WORK-RELATED MUSCULOSKELETAL DISORDERS OF TEACHING STAFF IN HIGHER EDUCATION

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ABSTRACT

Work-related musculoskeletal disorders are among the most common disorders of the musculoskeletal system. The aim of this paper is to determine the prevalence of the musculoskeletal disorders (MSD) for the teachers in higher education. Examinees and methods: 100 teachers (66% men and 34% women with average age of 38.8 ± 13.1) were included in the prospective study. The information about the state of the teachers' musculoskeletal system was gathered using a questionnaire for the MSD analysis. Potential risk factors for MSD were analyzed. MSD was observed in 74 (74%) teachers and associates (68.9% male and 31.1% female, $p<0.05$). 32% Teachers had pain within the first five years of teaching work, while the rest of MSD occurred after that period. 73% of teachers were diagnosed with rigor in the lower back, 62% were diagnosed with neck pain, 45.9% were diagnosed with upper back pain, while 27% had pain in their ankles/feet. Lower pain prevalence was noticed in wrist, hands, hips and elbows. The prevalence of the musculoskeletal disorders for teachers is 74% and it is higher for men than for women. MSD, whose samples are multifactorial, are the most common in the lower back, neck, upper back and shoulders. Ergonomics and ergonomic education are the primary factors in the prevalence and treatment of MSD.

Keywords: *Musculoskeletal disorders, work-related diseases, back pain, neck pain, ergonomic measures.*

INTRODUCTION

The word "ergonomics" comes from the Greek word ergo, which means "to work", and nomos, which encompasses natural laws or systems (1). Hence, the ergonomics is defined as a science which studies people in relation to their work environment, i.e. the adaptation of the devices and general conditions which should suit an individual in order to be fully efficient (2).

The positions in which teachers and administrative workers find themselves while doing their everyday activities are often forced positions with sympathogenic potential, which is why they are highly susceptible to musculoskeletal disorders. These disorders affect muscles, ankles, ligaments and nerves located between feet and neck. The symptoms vary from feeling uncomfortable and having weak or strong pain, to more serious health conditions which can cause social and economic consequences. They encompass lowered quality of work services, frequent absence from work or even retirement (3). The pain and physical disability brought about by MSD affects social functioning and mental health, further diminishing the patient's quality of life (4). The most common symptoms are back pain, affecting primarily the lumbar and cervical part of the spine, followed by shoulders, knees and feet. Factors contributing to the back and neck pain are: staying in the same position for a long time (sitting, standing), sudden body movements, obesity, spinal stud shape, aging, weak muscles, lack of exercising, the nature of the movements, techniques of lifting objects, mechanical load, stress, etc. (5).

The goal of this paper is to confirm the prevalence of the musculoskeletal disorders for teachers and associates with different years of service at the State University of Novi Pazar.

METHODS

One hundred teachers and associates of the State University of Novi Pazar took part in the analysis. "The standardized Nordic questionnaire for the analysis of the musculoskeletal symptoms" was used to gather the information about the prevalence of the musculoskeletal symptoms for the teachers (5, 6). A couple more questions were used as an addition to the questionnaire (2, 5, 6). They referred to the: gender of the examinees, age and years of service, working conditions (duration and frequency of the work-related activities), working hours, body position while working, taking breaks, existence of the musculoskeletal rigor and history of the rigor. The questions were formulated and asked so as to question the working conditions.

Possible risk factors for MSD (gender, age, years of service, number of working hours, posture - body position while working, body height) were also analyzed. There were 66% men and 34% women with the average age of 38,8±13,1, with 9,9±11,6 years of service in total. The data about the state of the musculoskeletal system of teachers and associates were gathered using the questionnaire, and they were input in a special database. All the gathered data was processed using SPSS, version 14.0 (SPSS Inc., Chicago, II, USA). The results are displayed in frequencies and percentages (5, 6).

