113 - APPLICATION OF ERGONOMICS TO REDUCE RISK FACTORS FOR MUSCULOSKELETAL DISORDERS IN CONSTRUCTION WORKERS

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1. INTRODUCTION

With the severe growth of the industries of construction, there was a high rate of employability and in turn, increased health problems of workers in this sector. They exhibit symptoms of body aches due to the exhausting pace of work activities undertaken, furthermore are exposed to ergonomic risks present in the construction industry. It is important to notice that the discomfort caused by painful symptoms affects the quality of life that eventually compromise the performance of the activity, overloading the other workers because of the physical stress of the worker that has pain symptoms (Hauser et al. 2010).

In construction sites are the vast majority of the population with low level of education, due to the fact that the construction sector does not require professional training. Workers carry out activities that require repetitive movements constantly and handling heavy loads, being the work activity characterized as a heavy-duty work, it makes it difficult to maintain correct postural patterns that end up forcing the overuse of the muscles (SAAD, 2008).

To Iida (2005), the construction jobs are restless, unstructured and most activities are held outdoors, under the action of the weather. The author also mentions that bricklayers bend over 1,000 times a day to pick up bricks, to get the mortar with a spatula and make laying. It is becoming increasingly concerned at the emergence of occupational diseases, in which many workers in construction sector suffer from musculoskeletal disorders of the services performed in this field.

Researches show that 82% of those who have taken part in construction job have complained of some sort of musculoskeletal symptoms. The most frequently mentioned symptom was back pain, shown in 65% of cases. As a result of pain, 12% of the employees missed work and 18% sought for medical care because of the pain in anatomical regions (SAAD, 2008 apud GOLDSHEVDER et al.,2002).

According to Saad (2008), the application of ergonomics helps to minimize the muscular demand generated by poorly structured work on construction sites. It is a science that offers help for the prevention of work-related musculoskeletal disorders. It also promotes a better quality of working life and reduces workers exposure to harmful agents. For Xavier (2010), the quality of work life shows how much the population of the environment is able to meet its personal needs through its work experiences and life in the company.

The work environment that provides physical, mechanical and psychological adverse conditions is characterized as one of the main risk factors for the emergence of changes in the musculoskeletal system. Therefore, in general, the main risks related to musculoskeletal disorders are the result of increased hours of work, fast pace, shortage of workers, often overtime, use of inappropriate tools, weather, use of excessive force for certain tasks, repetitive movements and incorrect postures to perform work activities (MAGNAGO, 2007).

In order to minimize the pain caused to employees, it is important to observe their adopted posture while performing work duties, as well as locate the painful points of the body of each individual and listen to their complaints. The data can be obtained using, for example, the Nordic questionnaire where the painful body regions can be brought up by employees .Such questionnaire was developed with the proposal to measure complaints of the musculoskeletal symptoms to make the analysis of results easy. The authors who developed this questionnaire only bother to identify musculoskeletal disorders, therefore, should not be used as a basis for clinical diagnosis (PINHEIRO et al., 2002).

According to Pinheiro et al. (2002) it was reported that the Nordic questionnaire consists of multiple-choice or binary in relation to the incident of pain in the anatomical regions which are more common. Workers interviewed must report the incident of symptoms considering the twelve months and seven days preceding the interview, and must report the incident of leave from daily activities in the last year worked.

So this research aims to identify the existence of painful body regions, reported in the last twelve months worked, through the application of a Nordic questionnaire to workers in certain activities performed in construction sector.

2. MATERIAIS AND METHODS

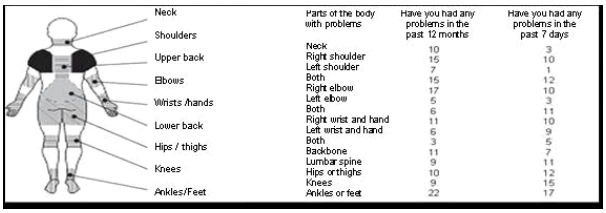
In order to identify the painful parts of the body, the Nordic questionnaire was chosen to be applied in form of interviews with construction workers. The main points of the survey were the construction workers, janitors, plumbers and electricians who are engaged in construction activities of the Federal Technological University of Parana, in Curitiba.

The population is made up of forty-two employees, being thirty bricklayers who develop the activities of laying ceramic bricks and coverings in general, two electricians, three plumbers and seven assistants, with an average age of 29 years old and an average height of 1,75 meters.

