



## Physical load, stress and musculoskeletal morbidity in administrative workers of the public sector

Carga física, estrés y morbilidad sentida osteomuscular en trabajadores administrativos del sector público

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### Resumen

**Introducción:** Los desórdenes musculoesqueléticos se asocian entre otros, con la carga física y aspectos organizacionales del trabajo. **Objetivo:** Determinar la relación entre la carga física, los niveles de estrés y la morbilidad sentida osteomuscular en trabajadores administrativos del sector público de Popayán (Colombia). **Materiales y métodos:** Estudio cuantitativo, transversal analítico-correlacional. La muestra aleatoria simple fue de 104 trabajadores, los instrumentos de recolección fueron: Evaluación de puesto de trabajo RULA (acrónimo de Rapid Upper Limb Assessment), cuestionario de Maslach y cuestionario nórdico estandarizado (Kuorinka et al., 1987), se realizó análisis uni y bivariado, para la comprobación hipótesis se utilizó el estadístico Chi Cuadrado. **Resultados:** Se encontró que 76% de los puestos de trabajo requiere investigación con posible necesidad de cambios. El 79% de los trabajadores tuvo un nivel bajo de cansancio y 83% de despersonalización. El dolor más prevalente en los últimos seis meses fue de cuello (51%), seguido de espalda (36%) y hombro (33%). Se encontró correlación estadísticamente significativa entre la carga postural y presencia del dolor muscular ( $p=0,301$ ). **Conclusiones:** La carga postural aumentada está relacionada con la presencia de dolor de cuello, sin embargo, el dolor no está relacionado con la presencia de estrés laboral.

**Palabras clave:** Salud laboral; ergonomía; estrés laboral; carga de trabajo. (Fuente: DeCS, Bireme).

### Abstract

**Introduction:** Musculoskeletal disorders are associated with physical and organizational aspects of work, among others. **Objective:** To determine the relationship between physical load, levels of stress, and musculoskeletal morbidity in administrative workers in the public sector of Popayán (Colombia), between 2016 and 2017. **Materials and methods:** An analytical-correlational, cross-sectional, quantitative study of a random sample of 104 workers. The data collection instruments were: the Rapid Upper Limb Assessment (RULA), the Maslach Burnout Inventory (MBI) and the Standardized Nordic Questionnaire (Kuorinka et al., 1987). Uni- and bivariate analysis were conducted, as well as a Chi-square to test the hypothesis. **Results:** It was found that 76% of the workplaces require further research and need changes. 79% of employees experienced low fatigue levels, whereas 83% manifested depersonalization. During the last six months, the most common pains reported were neck pain (51%), followed by back pain (36%) and shoulder pain (33%). There was a statistically significant correlation between postural load and muscle pain ( $p=0.301$ ). **Conclusions:** Although an increased postural load is related to neck pain, this pain is not associated with workplace stress.

**Key words:** Occupational health; ergonomics; occupational stress; workload. (Source: DeCS, Bireme).

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## Introduction

Musculoskeletal disorders (MSDs) are among the most important occupational health problems in developed as well as underdeveloped countries. In Colombia, MSDs are the most common pathologies among workers. Particularly, MSDs were between 2% and 10% of the work-related illnesses reported in 2011, with the most frequent diagnoses being: non-specific low back pain, lateral epicondylitis, rotator cuff syndrome and carpal tunnel syndrome<sup>(1)</sup>.

In terms of economic impact, in 2015, MSDs together with stress and depression/anxiety accounted for the majority of lost days due to occupational health problems in the UK<sup>(2)</sup>. In the United States in 2007, the direct costs triggered by MSDs and carpal tunnel syndrome were 1.5 and 0.1 billion dollars, respectively, whereas the indirect costs associated with both diseases were 1.1 and 0.1 billion dollars, respectively<sup>(3)</sup>. Finally, the Colombian expenditure in these diseases reached to \$44 billion (Colombian pesos) in 2013, a 15.3% increase with respect to 2012<sup>(4)</sup>. In this context, MSDs represent an important condition to address, not only because of the identification of the working conditions that cause them or their health consequences, but also due to the economic impact inflicted to both companies and health institutions. Therefore, this occupational health problem justifies proper actions and interventions with a preventive perspective.

MSDs have frequently related to manufacturing activities. However, it is important to analyze other sectors such as services-providing companies, in particular the work assigned to the administrative personnel. They have shown a higher risk to develop MSDs in their upper limbs and back<sup>(5-7)</sup> (e.g., cervicalgia, back pain, low back pain, and carpal tunnel syndrome), which have caused a considerable number of disabilities<sup>(8-10)</sup>.

