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Analysis of the role of job stress in the presence of musculoskeletal symptoms, related with ergonomic factors

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Abstract

Today, many studies have pointed to the role of both, ergonomic and psychosocial conditions in the development of various health problems in workers. One of the main problems encountered in the workplace is the musculoskeletal discomfort, which if not are removed can lead to cumulative trauma disorders. The theoretical evidence suggests that work organization can influence the development of these problems [1]. The aim of this paper is to present a comparative analysis of four studies, in which the presence of job stress with reports of musculoskeletal discomfort was related, additionally, the ergonomic conditions in the workplace where considered as a mediatorfactor.A cross-sectional study, comparative with 649 workers from four companies was conducted..The instruments used were: 1) Standardized Nordic Questionnaire on musculoskeletal symptoms of Kourinka; 2) The short version of the Job Content Questionnaire, with 27 items; and 3) List of ergonomic evaluation, in order to determine the risks to the upper and lower segments. In the four studies a relationship between the presence of job stress and reports of musculoskeletal symptoms was found. While a similar pattern on the strength of the relationship was not found, but variations in each group. These variations were influenced by gender and the ergonomic factors to which the subjects are exposed.The study results are consistent with findings of Lin, Chen and Lu [2], which indicate that females have a higher prevalence of skeletal muscle discomfort in all body areas compared to men.There is also consistency with the study by Solidaki, Chatzi, Bitsios, Markatzi, Plana, Castro, et al, [3], since in both subjects skeletal muscle discomfort in various body areas related to psychosocial factors was reported. We conclude that the design of jobs in industries not only generates musculoskeletal injury due to inadequate ergonomicconditions, but also influences the presence of stress among workers, which increases the presence of musculoskeletal symptoms.

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1. Introduction

It has been amply demonstrated that organizational factors in the workplace impact on the ergonomic demands, and simultaneously act as stressors at work. These conditions cause some stress-related disorders including musculoskeletal disorders [4].

There is scientific evidence that there are other factors that cause or increase the severity of symptoms and musculoskeletal problems. Coenen, Kingma, Boot, Twisk, Bongers& van Dieen [5] conducted an analysis of several epidemiological studies indicating that there is a division of risk factors: individual factors, physical work factors (ergonomics) and psychosocial factors (job stress, social support and job satisfaction, for example), which have helped to understand the low back pain, which is one of the musculoskeletal problems that cause more disability.

Among these psychosocial factors, job stress, has shown to have a greater association with musculoskeletal disorders, which has been studied in greater depth. To understand this relationship, is important to consider the role of work organization.

Carayon, Smith and Haims [1], point to two possible effects of work organization in generating risks. First, many organizational factors have been linked to stress reactions and second, the organization can influence ergonomic factors such as posture, repetition, and movements, which have been identified as risk factors for musculoskeletal disorders.

Work organization can define a) the nature, b) the force and c) time of exposure to ergonomic risk factors, determining how a job can be done by setting production levels and defining the structure of payment.

The aim of this paper is to present a comparative analysis of four studies, in which the presence of job stress with reports of musculoskeletal discomfort was related, additionally, the ergonomic conditions in the workplace where considered as a mediator factor.

2. Method

2.1. Participants

The study involved 646 workers of both genders. The sample was obtained at the convenience of four companies. The subjects worked in the production area. All participated voluntarily and were informed of the risks of participation.

2.2. Instruments

In the research three instruments were used:

- • Standardized Nordic Questionnaire on musculoskeletal symptomsKourinka [6] with the aim of determining the prevalence of musculoskeletal symptoms. The first part of it was used, which assesses nine body segments, showing if symptoms have occurred in the last seven days or the last twelve months. This questionnaire has been employed in different jobs.
- • The short version of the Job Content Questionnaire, Karasek, [7] as adapted by Juarez-Garcia, which consists of 27 questions. The questionnaire includes five items concerning psychological demands and social support. Control at work consists of nine items for skills and authority in the decision. It consists of a Likert scale with four points, ranging from strongly disagree to strongly agree.
- • List of ergonomic evaluation, in order to determine the risks to the upper and lower segments. This checklist provides a baseline for assessing risks and solve ergonomic problems that may arise in the workplace.