3. RESULTS

Each of the workers answered the Nordic questionnaire for the characterization of musculoskeletal symptoms, given the analysis of body parts with problems in the following order: 1 - Neck 2 - shoulders, 3 - elbows 4 - wrists and hands; 5 - backbone; 6 - lumbar spine, 7 - hips or thighs, 8 - knees and 9 - ankle or feet.

Figure 1 presents the Nordic questionnaire to thirty interviewed bricklayers .It can be seen in the Figure that some workers gave more than one answer, in other words, they feel pain in more than one body region.

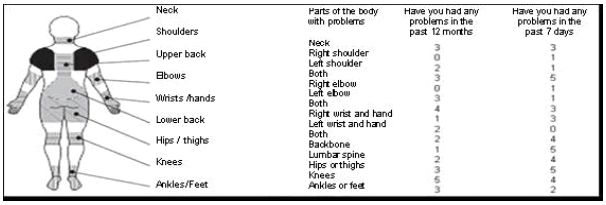


Parts of the body with problems	Have you had any problems in the past 12 months	Have you had any problems in the past 7 days
Neck	10	3
Right shoulder	15	10
Left shoulder	7	1
Both	15	12
Right elbow	17	10
Left elbow	5	3
Both	6	11
Right wrist and hand	11	10
Left wrist and hand	6	9
Both	3	5
Backbone	11	7
Lumbar spine	9	11
Hips or thighs	10	12
Knees	9	15
Ankles or feet	22	17

Figure 1 - Distribution of musculoskeletal symptoms by body regions of the bricklayers
Source: Adapted from Martarello and Benatti, 2008

Analyzing Figure 1, the following complaints from bricklayers about body aches in the last 12 months were obtained: 33% complained of neck pain, hip or thigh, 50% both shoulders, 56% right elbow, 16% elbow left, 20% both elbows, left wrist and hand, 36% right hand and wrist and spinal column, 10% both wrists and hands, 30% lumbar spine and knees and 73% ankles or feet. In the last 7 days, the painful body parts brought up by the bricklayers were 10% complains of neck pain and left elbow, 33% right shoulder, right elbow, wrist and right hand, 3% left shoulder, 40% both shoulders, hip or thigh, 36% both elbows and spine, 30% wrist and left hand, 16% both wrists and hands, 23% spine, 50% knees and 56% ankles or feet.

The seven janitors interviewed also gave more than one answer, in other words, felt pain in more than one body region. Figure 2 illustrates the complaints of the janitors with the application of the Nordic questionnaire.

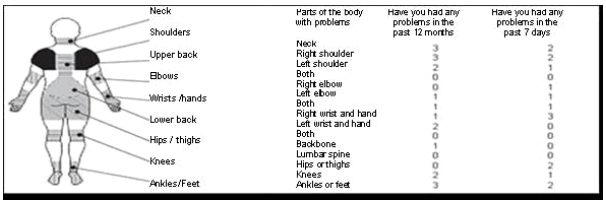


Parts of the body with problems	Have you had any problems in the past 12 months	Have you had any problems in the past 7 days
Neck	3	3
Right shoulder	0	1
Left shoulder	2	1
Both	3	5
Right elbow	0	1
Left elbow	3	1
Both	4	3
Right wrist and hand	1	3
Left wrist and hand	2	0
Both	2	4
Backbone	1	6
Lumbar spine	2	4
Hips or thighs	3	5
Knees	5	4
Ankles or feet	3	2

Figure 2 - Distribution of musculoskeletal symptoms by body regions of the janitors
Source: Adapted from Martarello and Benatti, 2008

Through the Nordic questionnaire in Figure 2, the following claims of the janitors in reference to the body aches in the last 12 months were obtained: 42% complained of pain in the neck, both shoulders, left elbow, hip or thigh and ankles or feet, 57% complained pain in both elbows, 14% spine, wrist and right hand, 28% left shoulder, lumbar spine, both wrists and hands and 71% experience pain in the ankles or feet. In the last 7 days complaints of pain in body parts were: 42% neck pain, both elbows, wrist and right hand, 14% complained of pain in right shoulder, left shoulder, right elbow and left elbow, 71% both shoulders, spine, hip or thigh, 57% both wrists and hands and knees, 28% ankles or feet.