There are other non-biomechanical factors that are related to the development of MSDs, including salary conditions<sup>(11)</sup> or job-related tension and stress, psychosocial stress, and fatigue<sup>(12)</sup>. Jacukowicz found that the possibility of musculoskeletal symptoms in the neck area increases as: the physical environment worsens; interpersonal conflicts develop; and the organizational stress intensifies<sup>(12)</sup>. Likewise, there is a correlation of pain intensity and pain of low back, shoulder, and wrist with low job satisfaction<sup>(13,14)</sup>.

Finally, psychosocial risks and stress have been identified as predictors of musculoskeletal pain<sup>(15)</sup>.

The National Institute for Occupational Safety and Health (NIOSH) of the United States has established three general theoretical standpoints regarding the relationship between MSDs and work psychosocial factors: (1) work psychosocial demands and stress can induce an increase in muscle tension and exacerbate the biomechanical effort related to a task; (2) psychosocial demands can affect consciousness generating musculoskeletal symptoms or they can affect the perceptions; and (3) this association can be the result of the causal relationship or the correlation between psychosocial and physical demands<sup>(16)</sup>.

This relationship between MSDs and psychosocial factors within workplaces is also affected by biomechanical, psychosocial, and cognitive components. As this work environment depends on technological tools, it requires automated and mechanized work. The psychological tension caused by work individual and organizational factors is behind this perception and appearance of symptoms. For instance, the work environment has a direct effect on how workers detect, interpret, and respond to physical demands<sup>(16)</sup>.

Although there are international studies about this issue, there are few studies in Latin America that relate the etiology of muscle pain to psycho-labor factors. The objective of this study was to study the associations between physical load and stress levels with musculoskeletal morbidity in administrative workers of the public sector of Popayán – Colombia.

## Materials and methods

A quantitative, cross-sectional, correlational study was carried out with a population of 160 administrative employees of a public institution from Popayán, Cauca (Colombia). A simple random sampling was performed and a sample size of 104 people was calculated based on a 95% confidence level and a 5% relative error. The inclusion criteria were: being an administrative worker; having been working longer than six months; and having the desire to participate in the study. The exclusion criteria was being diagnosed with musculoskeletal pathologies and psychological or depressive disorders prior to the study. The Nordic and Maslach questionnaires<sup>(17-21)</sup> were administered simultaneously, followed by a workplace evaluation

through the Rapid Upper Limb Assessment (RULA), which was conducted through a detailed observation<sup>(22)</sup>.

The Nordic questionnaire is a tool used to assess painful symptoms of musculoskeletal origin, which includes 45 items to explore symptoms in different body segments: neck, shoulder, elbow, hand, upper and lower back, hip, knee, ankle and foot<sup>(17)</sup>. The multiple selection questions are self-administered. The validated version for the Spaniard population was used, with consistency and reliability coefficients between 0.727 and 0.816<sup>(18,19)</sup>. Unfortunately, there is no a validated version for the Colombian population.

The Maslach Burnout Inventory<sup>(20)</sup> has 22 items that measure stress levels based on three dimensions: emotional fatigue, depersonalization, and personal accomplishment. This instrument was validated for the Colombian population by Oramas *et al.*,<sup>(21)</sup> with a reliability index of 0.711.

The RULA method was developed by McAtamney and Corlett in 1993. It assesses the exposure of workers to risk factors that cause a high postural load and trigger upper limb disorders. This method must be applied separately to the right and left sides of the body<sup>(22)</sup>. No special adaptation of the original method was developed in this study. The following variables were taken into account: age, gender, education, sport practice, seniority at work, daily working hours, weight, height, body mass index, type of contract, number of supervised employees, felt morbidity, intervention recommended by RULA, fatigue, depersonalization, and low personal accomplishment.

Quantitative variables were analyzed with the SPSS statistical program. Chi square with an  $\alpha < 0,05$  was used to test the hypothesis.

### **Ethical considerations**

This study followed the international biomedical research agreements under the Helsinki declaration. This research is classified as having “no risk”, according to the article 11, number “a” of the 1993 Administrative Act 8430 of the Colombian Ministry of Health and Social Protection.