3. Results

3.1. Participants characteristics

The four groups are described in Table 1, in which gender and age characteristics are detailed. The majority of participants was male, being representatives of the population.

Table 1. Participant's descriptions.

		Group 1 n=100	Group 2 n=203	Group 3 n=220	Group 4 N=122
Gender	Female	79	0	19	8
	Male	21	203	203	114
Age M(range)		35.78 (18-63)	34.19 (19-49)		41.82 (18-70)

3.2. Associations with musculoskeletal symptoms

The presence of job stress among workers of different groups (Table 2), present variations, data indicate that there is statistically significant difference, obtaining X^2 (g.l.) of 226.92 (3).

Table 2. Job stress distribution in the sample.

	Job stress	
	No	Yes
	Frec.(%)	
Group 1	69% (69)	31% (31)
Group 2	83% (169)	16.7% (34)
Group 3	81.9 (167)	18.1% (37)
Group 4	80.4% (90)	19.6% (22)
Total	80% (495)	20% (124)

By comparing the frequency of musculoskeletal symptoms among both genders in each group, it was found that there are statistically significant differences in some corporal areas. The neck and back areas differed in two groups. Group 3 was not included in this analysis since it is made up exclusively of men (Table 3).

Table 3. Relation between musculoskeletal symptoms and gender.

Corporal zone		Group 1 n=100			Group 3 n=220			Group 4 N=122		
		Gender			Gender			Gender		
		FM	MS	X^2 (p)	FM	MS	X^2 (p)	FM	MS	X^2 (p)
Neck	No	49	20	0.003 <0.01	7	165	20.835 <0.001	4	81	
	Yes	30	1		12	36		4	33	
Shoulder	No	68	20		15	182		8	93	
	Yes	11	1		4	19		0	21	
Elbow	No	75	18		17	190		7	108	
	Yes	4	3		2	11		1	6	
Wrist /Hands	No	57	21	0.024 <0.05	14	178		7	105	
	Yes	21	0		5	23		1	9	
Upper back	No	57	20	0.025 <0.05	8	11	19.449 <0.001	7	87	
	Yes	22	1		169	32		1	27	
Low back	No	63	20		11	148		6	78	
	Yes	16	1		8	53		2	35	
Hips /thighs	No	72	7		17	181		5	108	11.369 <0.05
	Yes	21	0		2	20		3	6	
Knees	No	69	21		10	151	4.475 <0.05	6	83	
	Yes	10	0		9	50		2	31	
Ankles / /feet	No	73	21		12	163		6	99	
	Yes	6	0		7	38		2	15	

When comparing the four groups studied (Table 4), it was found that the behavior of musculoskeletal symptoms is different for each of them, this difference was statistically significant at p <0.01.

Table 4. Distribution of musculoskeletal symptoms in the groups.

Corporal zone		Group 1 n=100	Group 2 n=203	Group 3 n=220	Group 4 N=122	X^2(g.l.)
Neck	No	69	109	172	85	316.27 (3)
	Yes	31	94	48	37	
Shoulder	No	88	143	197	101	313.44 (3)
	Yes	12	60	23	21	
Elbow	No	93	192	207	115	255.32 (3)
	Yes	7	11	13	7	
Wrist /Hands	No	78	166	192	112	269.86(3)
	Yes	21	37	28	10	
Upper back	No	77	120	177	94	310.00 (3)
	Yes	23	83	43	28	
Low back	No	83	56	159	84	491.05 (3)
	Yes	17	147	61	37	

Corporal zone		Group 1 n=100	Group 2 n=203	Group 3 n=220	Group 4 N=122	X^2(g.l.)
Hips /thighs	No	79	181	198	113	267.52 (3)
	Yes	21	22	22	9	
Knees	No	90	166	161	89	276.12 (3)
	Yes	10	37	59	33	
Ankles / /feet	No	74	170	175	105	293.03 (3)
	Yes	6	33	45	17	

The participants were arranged into two groups according to the presence of stress, and a comparison of musculoskeletal symptoms present in these groups was performed. In two of the body zones were statistically significant in relation to the presence of stress. These areas were the hands and knees (Table 5).