The Plumbers interviewed, as well as bricklayer and janitors also complained of pain in more than one body region. Figure 3 illustrates the result of applying the Nordic questionnaire to the three plumbers.

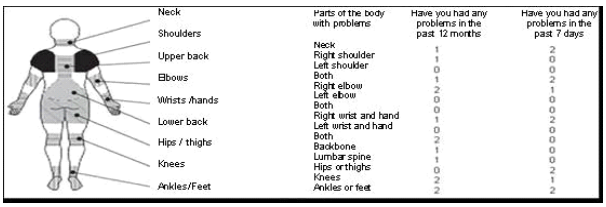


Parts of the body with problems	Have you had any problems in the past 12 months	Have you had any problems in the past 7 days
Neck	3	2
Right shoulder	3	2
Left shoulder	2	1
Both	0	0
Right elbow	0	1
Left elbow	1	1
Both	1	1
Right wrist and hand	1	3
Left wrist and hand	2	0
Both	0	0
Backbone	1	0
Lumbar spine	0	0
Hips or thighs	0	2
Knees	2	1
Ankles or feet	3	2

Figure 3 - Distribution of musculoskeletal symptoms by body regions of the plumbers
Source: Adapted from Martarello and Benatti, 2008

The regions of the body which plumbers felt more pain, according to results presented in the Nordic questionnaire of Figure 3 in the last 12 months are: 100% of complaints of neck pain, right shoulder, ankles or feet, 66% felt pain in left shoulder, left hand and wrist and knee, 33% complained of pain in both elbows, right hand and wrist and spine. The complaints for the last 7 days were 66% complained of pain in the neck, right shoulder, hip or thigh or feet and ankles, wrist and hand 100% right, 33% felt pain in his left shoulder, both elbows and knees.

Figure 4 shows the result of applying the Nordic questionnaire for the two electricians interviewed, these workers showed more than one region of the body where they're in pain.



Parts of the body with problems	Have you had any problems in the past 12 months	Have you had any problems in the past 7 days
Neck	1	2
Right shoulder	1	0
Left shoulder	0	0
Both	1	2
Right elbow	2	1
Left elbow	0	0
Both	0	0
Right wrist and hand	1	2
Left wrist and hand	0	0
Both	2	0
Backbone	1	0
Lumbar spine	1	0
Hips or thighs	0	2
Knees	2	1
Ankles or feet	2	2

Figure 4 - Distribution of musculoskeletal symptoms by body regions ot the electricians
Source: Adapted from Martarello and Benatti, 2008

Analyzing Figure 4, the following claims from the electricians regarding body aches in the last 12 months were obtained: 50% complained of pain in the neck, both shoulders, right wrist and hand, spine and lumbar spine, 100% right elbow, both wrists and hands, knees, ankles or feet. In the last 7 days, the complaints of pain in body parts were 100% pain in the neck, both shoulders, right wrist and hand, hip or thigh, ankles or feet, 50% right elbow and knees.

4. ARGUMENTATIONS

With the questionnaire given to the workers, it is observed that the interviewees complained of pain in more than one region of the body. This happens because in most construction sites the activities are carried out manually, thus eventually resulting in activities with a high degree of risk to the workers. Certain activities need to be implemented in several positions and heights, forcing workers to adopt aggressive postures, such as flexing in crouching positions, repetitive movements, use of

constant physical force, loading of materials and heavy equipment, reaching places away from the body and above head, going up and down, among others. The graph in Figure 5 shows the total answers of the forty-two workers interviewed. They are presented only complaints of pain in the last 12 months.

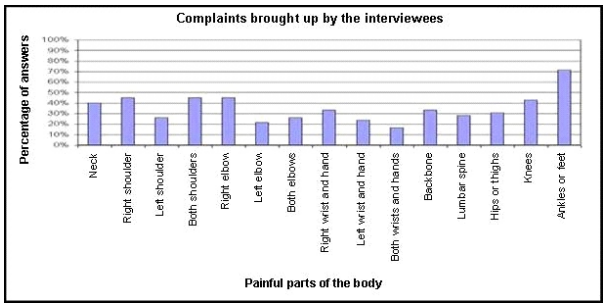


Figure 5 - Representation of the most painful regions of the body indicated by the workers

Figure 5 shows all the painful body regions indicated by the workers. After an analysis of all responses it is clear that the most painful regions of the body are the ankles or feet with 71% of complaints.