This research had the approval of the Ethics Committee of the Libre University from Cali, Valle del Cauca (Colombia). Data strict confidentiality was

guaranteed through the encryption of personal information using numerical codes. Participants and their information were treated with respect and dignity. Everyone who met the inclusion criteria was able to participate without any type of discrimination and had the choice to quit at any time, according to the informed consent. Based on the research design, this study did not represent a health risk to the participants, did not generate any revenue, and did not harm the environment.

### **Results**

Most of the participants were female (66%) and the age range was between 23 to 58 years, with a median of  $39.4 \pm 10.3$  years old. 56.7% of employees did not practice any sport and 37% were overweight. 45% of participants were single, 45% had professional education levels, 54.8% had service providing contracts and worked between 6 to 15 hours per day. Finally, 58% of employees had been working for 1-5 years in the study institution.

Participants reported having neck (51%), back (36%), and shoulder (33%) pain during the last six months. This pattern did not during the last seven days of the study (36%, 27%, and 25%, respectively). Neck (18.3%) and hand-wrist (15.4%) pain were the ones that caused greater difficulties for participants to perform their work and limited their daily activities (13.8% and 14.4%, respectively) (Table 1).

In terms of intensity, neck, shoulder, and hand pain were classified as mild (23%, 12.5%, and 11.5%, respectively).

16% participants had neck while 10% of them experienced shoulder pain during a time range of 13 months to 3 years. On the other hand, 12% of workers experienced shoulder pain and 11% had back pain, both groups experienced it for 2-6 months. 19.2% of employees consulted a doctor for neck pain, 17.3% for shoulder pain, and 12.5% for back pain. 32% of the participants attributed their pain to stress, 24% to repetitive movement, and 21% to an inadequate posture.

In relation to the stress levels that were assessed with the Maslach scale, 79% of workers were placed at low fatigue levels. The same scale showed that 83% of participants were at low depersonalization levels and 73% were at high personal achievement levels (Table 2).

**Table 1.** Prevalence of pain according to anatomical regions and its effect on both work-related and unrelated activities in administrative employees from the public sector in Popayan (Colombia)

Anatomical region	Pain in the last six months		Pain in the last seven days		Working difficulties due to pain		Reduction in activities due to pain	
	n	%	n	%	n	%	n	%
Neck	51	49	36	34.6	19	18.3	14.4	13.8
Shoulder	33	31.7	25	24	14	13.5	14.4	13.8
Elbow	10.6	10.2	7	6.7	5	4.8	4	3.8
Hand/wrist	29	27.9	21	20.2	16	15.4	15	14.4
Back	36	34.6	27	26	12.5	12	12.5	12
Hip	4	3.8	3	2.9	2	1.9	3	2.9
Knee	4	3.8	96	92.3	0	0	1	1
ankle	2	1.9	0	0	1	1	1	1

With respect to the postural load measured by RULA, 76% of the workers have a medium risk level of MSD, which requires further studies to implement changes. On the contrary, 13% of employees have a very high-risk level of MSD that requires a deep analysis to provide rapid changes. Finally, only 11% of participants have an acceptable posture.

The crossing of variables showed a statistical significance between the following relationships: gender and depersonalization ( $p=0.031$ ); shoulder pain and gender ( $p=0.049$ ); hand pain and sports engagement ( $p=0.003$ ); back pain and years in office ( $p=0.010$ ); neck pain and postural load ( $p=0.003$ ); and elbow pain and emotional fatigue ( $p=0.037$ ) (Table 3).

**Table 3.** Relationship between postural load and stress levels, with presence of pain according to anatomical regions

Contrast variables	Neck	Shoulder	Elbow	Hand	Back	Hip	Knee	Ankle
	Postural load	0.003*	0.685	0.228	0.409	0.543	0.483	0.483
Emotional fatigue	0.390	0.679	0.037*	0.160	0.156	0.291	0.848	0.460
Depersonalization	0.143	0.538	0.356	0.644	0.447	0.678	0.078	0.217
Personal accomplishment	0.497	0.629	0.854	0.169	0.515	0.556	0.556	0.680

\* $p < 0.05$ , statistically significant

## Discussion

In reference to the musculoskeletal morbidity, the body areas that exhibited the highest pain prevalence were neck, shoulder, back, and wrists. These results are consistent with previous studies demonstrating that the occupational role of administrative workers is associated with a high risk of MSD due to physical load. The reason of this risk is that these jobs involve prolonged postures in a sitting position, demand activation of muscles from the back and all the entire upper body including the shoulder, and require recurring movements of shoulder and wrist, which

A lack of furniture updating and maintenance was perceived during the application of the instruments. In addition, the inadequate arrangement of the furniture with respect to the overall space and light sources as well as the absence of orientation about the adjustment and correct use of work materials and tools were observed.

