohorič, A., and Kacjan, Žgarjan, K., 2024.) where a higher prevalence of pain in the upper extremities among teaching staff was recorded, especially in the neck (67%) and shoulders (72%). In wrists (41%) and hands (44%), our study shows a slightly higher prevalence than in the mentioned research (31% wrists, 17% hands). In both studies, the chi-square test did not show a statistically significant difference between the groups, indicating that although the trends suggest a higher frequency of complaints among teachers, the differences were not statistically confirmed. Analysis of the distribution of complaints by body side showed different patterns between teaching and non-teaching staff. Among teaching staff, complaints are more often present on the right side of the body, which is in accordance with earlier research that showed a greater involvement of the right side in university teachers. In contrast, in non-teaching staff, bilateral complaints predominate, which deviates from earlier findings where the right side was more often affected. Among teaching staff, 31% of respondents use ergonomic accessories, while 69% do not. Among non-teaching staff, 21% of respondents use supplements and 79% do not. In total, 28% of all respondents apply these strategies. The results indicate that the majority of respondents do not use preventive or ergonomic aids, which can be a starting point for education and interventions in the prevention of hand pain in the workplace.

Tabela 3. Prevalence of hand symptoms in teaching and non-teaching staff (percentages)

	Teachers N=71		Non-teaching staff N=24	
	Yes	No	Yes	No
I feel pain in my arm as soon as I finish work	0.35	0.65	0.38	0.62
The pain goes away after rest	0.25	0.10	0.17	0.21
I feel fatigue and exhaustion in my hand	**0.48**	0.52	**0.63**	0.37
Discomfort disappears after a short rest	0.37	0.11	0.42	0.21
I feel stiffness in my fingers	0.25	0.75	0.29	0.71
The stiffness goes away after a short rest	0.18	0.07	0.17	0.13
I feel numbness in my fingers	0.32	0.68	0.33	0.67
The numbness goes away after a short rest	0.25	0.07	0.25	0.08
I feel tingling in my fingers	0.24	0.76	0.25	0.75
Tingling stops after work	0.11	0.13	0.00	0.25
I feel weakness in my arm	**0.24**	0.76	**0.38**	0.62
Weakness stops after work	0.13	0.11	0.13	0.25
I suffer from swelling in my hands	0.17	0.83	0.21	0.79
Swelling stops after work	0.06	0.11	0.13	0.08
I feel swelling and stiffness in my hand	0.23	0.77	0.25	0.75
I feel constant pain in my arm	0.08	0.92	0.13	0.88

Note: Data were obtained using an adapted version of the Maastricht Upper Extremity Questionnaire (MUEQ). Values are expressed as the proportion of "Yes" and "No" responses.

Table 3 shows the frequency of hand symptoms in teaching (N=71) and non-teaching staff (N=24), expressed as a percentage. The most common symptoms in both groups are fatigue and exhaustion in the hand after work (48% of teaching and 63% of non-teaching staff), pain in the hand as soon as I finish work (35% of teaching and 38% of non-teaching staff). Symptoms that occur less often include persistent pain or tingling (8% of teaching staff and 13% of non-teaching staff), swelling in the hands (17% of teaching staff and 21% of non-teaching staff), and arm weakness (24% of teaching staff and 38% of non-teaching staff). In most symptoms, non-teaching staff have a slightly higher prevalence than teaching staff, especially fatigue and weakness. Most complaints disappear after a short rest or work, which indicates the temporary character of the symptoms. These data suggest that arm discomfort occurs in a significant number of subjects in both groups, but is mostly transient and not constantly present.

Comparing our results with research (Plemelj, Mohorič, A., and Kacjan, Žgarjan, K., 2024.), it is noted that the most common symptoms are pain in the hand, fatigue and tingling in the fingers in both groups. It is interesting that in our research, non-teaching staff showed a slightly higher prevalence of symptoms in the hand and fingers compared to teaching staff, while in the mentioned research the trend was reversed - teachers had more symptoms. Also, the prevalence of swelling, weakness and numbness in our study is higher than in previous research. These differences can be explained by different work tasks and the length of time spent working with the computer. In both cases, the importance of the exposure factor is confirmed - longer

sitting and more intensive work at the computer lead to a greater load on the upper extremities.