RESULTS

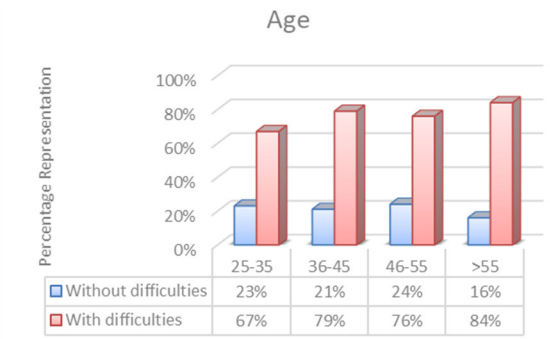
Musculoskeletal rigor was found in 74 teachers and associates (74%) out of 100 examinees; 51 were male (68.9%) and 23 (31.1%) female. For male teachers, the highest percentage of the rigor was discovered in the lower back (78,4%), followed by the neck rigor (65%) and upper back rigor (53%), and the lowest percentage was in the hips (21,5%) and elbows rigor (7,9%). For female teachers, the highest rigor percentage was also in the lower back (69.8%), followed by the neck rigor (61.2%) and upper back rigor (48%), while they felt the least amount of rigor in the hips (17.4%) and elbows (8,7%) (Table 1).

Table 1. The frequency of pain in different parts of the body relative to the gender of the teachers

Body parts	Men		Women	
	Without pain	With pain	Without pain	With pain
Neck	18 (35%)	33 (65%)	9 (38,8%)	14 (61,2%)
Shoulders	45 (89,3%)	6 (11,7%)	16 (69,5%)	7 (30,5%)
Elbows	47 (92,1%)	4 (7,9%)	21 (92,3%)	2 (8,7%)
Wrist joints/hands	46 (90,2%)	5 (9,8%)	18 (78,3%)	5 (21,7%)
Hips	40 (78,5%)	11 (21,5%)	19 (82,6%)	4 (17,4%)
Upper back	24 (47%)	27 (53%)	12 (52%)	11 (48%)
Lower back	11 (21,6%)	40 (78,4%)	7 (30,2%)	16 (69,8%)
Knees	43 (84,3%)	8 (15,7%)	15 (65,2%)	8 (34,8%)
Ankles/Feet	42 (82,4%)	9 (17,6%)	14 (60,9%)	9 (39,1%)

Among younger teachers (25-35 years old) rigor was discovered in 67% of the cases, with values which were similar to the age groups 36-45, i.e. 46-55. For teachers older than 56, rigor was discovered in more than 80% of cases (Graph 1). There were no statistically significant differences in

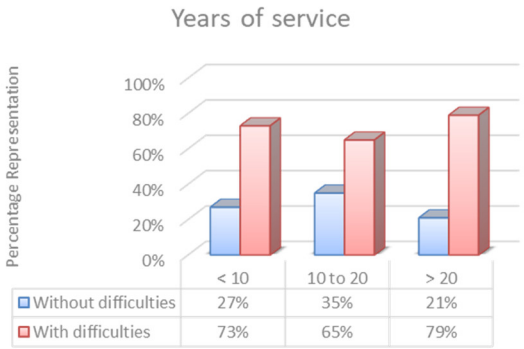
musculoskeletal pain occurrence for the examinees of different ages.



Graph. 1. The frequency of pain in subjects of different ages

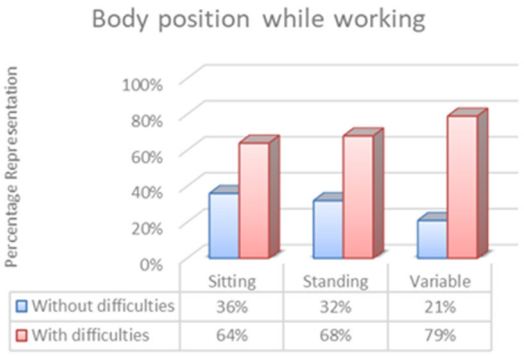
Half of the examinees felt pain in the first three years of employment. For the teachers with up to 10 years of service, for those between 10 and 20 years of service, as well as for those with more than 20 years of service, rigor was discovered in more than 60% of cases. There was no statistically significant difference in musculoskeletal pain occurrence for the examinees with different years of service (Graph 2).

Most of the teachers (77.5%) worked 5 days a week. Working hours varied from 1 to 12. 28.1% worked 8 hours a day, and 20.2% worked 6 hours a day. As much as 95% of the teachers constituted in the group who worked more than 10 hours a day.



