




Manifestations of musculoskeletal disorders in metal model makers

Manifestaciones de trastornos musculoesqueléticos en moldeadores manuales metalúrgicos

Manifestações de afecções musculoesqueléticas em moldadores metalúrgicos manuais

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ABSTRACT

Introduction: musculoskeletal disorders in the metallurgical work context have a negative impact from the personal, economic and social perspective of workers. **Objective:** to identify the manifestations of musculoskeletal disorders in metallurgical manual molders in the foundry area of the Holmeca company in the province of Holguín, Cuba, in the period from January to March 2021. **Method:** an observational, non-experimental study was carried out, cross-sectional study in 19 metallurgical manual shapers, which included sociodemographic variables, location of painful areas, pain intensity, time of onset and duration of the disorder. Theoretical and empirical methods were used. The standardized Kuorinka Nordic Questionnaire and the Visual Analog Scale were used. The information processing was carried out using descriptive statistics. **Results:** the painful areas and the highest prevalence of musculoskeletal pain were identified in: wrist/hand (94.74%), shoulder (89.47%),

dorsal/lumbar (89.47%) and elbow/forearm (84.21%). The intensity of the pain was determined as intense in 36.84% and moderate in 42.11% of the workers; while in 21.05% it was mild. The duration of the disorders was 3-38 years, which appeared after 5 to 7 years after beginning work in the study area. **Conclusions:** the prevalence of manifestations of musculoskeletal disorders in metallurgical manual molders in the foundry area of the Holmeca Company in Holguín is high. They are identified in the hand/wrist, shoulder, lumbar and elbow/forearm, as the anatomical areas most affected in this population group.

Keywords: musculoskeletal disorders; metallurgical hand shapers; prevention; occupational medicine



RESUMEN

Introducción: los trastornos musculoesqueléticos en el contexto laboral metalúrgico repercuten negativamente desde la perspectiva personal, económica y social de los trabajadores. **Objetivo:** identificar las manifestaciones de trastornos musculoesqueléticos en los moldeadores manuales metalúrgicos del área de fundición de la empresa Holmecca de la provincia Holguín, Cuba, en el período comprendido enero-marzo de 2021. **Método:** se realizó un estudio observacional, no experimental de corte transversal en 19 moldeadores manuales metalúrgicos, en el que se incluyeron variables sociodemográficas, ubicación de zonas dolorosas, intensidad del dolor, tiempo de aparición y duración del trastorno. Se emplearon métodos teóricos, empíricos. Fue utilizado el Cuestionario Nórdico estandarizado de Kuorinka y la Escala Visual Analógica. El procesamiento de la información se llevó a cabo mediante la estadística descriptiva. **Resultados:** se identificaron las zonas dolorosas y la prevalencia más alta de dolor musculoesqueléticos en: muñeca/mano (94,74 %), hombro (89,47%), dorsal/lumbar (89,47%) y codo/antebrazo (84,21%). La intensidad del dolor fue determinada como intenso en el 36,84 % y moderado en el 42,11 % de los trabajadores; mientras que en el 21,05 % fue leve. El tiempo de padecimiento de los trastornos fue de 3-38 años, que aparecieron luego de 5 a 7 años de haber comenzado las labores en el área de estudio. **Conclusiones:** la prevalencia de manifestaciones de trastornos musculoesqueléticos en los moldeadores manuales metalúrgicos del área de fundición de la empresa Holmecca de Holguín es elevada. Se identifican en mano/muñeca, hombro, lumbar y codo/antebrazo, como las zonas anatómicas más afectadas en este grupo poblacional.

Palabras clave: trastornos musculoesqueléticos; moldeadores manuales metalúrgicos; prevención; medicina del trabajo