The bricklayers and janitors interviewed develop everyday tasks such as the lifting of masonry, stucco laying, plaster and placing of ceramic products, which are the reason for their complaints of pain in parts of the body. During these activities, they are exposed to ergonomic risks, as they remained in incorrect postures most of the time, they are manual lifting and carrying weight and using physical force, besides the risk of falling from high altitude or falling at the same height or level, upper body amputations and electric shock.

The reason for the pain to which the electricians claimed is due to poor posture, crouched positions and repetitive movements during the development of the activity. These professionals are prone to accidents such as electric shock, cutting and puncturing of the upper limbs.

The main reason that causes pain in the plumbers interviewed is the exposure to ergonomic risks such as incorrect postures, manual lifting and carrying weight.

The Interviewees due to negligence or even lack of knowledge of the correct procedures to be adopted for the development of the activity might be surprised by the most aggravating problems in the spine, in addition to musculoskeletal disorders and discomfort caused by painful symptoms.

5. CONCLUSIONS

The survey of the Nordic questionnaire indicated that the interviewees feel weak pain, but uncomfortable. The bricklayers, janitors, electricians and plumbers acknowledge that there is a physical strain for the development of their activities and are aware of the pain and musculoskeletal injuries that arise from the use of excessive force, incorrect postures and repetitive movements.

The workers interviewed complained of pain in more than one body region, however, the percentages of responses were 16% both wrists and hands, 21% left elbow, 24% left wrist and hand, 26% left shoulder and both elbows, 28% lumbar spine, 31% hip or thigh, 33% right hand and wrist and spine, 40% neck, 43% knees, 45% both shoulders and right elbow and 71% ankles or feet.

We conclude that it is necessary to promote suitable measures to guide workers in carrying out their activities, such as manual lifting and carrying weight, repetitive motions, incorrect postures and the risks of accidents in which they are exposed.

Constant training to workers and explanations of ergonomic risks will make them aware of the correct procedures to carry out the activities. Thus it is possible to eliminate or minimize body aches and perform better while carrying out tasks, especially keeping better quality of life at work.

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APPLICATION OF ERGONOMICS TO REDUCE RISK FACTORS FOR MUSCULOSKELETAL DISORDERS IN CONSTRUCTION WORKERS

ABSTRACT

This research presents an assessment of ergonomic risk in certain activities performed by workers who work in private construction projects of the Federal Technological University of Paraná, in Curitiba. To this end, it was necessary to use a Nordic questionnaire as a research tool to identify the existence of painful body regions, reported by 42 workers over the past twelve months worked. With the questionnaire application, it was observed that construction workers indicated that the pains occur in more than one body region. Workers interviewed; due to negligence or even lack of knowledge of the correct procedures, may be surprised by aggravating problems in the spinal column, in addition to musculoskeletal disorders and discomfort caused by painful symptoms in the body. The bricklayers, janitors, electricians and plumbers, reported suffering from minor pain, yet uncomfortable. consequently, these professionals reported they were aware of the pains and musculoskeletal injuries, which would be the consequences of using excessive force, incorrect postures and repetitive movements. Thus, it is concluded that there is need for constant training, with better insight into the ergonomic risks to which these workers are exposed while performing their activities, such as manual lifting and carrying weights, repetitive motions, incorrect postures and risks of work-related accidents.

KEYWORDS: ergonomic risks; construction; Nordic Questionnaire.

APPLICATION DE L'ERGONOMIE POUR RÉDUIRE LES FACTEURS RISQUE DE TROUBLES MUSCULO-SQUELETTIQUES DANS TRAVAILLEUR DE LA CONSTRUCTION

RÉSUMÉ

Cette recherche présente une évaluation des risques ergonomiques dans certaines activités relisées par quarante-deux ouvriers qui travaillent dans la construction de l'Université Technologique Fédérale du Paraná, à Curitiba. Pour cela, il a été nécessaire utiliser comme outil de recherche un questionnaire nordique pour identifier l'existence de régions corporelles douloureuses. Le questionnaire a été rapporté par les travailleurs au cours des douze derniers mois travaillés. Avec ce questionnaire, il a été noté que les professionnels de la construction, ont indiqué que les douleurs surviennent dans plus d'une région du corps. Les travailleurs interrogés, par négligence ou manque de connaissance des procédures correctes, peuventêtre surpris par des problèmes aggravants dans la colonne vertébrale, au-dela des troubles musculo-squelettiques et des inconforts causés par les symptômes douloureux dans le corps. Les maçons, ouvrires, électriciens et plombiers, ont déclaré souffrir de douleurs mineures, mais inconfortables. Pour ce fait, ces professionnels ont déclaré qu'ils étaient conscients de la douleur et les blessures musculo-squelettiques, qui seraient les conséquences d'utiliser une force excessive, de mauvaises postures et des mouvements répétitifs. Ainsi, nous concluons qu'il ya besoin d'une formation constante, avec de meilleurs renseignements sur les risques ergonomiques auxquels ces travailleurs sont exposés dans l'exercice de leurs activités, telles que la levée et le transport manuel de poids, des mouvements répétitifs, des postures et des risques d'accidents.