Exploratory factor analysis (EFA) was applied to examine the latent structured arrangement of items in six domains: body position, job control, job demands, breaks, work environment, and social support. EFA is a suitable method for identifying factors that explain intercorrelations among items and for checking whether items within each domain cluster into the expected dimensions. Before starting the factor analysis, checks of sample adequacy and intercorrelations of items were performed using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. A multivariate normality check (Mardia test) was also performed to determine which rotation methods best fit the data.

Exploratory factor analysis for the body posture domain revealed four factors. The first factor explained 26% of the variance, the second 14%, the third 10%, and the fourth 9%, with a total of 58% of the explained variance. After Promax rotation, the distribution of variance became more even (Factor 1 - body asymmetry: 18%, 3 items; Factor 2 - ergonomic arm and body position: 16%, 3 items; Factor 3 - repetitive tasks/long sitting: 14%, 2 items; Factor 4 - head positions: 11%, 3 items). The items I sit for more than two hours with raised shoulders and I find my work physically exhausting are not clearly loaded on any factor and have high uniqueness, which means that they contribute less to defining the latent structure.

For the job control domain, EFA identified two factors, which was also confirmed by parallel analysis (λ_1 = 3.25 vs. 1.34; λ_2 = 1.94 vs. 1.23). The factors together explain 47% of the variance (Factor 1 – development and creativity: 4 items; Factor 2 – autonomy in work: 5 items). Items such as I solve problems at work by myself and I participate with others in decision-making are not strongly loaded and have high uniqueness (>0.70). The workplace demands domain forms one dominant factor that includes all 7 items, which confirms the coherence of this domain in the questionnaire and implies that all items are well connected to the main construct. For the break domain, most items (6 out of 8) load on one main factor related to the planning and distribution of breaks. The items I can do work without a computer and I change tasks alternately are not clearly loaded and have high uniqueness. The main factor explained 34% of the total variance. In the work environment domain, EFA identified two factors (Factor 1 – air quality and room comfort: 4 items; Factor 2 – lighting and screen work: 3 items), together explaining 40% of the variance. The items The air in the office is too dry and My work environment is noisy are not strongly related to the factors (high uniqueness >0.7). For the social support domain, two factors were identified (Factor 1 - support from superiors and colleagues: 5 items; Factor 2 - autonomy and opportunities for research at work: 2 items), explaining a total of 59% of the variance. The item My work tasks depend on other colleagues is not clearly loaded and has a high uniqueness (0.88), which means that its contribution to the factors is not significant and represents a specific situation of dependence on others.

In a recently published systematic review, the most commonly identified work-related upper extremity disorder was rotator cuff disease. Diagnostic criteria for upper extremity disorders varied among studies, presentation of research findings was not

always consistent, and most studies were based on questionnaires, with or without physical examination [15]. Although there are not enough studies to confirm that ergonomic adjustments affect productivity and efficiency during work, the researchs were mostly concerned with the characteristics of the chairs and in all 5 studies it was emphasized that they should be adjustable with different variations that include a comparison between curved, flat and saddle-shaped seats. Training to use adjustable functions was also prominent in all studies. Only one study investigated productivity outcomes and found no significant differences [16 available from https://doi.org/10.1186/1471-2474-13-145, 17]. Prolonged sitting (as a specific example of sedentary behavior), without physical activity, is recognized as a risk factor for a variety of negative health outcomes associated with low back pain, shoulder tension, and joint and elbow pain [18]. According to data from the Institute for Public Health (BATUT, 2022.), 23% of the Serbian population was exposed to an excessive sedentary lifestyle (sitting for 420 or more minutes during a typical day), and the sedentary lifestyle is most prevalent among the elderly population in urban areas, among those with the highest incomes (30.2%) and the most educated (32.2%) [19]. Studies conducted in the general population, as well as those involving employees, show that disorders of the function of the upper extremities negatively affect the quality of life as a whole. Pain in the upper extremities can cause significant disability, require the need for health services, and lead to loss of productivity at work [20].