**Table 2.** Stress levels in administrative employees of the public sector from Popayán, Cauca (Colombia)

Variable	Low		Medium		High	
	n	%	n	%	n	%
Fatigue	82	79	18	17	4	4
Depersonalization	86	83	13	12	5	5
Personal accomplishment	8	8	20	19	76	73

increase the possibility of the appearance of pain symptoms<sup>(23,24)</sup>. In addition, an excessive sitting position predominates, which is associated with the presence of musculoskeletal symptoms in upper limbs, lower back and inferior limbs<sup>(25)</sup>. This situation worsens as both age and exposure increase<sup>(26,27)</sup>. In this context, a relationship between the length of the service and the presence of back pain was found.

Due to the type of activities executed by administrative workers, they carry out little physical activities, have sedentary lifestyles, and show

overweight/obesity. These elements increase muscle fatigue and pain levels<sup>(26,27)</sup>, which affect both work and non-work activities<sup>(16,28)</sup>.

An increased postural load was found, with 76% of cases requiring further research and a possible need for changes, while 13% require rapid changes. This study identified a significant correlation between neck pain and postural load. When inadequate postures are developed in a work place, overload of certain muscle groups occurs, generating a biomechanical alteration of the body and causing the appearance of muscle pain. These findings are in agreement with those reported by Mendinueta and Herazo, who have indicated that maintaining prolonged positions and bearing inadequate loads are associated with musculoskeletal disorders in upper limbs<sup>(29)</sup>.

Given that this study was conducted in a public institution, there was a lack of furniture updating. Similarly, all the equipment and materials have been inherited from previous administrations, being this the main reason for the lack of maintenance, an inadequate arrangement of furniture with respect to spaces and light sources, and the absence of training about adjustment and correct use of work materials and tools. These factors increase the exposure to harmful postures due to the lack of comfort and worsen the risk due to physical load<sup>(30)</sup>. The finding of an increased postural load reflects the need for changes in work spaces, re-adaptation, ergonomic improvement, and the inclusion of self-care educational processes, such as good postural hygiene practices<sup>(30)</sup>.

The type of responsibilities undertaken by public employees could generate high levels of stress. However, the analysis of the stress variable in this case showed that the majority of employees are at a low level of emotional fatigue and depersonalization, while having high levels of personal accomplishment, which is opposite to what was found by Eijkelhofab *et al.* regarding perceived stress<sup>(31)</sup>. The findings of this study can be associated with the fact that the participating population shows high levels of personal satisfaction that can act as a protective factor. The higher the job satisfaction level in employees the lower the negative effect on their health<sup>(32)</sup>.

Despite the belief that the lack of job security is a strong predictor of poor health (due to the current

forms of hiring, including service provision)<sup>(33)</sup>, this study did not identify high levels of perceived stress, despite the fact that half of the participants have service provision contracts. These results may be due to the fact that the type of hiring does not predict happiness at work, thus evidencing that structural and more stable factors are involved, which do not depend on work conditions or external circumstances<sup>(34)</sup>.

This is an aspect that reflects how individual growth, a positive work environment, type of hiring, and low stress levels allow the worker to properly face the demands of their jobs, protecting them from stress and muscle pain. The higher the stress level the stronger the muscle fatigue<sup>(35)</sup>.

## Conclusions

The need to carry out an ergonomic refocusing in the workplace and to educate in order to promote selfcare behaviors that reduce biomechanical risk was identified in the population of administrative employees from the public sector of Popayán (Colombia).

Taking into account that the high levels of personal accomplishment are a protective factor against musculoskeletal symptoms, public institutions should focus on analyzing these aspects with employees and promote job opportunities that enrich personal and professional growth and satisfaction, as a measure to maintain physical and mental health of their employees.

This research contributes to the analysis of biomechanical risks involved in these jobs, contextualizing those risks within psychological aspects and indicating that in order to maintain physical well-being, the mental and social spheres must always be linked. The separation these two aspects can make it difficult the understanding of this phenomenon.

## Recommendations

For future studies, the use of a software to analyze physical load is recommended, which can facilitate the processing of information and expansion of the study population.

## Conflict of interests

The authors have no conflict of interest.

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