Dimensioning of the Work Environment and Prevalence of Pain in University Staff

ABSTRACT

Aims: The objective of the research was to verify the relationship between musculoskeletal pain and the size of the work environment in the sitting posture of university agents.

Methodology: The evaluation of the prevalence of musculoskeletal pain using a recall record. The measurements in the sitting working posture evaluated were: popliteal height, height from elbow to seat, table height, thigh height, hip width and sacral length. The arrangement of the workstation was also evaluated, and the height of the monitor was checked. All measurements were made using a measuring tape, with a 1mm scale. The selected group is made up of university agents from UNICENTRO who agreed to participate in the research.

Results: The results of measurement vs estimated height, for male there was different in all variables (chair to floor, arm bent to the chair, depth measurement, eyes to the ground and table to monitor), in female group just in chair to floor, arm bent to the chair, depth measurement and table to monitor ($p<0.05$). The comparation of without pain vs with pain for male, there was difference in measurement from chair to floor and measurement from eyes to ground, in female group just measurement from table to monitor, ($p<0.05$).

Conclusion: The results suggest that inadequate work station conditions can be linked to development of pain.

Keywords: Musculoskeletal pain; furniture; ergonomics.

1. INTRODUCTION

It can be understood that the absence of discomfort is directly related to the use of appropriate furniture, that is, compatible with the user's postural needs. Therefore, several improvements are demanded and there is an increasing need for ergonomic solutions for work [1].The ergonomic solutions mentioned by the author directly influence the individual's well-being, since operators cannot be considered just as a 'pair of hands', on the contrary, workers from an ergonomics point of view, must be seen as integral beings, this fact contributes to work no longer being a heavy burden beyond what is necessary, that is, treating the worker with humanity and not seeing him just as an automated being to carry out tasks[2].

While most of the ergonomics assessment studies to date have been conducted on industrial workers, very few studies have considered evaluating the working postures of staff or professors in universities who are exposed to prolonged sitting, while working at computer workstations [3]. Thus, the objective of study was to verify the relationship between musculoskeletal pain and the size of the work environment in the sitting posture of university agents. Furthermore, provide a factual background, clearly defined problem, proposed solution, a brief literature survey and the scope and justification of the work done.

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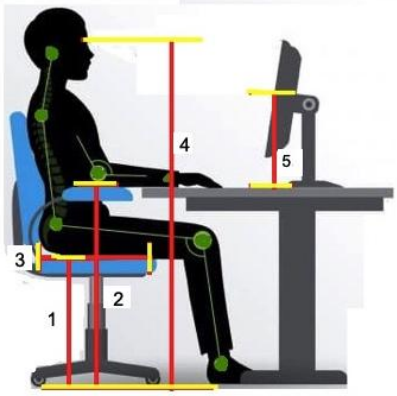
2. MATERIAL AND METHODS

The research presents a cross-sectional correlational study, being approved by the Ethics Committee for Research with Human Beings of the University of Middle-West – UNICENTRO, under opinion no. 857.660/2014. Firstly, the total number of university agents working on the Santa Cruz and CEDETEG campus of the Central-West State University was surveyed. Thus, at the beginning of the research, the university had 277 university agents, of which 248 worked in a sitting position and 71 were at their workstation at the time of the evaluations and agreed to participate in the research, 29 agents from the CEDETEG campus and 42 agents from the Santa Cruz campus.

The university agent was asked to respond, at his work station, to a questionnaire to assess the prevalence of musculoskeletal pain, using the questionnaire proposed by Corlett and Manenica[4]. Next, anthropometric data on body mass (kg) and height (cm) were collected by recall record to obtain the BMI (body mass index in kg/m^2). The measurements in the sitting working posture evaluated were: popliteal height, height from elbow to seat, table height, thigh height, hip width and sacral length[5]. The arrangement of the workstation was also evaluated, and the height of the monitor was checked. All measurements were made using a measuring tape, with a 1mm scale.



1. Measurement from chair to floor (cm)
2. Measurement of the arm bent to the chair (cm)
3. Chair depth measurement (cm)
4. Measurement from eyes to ground (cm)
5. Measurement from table to monitor (cm)

Figure 1. Measurements in the sitting working posture.

At the end of the research, data were collected from 71 university agents (42 men and 29 women). Agents not evaluated were excluded for various reasons: they refused, were on leave, were on vacation, were not found at their work stations, worked outside the municipality, worked night shifts and no longer worked at UNICENTRO.