Conclusion

Based on the conducted research, it can be concluded that neck, shoulder and hand problems are very widespread among the employees of the College of Health Sciences, regardless of whether they are teachers or non-teaching staff. The most common symptoms are fatigue, exhaustion and pain in the hands, while numbness and weakness are somewhat rarer, but still present in a significant number of respondents. Non-teaching staff, who spend more time at the computer, showed a higher prevalence of certain symptoms bilaterally, which confirms that longer exposure to computer work increases the risk of upper extremity complaints.

Although the symptoms usually disappear after a short rest, the fact that they occur regularly and in a large number of employees indicates a potential risk of chronicity and reduced work capacity if preventive measures are not taken. Of particular concern is the fact that the majority of employees does not use ergonomic aids or practice protective postures, although these procedures are proven to be effective in reducing workload. This opens up space for organizing systematic education, workshops and prevention programs, so that employees develop proper work habits and learn strategies to reduce pain and tension.

The results of the research can serve as a basis for the development of guidelines and recommendations intended for employees, but also for the management of the institution, with the aim of improving ergonomic working conditions and introducing practical interventions (adjustable tables and chairs, ergonomic keyboards and mice, proper lighting and arrangement of equipment). In this way, the working environment

could be improved and the number of employees with painful syndromes of the upper extremities could be reduced in the long term.

For future research, it would be useful to include a larger sample of respondents from different educational and health institutions, as well as to combine questionnaires with objective assessment methods (physical examination, electromyography, monitoring of work habits). In this way, more precise data on prevalence and risk factors would be obtained, as well as clearer guidelines for the implementation of prevention measures.

Overall, the results indicate that upper extremity strain is a significant problem among employees, which requires a more serious approach and the introduction of preventive programs, with the aim of preserving the health, productivity and quality of life of employees in educational and health institutions.

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OPTEREĆENJE U VRATU, RAMENU I RUCI ZAPOSLENIH U VISOKOJ ZDRAVSTVENOJ ŠKOLI PRI RADU ZA RAČUNAROM

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Sažetak. *Problemi sa bolovima, parestezijama, slabošću mišića vrata, ramena i ruku česti su kod osoba koje rade sedeći posao i u radu koriste računar, a razlog su odsustvovanja sa posla zbog bolovanja. Ovi problemi ukazuju na potrebu za različitim personalnim i ergonomskim adaptacijama radnog mesta, bilo da su u pitanju kabineti/učionice, ili rad za računarom u kancelariji. Istraživanje je počelo u letnjem semestru školske 2024/25.g. uz saglasnost rukovodioca odseka Visoka zdravstvena škola i odobrenje Etičkog odbora. Obuhvatilo je 71 nastavnika u stalnom radnom odnosu i 24 ispitanika iz službe stalno zaposlenog nenastavnog osoblja koje u radu koristi računar. U istraživanju je korišćena prilagođena verzija upitnika Maastricht Upper Extremity Quetionnaire – MUEQ. Cilj rada je da se prepoznaju problemi i da se eventualno predloži i organizuje obuka zaposlenih zaštitnim položajima i pokretima kojima se mogu olakšati tegobe i smanjiti opterećenje. Rezultati pokazuju da su najčešći simptomi umor i iscrpljenost u rukama (48% nastavnog i 63% nenastavnog osoblja), dok su parestezije i slabost nešto ređe, ali prisutne kod značajnog broja ispitanika. Statistički značajne razlike u distribuciji bola između grupa nisu potvrđene, ali je primećeno da nenastavno osoblje provodi više vremena za računarom i češće prijavljuje slabost i umor u rukama. Samo 28% ispitanika koristi ergonomska pomagala ili preventivne položaje. Zaključuje se da su tegobe gornjih ekstremiteta značajno zastupljene kod zaposlenih u visokom obrazovanju, uz nedovoljnu primenu ergonomskih strategija. Dobijeni nalazi ukazuju na potrebu za organizovanjem edukacije o zaštitnim položajima i pokretima, kao i za unapređenjem ergonomskog dizajna radnog mesta, čime bi se smanjilo opterećenje i unapredilo zdravlje i radna sposobnost zaposlenih.*

Ključne reči*: bol u ramenu, vratu, ruci; zaštitni položaji i pokreti; ergonomsko prilagođavanje*