RESUMO

Introdução: as lesões osteomusculares no contexto do trabalho metalúrgico têm um impacto negativo na perspectiva pessoal, econômica e social dos trabalhadores. **Objetivo:** identificar as manifestações de distúrbios osteomusculares em moldadores manuais metalúrgicos da área de fundição da empresa Holmecca, na província de Holguín, Cuba, no período de janeiro a março de 2021. **Método:** foi realizado um estudo observacional, não experimental. estudo transversal em 19 modeladores manuais metalúrgicos, que incluiu variáveis sociodemográficas, localização das áreas dolorosas, intensidade da dor, tempo de início e duração do distúrbio. Foram utilizados métodos teóricos e empíricos. Foram utilizados o Questionário Nórdico Kuorinka padronizado e a Escala Visual Analógica. O processamento das informações foi realizado por meio de estatística descritiva. **Resultados:** as áreas dolorosas e as maiores prevalências de dores musculoesqueléticas foram identificadas em: punho/mão (94,74%), ombro (89,47%), dorsal/lombar (89,47%) e cotovelo/antebraço (84,21%). A intensidade da dor foi determinada como intensa em 36,84% e moderada em 42,11% dos trabalhadores; enquanto em 21,05% foi leve. A duração dos distúrbios foi de 3 a 38 anos, surgindo após 5 a 7 anos após o início do trabalho na área de estudo. **Conclusões:** é elevada a prevalência de manifestações de distúrbios musculoesqueléticos em moldadores manuais metalúrgicos na área de fundição da empresa Holmecca em Holguín. São identificadas na mão/punho, ombro, lombar e cotovelo/antebraço, como as áreas anatómicas mais acometidas neste grupo populacional.

Palavras-chave: distúrbios musculoesqueléticos; modeladores manuais metalúrgicos; prevenção; medicina do trabalho

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INTRODUCTION

Work, as an essential form of human activity, takes place in environments whose specific characteristics influence the health of workers. Among the most recurrent occupational diseases are musculoskeletal disorders. They affect the quality of life of workers and represent a high economic and social cost in terms of incapacity, physical ailments, absenteeism, early retirement, expenses for medical examinations, rehabilitation treatments and increased physical burden for the work colleagues of the sufferer.^(1,2)

Musculoskeletal disorders are physical and functional alterations associated with the locomotor system, caused or aggravated by work and the effects of the environment in which it is developed; whose main symptoms are pain associated with inflammation, loss of strength and functional limitation of the affected part, which hinders or prevents the performance of certain movements.⁽³⁾

The causes that influence the appearance of musculoskeletal disorders can be: overexertion, manual handling of loads for prolonged periods, dysfunctional postures, static muscular effort, muscular inactivity, repetitive movements, exposure to vibrations, physical risks, individual, environmental and psychosocial factors.⁽¹⁾ For this reason, emphasis is placed on their prevention.

The metallurgical industry is one of the sectors that most reports these ailments among its workers. It is worth noting that the energy sector, primary sector industries, transportation, telecommunications networks, agri-food, chemical, petrochemical, plastics, and the metalworking and electrical industries themselves depend on it for their supply.⁽⁴⁾ It is a fundamental activity for the development of any country.

It has been proven that, in metallurgy, hygienic risks due to exposure to chemical agents stand out,⁽⁵⁾ those related to safety refer to the projection of fragments or particles of molten metal that can cause eye injuries or skin burns, as well as those derived from explosions produced by metal melting furnaces and exposure to vibrations.^(6,7)

The process of casting ferrous and non-ferrous metals is carried out in several stages, the most important of which are: melting of the metal charge, production of the mold and pouring of the liquid metal

For the production of the mold, the pneumatic rammer is used, which produces noise and transmits vibrations from the upper extremities to the whole body of the manual metal caster, which together with the adoption of inadequate postures, overexertion and, on occasions, manual handling of loads, cause musculoskeletal disorders.

Studies have been carried out to contribute to the prevention of risks that favor the appearance of occupational diseases in the metalworking industry. However, in the epistemological review carried out by the authors, there was no history of research aimed at preventive care of pathologies of the osteomioarticular apparatus in manual metalworkers.



These considerations induced to carry out a study with the purpose of identifying the manifestations of musculoskeletal disorders in metallurgical manual molders of the foundry area of Holmeca Company in Holguin province.

METHOD

An observational, non-experimental, cross-sectional, cross-sectional study was carried out in the foundry area of the Holmeca Company in Holguin, in the period from January to March 2021. In the selection of the subjects, the following criteria were established: two years of work experience in the production of molds, no musculoskeletal injuries, and willingness to participate in the research and to sign the informed consent, in accordance with the principles of the Helsinki declaration.

The objective of the study, the anonymity of the data, its ethical use only for research purposes and the importance of the results for personal health and collective productivity in the company were also explained in detail.

The research made use of methods, namely:

Theoretical

- Historical-logical: to deepen in the background and tendencies of the investigated problematic.
- Analytical-synthetic: it allowed characterizing the work process of the metallurgical manual molders, the musculoskeletal disorders caused by it; as well as analyzing, synthesizing the information obtained in the literature consulted and the interpretation of the data obtained.
- Inductive-deductive: in the interpretation of the data and establishment of essential logical relationships of the research process.