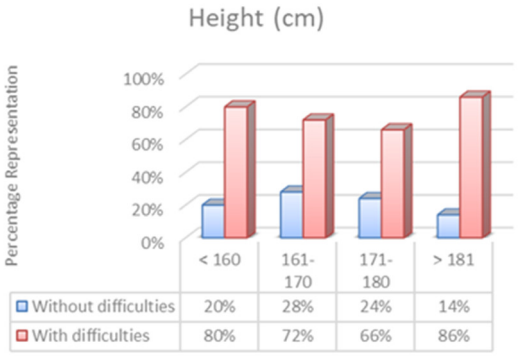
Graph. 2. The frequency of pain in subjects depending on length of service

29,2% of them sat while working and had rigor in almost 70% of the cases, while 30,3% of them stood, but still had the same percentage of the registered rigor (70%). Still, the highest number of the teaching personnel (40,4%) changed their positions and had the highest rigor percentage (around 80%) (Graph 3). 95,9% of the teachers took breaks.



Graph. 3. The frequency of pain in subjects depending on body position

The average height of the examinees was 173.87 cm, with a standard deviation of 10.26 cm. The median was 172 cm. The percentage of the teaching personnel with painful rigor was almost the same (75%) for the different height examinees. Students' t-test did not show any statistically significant difference for the musculoskeletal pain occurrence in the different height examinees (Graph 4).



Graph 4. The frequency of pain in subjects depending on height

According to the standardized Nordic questionnaire, the highest number of the teaching personnel felt the lower back pain (75,7%), followed by the neck pain (63,5%); 51,3% had upper back pain; 24,3% had ankle/foot rigor; 21,6% had knee rigor; 20,3% had hip rigor and 17,6% had shoulder rigor. The lowest pain prevalence was discovered in the elbows area (8,1%) (Table 1).

DISCUSSION

The standardized Nordic questionnaire for the analysis of the musculoskeletal symptoms is internationally recognized questionnaire for evaluating the degree of the musculoskeletal rigor (5, 7) and it was used in our examination. Musculoskeletal pain prevalence among the examined teaching personnel was 74%.

The study showed that all the examinees took positions which were not optimal while working and it significantly contributed to the MSD occurrence, as Kaljic (1) showed in

his paper. The theory that workers (teachers) are the most common patients due to the more frequent mechanic change on their spine is supported by the study (1) done in a policlinic for physical therapy and rehabilitation Stari Grad in the period from April 1st 2004 to December 31st 2009, where they treated 913 patients with pain in the lumbar part of their spine. They came to a conclusion that clerks were the most common (466 or 51% in total). Out of 913 patients in the same study, the highest number of the treated patients were between 45 and 54 years old (283 or 30.99%). The age structure of the examinees shows the frequency of the painful lumbar syndrome for the ages between 25 and 65, which represents work-related active group of examinees.

Some authors showed that the pain occurrence is influenced by the years of service, teachers' age, and the working hours. The pain prevalence can also be influenced by the body height of the teaching personnel (3, 5). Our examination showed that working hours are an important risk factor for pain occurrence.

Some examinations show (8-11) that most of the teaching personnel who take the sitting position have kyphotic posture. Ergonomically looking, the teaching personnel should take positions which preserve the physiological curves of the spine. Such positions, besides being considered neutral, diminish the tension of the soft tissue structures, stabilizers and spine and thus, prevent their elongation and micro-traumas, which can lead to consequential degenerative changes at the spinal unit level due to their repetitive nature, and can later spread to the entire spine segment. Ergonomic chairs which follow the physiological spinal curves are the most suitable and they diminish the need for taking the discogens positions while working (12).

The common teacher's posture while working is protraction, head and shoulders flexion, with shoulders bent forward. That can cause shortening of m. sternocleidomastoideus, m. scalenus, m. serratus anterior and m. pectoralis minor; while the middle and lower bundles m. trapezius can be elongated due to the adaptation to that posture. Such muscle imbalance can play a role in developing not localized chronic pain (13, 14). Muscle imbalance between abs and lower back muscles, which is very common for the teaching personnel, can cause additional rigor. Repetitive bending forward, while bending our backs, can cause exhaustion in the top extensors of the lower back, while deep abs (m. tranversus abdominis and m. obliquus abdominis) tend to get weaker (15).

McKenzie's institute for mechanic diagnosis and therapy in New Zealand recommends taking neutral posture while doing everyday activities, and doing exercises in the direction of the primary movements (direction opposite to the one usually done while working) in order to prevent the musculoskeletal rigor. Head should be in a neutral position, with the chin parallel to the ground. Neck should be in the flexion from 0 to 10 degrees, without rotation and bending to the side, or in protraction. Shoulders and the pelvis should be horizontal, and we should put a stand under one of our feet, so that the pressure can be transmitted equally and unload bone joints of the lower limbs (2, 16).