Using these data, the analysis was carried out using descriptive statistics with mean and standard deviation. For inferential analysis, Student's t-test was used for independent variables. All analyzes were performed using SPSS version 20 software, with a significance level of $p<0.05$.

3. RESULTS AND DISCUSSION

The furniture used by both sexes of the participants showed that the measurements of the chair on the floor and the arm flexed on the chair present values higher than the estimates,

Comment [MOU2]: Please provide an adequate explanation of the questionnaire used in this research

Comment [MOU3]: Pleaseadd, What standards and measuring tools do researchers use to assess respondents' work posture?

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If data on pain complaints and respondents' working posture is available, please analyze it statistically

as shown in the records in the following tables. The depth measurements of the chair, eyes to the ground and table to monitor obtained values lower than the estimates respectively.

Table 1. Comparison between the evaluated measures and the estimated measures among university agents.

		Mean	Standard Deviation	p
Male (42)	Measurement from chair to floor (cm)	47.8	7.6	0.002*
	Estimate of the measurement of the chair to the floor (cm)	43.9	2.1	
	Measurement of the arm bent to the chair (cm)	56.9	20.3	0.001*
	Estimate of the measurement of the arm bent to the chair (cm)	23.8	1.1	
	Chair depth measurement (cm)	44.3	2.7	0.001*
	Estimate of chair depth measurement (cm)	49.4	2.3	
	Measurement from eyes to ground (cm)	117.1	6.7	0.001*
	Estimated measurement from eyes to the ground (cm)	123.5	7.1	
	Measurement from table to monitor (cm)	25.7	7.7	0.001*
	Estimated measurement from table to monitor (cm)	56.2	2.7	
Female (29)	Measurement from chair to floor (cm)	46.3	3.8	0.001*
	Estimate of the measurement of the chair to the floor (cm)	40.9	1.3	
	Measurement of the arm bent to the chair (cm)	57.9	19.5	0.001*
	Estimate of the measurement of the arm bent to the chair (cm)	22.2	0.7	
	Chair depth measurement (cm)	43.9	2.9	0.005*
	Estimate of chair depth measurement (cm)	45.9	1.5	
	Measurement from eyes to ground (cm)	114.2	6.8	0.446
	Estimated measurement from eyes to the ground (cm)	115.5	3.2	
	Measurement from table to monitor (cm)	26.1	6.5	0.001*
	Estimated measurement from table to monitor (cm)	52.3	1.6	

Significance level: $p<0.05$.
Tested by Student's t-test for independent variables.

This result is similar to the study by Villarouco and Andreto[6],which shows that the chairs in the researched environment were inadequate, causing constant back pain for employees. In this sense, it is observed that the study in question can contribute to improving the work environment in the HEI researched, as another aspect of ergonomics highlighted for the improvement of human work is the study of the environment in which the work is carried out, this is the area of ergonomics in the built environment [3].

Table 2. Comparison between furniture measurements and the prevalence of neck pain.

			Mean	Standard Deviation	p
Male	Measurement from chair to floor (cm)	Without Pain (32)	45.5	4.2	0.001
		With Pain(10)	55.4	10.9	
	Measurement of the arm bent to the chair (cm)	Without Pain (32)	55.4	19.8	0.404
		With Pain(10)	61.7	22.1	
	Chair depth measurement (cm)	Without Pain (32)	44.1	3.1	0.415
		With Pain(10)	44.9	1.1	
	Measurement from eyes to ground (cm)	Without Pain (32)	116.2	3.2	0.001
		With Pain(10)	123.4	4.4	
	Measurement from table to monitor (cm)	Without Pain (32)	25.9	7.6	0.660
		With Pain(10)	24.8	8.9	
Female	Measurement from chair to floor (cm)	Without Pain (24)	46.3	3.9	0.986
		With Pain (5)	46.3	3.3	
	Measurement of the arm bent to the chair (cm)	Without Pain (24)	59.7	19.1	0.282
		With Pain (5)	49.2	21.1	
	Chair depth measurement (cm)	Without Pain (24)	44.2	2.7	0.466
		With Pain (5)	43.0	3.8	
	Measurement from eyes to ground (cm)	Without Pain (24)	114.9	6.2	0.361
		With Pain (5)	112.2	4.8	
	Measurement from table to monitor (cm)	Without Pain (24)	27.3	5.8	0.031
		With Pain (5)	20.4	7.6	

Significance level: $p<0.05$.

Tested by Student's t-test for independent variables.