MOTS-CLÉS: Risques ergonomiques; Construction; Questionnaire nordique.

APLICACIÓN DE LA ERGONOMÍA PARA REDUCIR LOS FACTORES DE RIESGO DE LOS DISTURBIOS MUSCULARES EN EL TRABAJADOR DE LA CONSTRUCCIÓN

RESUMEN

Este estudio presenta una evaluación de riesgos ergonómicos en ciertas actividades realizadas por los empleados que trabajan en obras de construcción de la Universidad Federal Tecnológica de Paraná, en Curitiba. Por lo tanto, fue necesario utilizar como herramienta de investigación un cuestionario nórdico para identificar la existencia de regiones dolorosas del cuerpo, según los 42 trabajadores en los últimos doce meses trabajados. Con el cuestionario, se observó que los profesionales de la construcción indicaron que los dolores se producen en más de una región del cuerpo. Los trabajadores entrevistados, por negligencia o falta de conocimiento de los procedimientos correctos, pueden ser sorprendidos por los problemas agravantes en la columna, además de los disturbios musculares y molestias causadas por los síntomas de dolor en el cuerpo. Los albañiles, peones, electricistas y fontaneros, informaron que sufren de dolor de menor importancia, pero incómoda. Por lo tanto, estos profesionales informaron de que estaban conscientes del dolor y las lesiones músculo esquelético, que serían las consecuencias del uso de fuerza excesiva, las posturas forzadas y movimientos repetitivos. Sin embargo, concluye que existe la necesidad de formación continua, con un mejor conocimiento de los riesgos ergonómicos a los que estos trabajadores están expuestos durante la ejecución de sus actividades, por ejemplo, levantar y transportar pesos manualmente, movimientos repetitivos, posturas incómodas y riesgo de accidentes.

PALABRAS CLAVE: Riesgos ergonómicos, Construcción, Cuestionario Nórdico.

APLICAÇÃO DA ERGONOMIA PARA REDUZIR OS FATORES DE RISCO DE DISTÚRBIOS OSTEOMUSCULARES EM TRABALHADORES DA CONSTRUÇÃO CIVIL

RESUMO

Esta pesquisa apresenta uma avaliação do risco ergonômico em determinadas atividades realizadas por trabalhadores que atuam nas obras da construção civil da Universidade Tecnológica Federal do Paraná, na cidade de Curitiba. Para tal, foi necessário utilizar como instrumento de pesquisa um questionário Nórdico para identificar a existência de regiões corporais dolorosas, relatados por 42 operários, nos últimos doze meses trabalhados. Com a aplicação do questionário, nota-se que os profissionais da construção, indicaram que as dores acontecem em mais de uma região do corpo. Os operários entrevistados, por negligência ou mesmo por falta de conhecimento dos procedimentos corretos, podem ser surpreendidos por problemas agravantes na coluna, além dos distúrbios osteomusculares e desconfortos causados pelos sintomas dolorosos no corpo. Os pedreiros, serventes, eletricistas e encanadores, informaram sofrerem de dores fracas, porém desconfortáveis. Para tanto, esses profissionais, relataram que estavam cientes das dores e lesões músculo-esquelético, as quais seriam conseqüências do uso de força excessiva, posturas inadequadas e movimentos repetitivos. Assim, conclui-se que há necessidade de treinamentos constantes, com melhores esclarecimentos sobre os riscos ergonômicos, aos quais esses trabalhadores estão expostos durante a execução de suas atividades, como por exemplo, levantamento e transporte manual de pesos, movimentos repetitivos, posturas inadequadas e riscos de acidentes de trabalho.

PALAVRAS CHAVE: Riscos ergonômicos; Construção civil; Questionário Nórdico.