The main torso and shoulder muscles are supposed to offer a firm and secure support to our arms. Strengthening these muscles is the basis of Pilates. Pilates is an exercising program that can contribute to musculoskeletal health of the teaching personnel, and it requires using light weights and a high number of repetitions. While doing these exercises we should pay attention to strengthening the deep torso muscles using isometric weight volume. Muscle strengthening exercises should be done three times a week, taking a one-day break after exercising. We should start with a small number of trainings and repetitions and increase them over time (16).

Ergonomically speaking, chairs are very important in classroom (15). Chairs should support the teachers' bodies in neutral positions. Backrest convexity should keep the natural lumbar position while sitting, so that's why it's called lumbar support. This lumbar support should be approximately 20 cm high, not thicker than 3-5 mm, convex bottom to the top, so it can imitate the natural back posture. If it was thicker, it could create additional pressure to the lumbar vertebra. When it comes to the high backrests, the top part should not create pressure on the pectoral part of our back and thus push it forward. All the backrests that surpass the lower border of the blade bone can lower the usage of the lumbar support by transferring the pressure to the blade bone, so they should be about 6 cm below the bottom border of the blade bone (17). Chairs without backrests are also considered to be ergonomic, since while sitting in such chairs our pelvis is in almost neutral position, like in a saddle or while standing. Such pelvis position helps balance the spine while performing various movements, but such chair design could still create pressure on the peritoneal region (15).

Many researches have confirmed that armrests help prevent the neck, shoulder and lower back pain, since they lower muscle activity, especially for the trapezius of the dominant hand. Armrests should be highly adjustable and should offer support in the neutral position. Well-adjusted armrests will prevent the development of the neck and shoulders pain. Elbow-rests lower the activity of the m. rhomboideus, as well as that of peritoneal and cervical part of the m. errector spinae (15, 18).

Except for the position, another factor is the working hours. It has been proven that even a low level of pressure, which lasts for a while, can cause muscle tiredness and chronic pain (6). Hence, a number of studies have shown promising results for the provision of work breaks of varying durations. However, studies that would aim to identify the optimal duration of work breaks by comparing different break durations are still lacking (7).

Several short breaks while working (no longer than 5 seconds) are more practical and offer complete recovery of the tired muscles. During these micro-breaks, the tense muscles

get more blood and time to recover (13). Bearing in mind that we should avoid static positions, it would be good to adjust the backrests and chairs every now and then, so that the pressure would be transferred from one tissue to another and thus the micro-trauma would be minimized (16).

MSD are a major medical, social and economic problem because of their high prevalence and the ever-increasing number of patients. The results of many studies showed that MSD do not only affect an individual, but also their families, workplace and the health care system (19-21).

Another problem is the lack of effective prevention which would reduce the incidence of MSD. Additionally, there are social and economic consequences of MSD as many people with musculoskeletal problems leave the labor market, either temporarily or permanently, usually with adverse effects on their family life and socio-economic status (22).

The significance of our study is that reflected prevention of MSD related to work is necessary in terms of providing ergonomically designed working environment, taking correct body posture during work, regular pauses and posture changes during work, doing physical activities (exercises) as well as health promotion which would contribute to preventing absence from work due to MSD, increase labor productivity, but most importantly, it would improve the life quality of the teaching staff.

Many studies indicate the importance of ergonomic measures in the prevention of work-related MSDs (23-25).

CONCLUSION

Our study showed that the prevalence of the musculoskeletal rigor for the teaching staff of the State University of Novi Pazar was 74%, and it was higher for men than for women. The highest number of the examinees had musculoskeletal rigor in the lower back, neck, upper back and shoulders. To prevent the work-related musculoskeletal diseases (MSD), it is necessary to do the appropriate MSD risk evaluation at the work place, which will be used to give ergonomic solutions along with the evaluation of the given suggestions.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and the Helsinki Declaration of 1975, as revised in 2013. Voluntary written and informed consent was obtained from each participant prior to enrollment in the study. The protocol of the study was approved by the local ethics committees of State University of Novi Pazar, Novi Pazar, Serbia.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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None.

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