The information collected shows that ergonomically inadequate furniture, that is, outside of established standards, is the main factor in the prevalence of neck pain for approximately 17% of women and 24% of men; pain in the thoracic spine region affects around 14% of women and 12% of men in the surveyed population, and low back pain is the complaint of around 20% of women and 28% of men.

In the study of Chowdhury et al. [2], with objective of ergonomic assessment of working postures for the design of university computer workstations, the upper limbs of computer workstation users seem to be more prone to work-related musculoskeletal disorders and repetitive stress injuries symptoms. In 85.5% of cases, they indicate that work of office employees may cause a disorder more in the upper limbs than the lower limbs. Therefore, alignment of the monitor was found to be the most significant design parameter. Among different body parts, trunk was the most affected one, as a result of poor posture and/or workplace design followed by shoulder and upper arm, and forearm and wrist.

The physical measurements in 40 computer workstation design in typical offices, forty-five percent of the employees used nonadjustable chairs, 48% of computers faced windows, 90% of the employees used computers more than 4 h/day, 45% of the employees adopted bent and unsupported back postures, and 20% used office tables for computers. Major problems reported were eyestrain (58%), shoulder pain (45%), back pain (43%), arm pain (35%), wrist pain (30%), and neck pain (30%). These results indicated serious ergonomic deficiencies in office computer workstation design, layout, and usage [7].

In a sample of 30 computer operators was selected purposively from private and public sector organization, the assessment of computer workstation design revealed that 36.6 percent of workers used chairs with low seat height which was not proper. Chairs with adjustable seat height were used only by one half of the users. The distance from acromion to edge of desk was in average range and 56.7 percent of the users were having pull out extra leaf for keeping keyboard while only 13.3 percent respondents were using the extra leaf for keeping the mouse. It was revealed that none of the respondents kept the screen straight ahead which is the most appropriate position. A vast majority reported that they suffered from shoulder pain, headache, eyestrain, back pain and felt discomfort during computer work. Ninety percent of workstations were found in ‘Average’ category. Assessment of body discomfort revealed that after 4 hour of work 40 percent of the workers felt ‘Moderate’ discomfort while 10 percent expressed feeling of ‘Severe’ discomfort. Assessment of localized body discomfort elicited that the respondents felt discomfort in right shoulder, in eyes and pain in neck [8].

In a survey with 42 participants who use desktop computer workstations for at least 6 hours per day, the electromyography results indicated that discomforts are pronounced in shoulder, neck, lower and upper back and hand-wrist regions. The risk assessment model showed that experiencing troubles in the neck ($p=0.022$), shoulder ($p=0.023$), and wrist/hands ($p=0.020$) within 12 months were the significant factors. ANOVA results proved that the optimized design of a computer workstation causes less muscular pressure on the muscles at each measured body region [9].

Rodrigues et al. [10], demonstrated that computer office workers who reported musculoskeletal pain had worse ergonomics indexes for chair workstation and worse physical risk related to upper limb than workers without pain. However, there were no

observed differences in workers with and without musculoskeletal pain regarding work-related psychosocial factors. The results suggest that inadequate workstation conditions, specifically the chair height, arm and back rest, are linked to improper upper limb postures and that these factors are contributing to musculoskeletal pain in computer office workers.

Finally, Workineh and Yamaura[11], studied a new type of ergonomic computer workstation, which allows users to sit in multiple working positions, is proposed in order to provide better comfort to people who spend a long time sitting at their workstations. The researchers have designed and developed a new multi-position ergonomic computer workstation which has 19 degrees of freedom and which can accommodate from 5th to 95th percentile human size. Results showed that the new workstation is much more comfortable, supporting the body in a balanced way. Users have the freedom to stretch and relax in different working positions before they feel any noticeable discomfort; as a result, it lets users work for a longer period without strain, thus resulting in higher productivity.

4. CONCLUSION

In this study, some problematic elements were identified by the researchers and little noticed by users, such as the height of the chair. Thus, the evaluations carried out with UNICENTRO university agents allowed us to conclude that the furniture found is ergonomically incorrect and this fact results in musculoskeletal pain and, as a result of this disconnection, there is a loss of productivity. In this sense, it is suggested that correct ergonomic planning of work furniture or small changes, such as adjusting chairs, for example, employees of the HEI evaluated are able to improve their quality of life at work.

Comment [MOU5]: The aim of this research is to verify the relationship between musculoskeletal pain and the size of the work environment in the sitting posture.So what is your conclusion, is there a significant relationship or not?

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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