Table 5. Relation between job stress and musculoskeletal symptoms.

		Job stress		
Corporal zone		No	Yes	X^2(g.l.)
Neck	No	247	66	0.472 (1)
	Yes	79	24	
Shoulder	No	294	59	0.180 (1)
	Yes	51	12	
Elbow	No	314	61	0.960 (1)
	Yes	36	5	
Wrist /Hands	No	291	63	**3.814 (1)**
	Yes	44	18	
Upper back	No	263	61	0.951 (1)
	Yes	71	21	
Low back	No	249	52	2.190 (1)
	Yes	90	24	
Hips /thighs	No	308	55	0.968 (1)
	Yes	42	11	
Knees	No	262	42	**9.062 (1)**
	Yes	85	27	
Ankles / /feet	No	285	49	1.599 (1)
	Yes	66	16	

Through a binary logistic regression analysis, the behavior of the variables that theoretically affect the presence of musculoskeletal symptoms was analyzed. Ergonomic risk factors were included, and two of the components of job stress were analyzed: psychological demands and control.

The weight of the variables in the model presented changes in some body segments in which symptoms were reported; Table 4 presents the results of the logistic regression, highlighting the most important factors.

Table 6. Models of binary logistic regression for musculoskeletal symptoms.

			I.C. 95%	
Corporal zone	Factor	O.R.	Lower.	Upper.
Neck	Work station	3.762	.466	30.381
	Use of Upper Limb	.556	.066	4.715
	Psychological job demands	**3.506**	**1.299**	**9.461**
	Job control	.738	.280	1.947
Upper back	Work station	2.847	.350	23.156
	Psychological job demands	1.830	.659	5.083
	Job control	2.097	.739	5.957
Low back	Work station	3.051	.658	14.136
	Use of Upper Limb	.267	.033	2.173
	Psychological job demands	.666	.282	1.573
	Job control	.826	.356	1.914
Elbow	Use of Upper Limb	1.731	.183	16.338
	Psychological job demands	.226	.049	1.038
	Job control	2.852	.626	12.982
Wrist /Hands	Work station	2.456	.299	20.178
	Psychological job demands	.370	.116	1.183
	Job control	1.789	.553	5.783
Knees	Work station	.374	.130	1.071
	Use of Upper Limb	.929	.181	4.781
	Psychological job demands	.231	.097	.549
	Job control	1.853	.779	4.409

4. Conclusions

The study results are consistent with findings of Lin, Chen and Lu [2], which indicates that females have a higher prevalence of musculoskeletal discomfort in all body areas compared to men. Similarly, Nordander et al. [8] indicate that in many groups in which participants of both genders are included, the female group is the one with a higher prevalence of disorders. Also reported that repetitive jobs increase this ratio.

There is also consistency with the study by Solidaki, Chatzi, Bitsios, Markatzi, Plana, Castro, et al, [3], since in both subjects skeletal muscle discomfort in various body areas related to psychosocial factors was reported.

The results allow to appreciate that subjects not only have symptoms in a body area, but many areas are affected. According to Daraiseh, Genaidy, Karwowski, Davis, Stambough& Huston [9], this is due to psychosocial working conditions which have multiple effects, especially for the effort made, the risk perceived by the subject and the conditions generated by work. They found that these conditions had a statistically significant association with symptoms in the lower back and neck area; while in the present study an association between stress and discomfort in the wrists and knees was found. This association was modified by incorporating the ergonomic conditions into the model, also being found a relationship with neck discomfort.

Like Mahmud, Bahari, &Zainudin [10] was necessary to break down the job stress in their components, psychological demands and job control in order to introduce them into the logistic regression model and get the actual weight of these components, and meet its effect on the presence of musculoskeletal symptoms.

We conclude that the design of jobs in industries not only generates musculoskeletal symptoms due to inadequate ergonomic conditions, but also influences the presence of job stress among workers, which increases the presence of musculoskeletal symptoms.

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