Empirical

- Scientific observation: made it possible to verify the particularities of the molding process with a pneumatic rammer.
- Survey: made it possible to determine the most affected body segments and the most common manifestations of musculoskeletal disorders in the population.

The instrument selected to collect the information in the metallurgical work context was the standardized Nordic Kuorinka Questionnaire,⁽⁸⁾ as it enables early detection of symptoms that have not been declared occupational diseases (pain, discomfort, numbness or tingling in different areas of the body).

The Visual Analog Scale (VAS) was chosen to determine the intensity of pain. This instrument is a one-dimensional scale represented by a horizontal segment 10 cm long, where the left side means no pain (0) and the right side means the worst pain imaginable.⁽¹⁰⁾ The individual must place a mark to evaluate his or her pain. This scale has demonstrated its validity and reliability, it is one of the most used in evaluation processes.⁽⁹⁾

The mathematical-statistical method was used to process the information.



The data obtained from the instruments applied were subjected to statistical analysis using SPSS software, version 22.0. The descriptive analysis of the qualitative variables was determined in percentages and absolute frequencies. Quantitative variables were expressed as measures of central tendency (mean and median) and measures of dispersion (standard deviation and range). Percentages were used to establish prevalence.

RESULTS

The population consisted of 19 manual metallurgical molders, who met the inclusion criteria established in the study. The sociodemographic variable behaved as detailed. In relation to age, the mean was 51 ± 10.74 years and varied in the interval between 25-63 years.

Regarding the time working in the position, the mean was 22 ± 10.60 years with an interval between 6-41 years. Of these, 15 were metalworkers A (78.95 %) and 4 (21.05 %) metalworkers B. All the workers reported predominance of the right hand.

According to the localization, as shown in Table 1, although painful affectations were reported in different anatomical areas, the highest prevalence was manifested in the upper part of the body of the metalworkers, in particular, the upper extremities.

Table 1 Manual molders according to the location of painful anatomical areas

Painful areas	Number of molders (n=19)	%
Neck	6	31,58
Shoulder	17	89,47
Elbow/forearm	16	84,21
Hand/wrist	18	94,74
Back/back	17	89,47
Knee	9	47,37
Ankle/foot	4	21,05

Source: Kuorinka questionnaire.

The application of the VAS instrument to determine the intensity of pain revealed that 7 subjects (36.84%) reported severe pain, 8 reported moderate pain (42.11%), while 4 casters (21.05%) reported mild pain.

In relation to the location of the pain, the lumbar area and the wrist showed a bimodal behavior with values of 7 and 8, while, in the case of the shoulder, in spite of the fact that its mode does not exist, moderate⁽¹⁾ and intense⁽³⁾ values were reported. 100% of the metal workers expressed feeling more pain in the dominant hand than in the other.



It was found that the values of the variable, time of onset of the disorder after the beginning of the job performance are in the range between 5 and 7 years, with a mean of 6 ± 1.78 . By number of painful areas: 3 casters reported 7; 2 identified 6; 5 indicated 5; 5 referred 4; 2 marked 3; 1 caster declared 2 and 1 referred only 1. The variable time of suffering from the disorder acquired values belonging to the interval 3-38 years, the mean was 18 ± 10 .

DISCUSSION

The results were compared with those derived from studies carried out in other metallurgical companies in which similarities were found, although they differed in the populations under investigation, since they do not use the pneumatic rammer as a working tool.

Krishan, et al.⁽¹⁰⁾ detected work-related musculoskeletal symptoms in small-scale foundry workers, and found a higher frequency in distal regions of the upper extremities, lumbar area, neck and shoulders.

A retrospective cross-sectional study in workers of metallurgical industries carried out by Petrini-Lopes, et al.⁽¹¹⁾ showed the presence of lateral epicondylitis (8.34%), rotator cuff syndrome (5.55%) and low back pain (22.28%).

Hyunjin, et al.⁽¹²⁾ investigated musculoskeletal diseases in 855 heavy industry workers of 35 occupations, who received physiotherapy services, among them 30 subjects (28 %) manufacturing metal molds were found. They found that lumbar spasms (31.1 %) and shoulder sprains and spasms (19.4 %) were the most frequent.

Data obtained by Hemberger, et al.⁽¹³⁾ in a metallurgical company, showed that the upper extremity was the most affected body region: shoulder (24.8 %), elbow or forearm (15.5 %), wrist or hand (19.0 %), upper or lower back (13.3 %), neck (5.8 %) and hip or lower limb (5.3 %).

The aforementioned studies^(10,13) coincide with the present one in the use of the standardized Nordic questionnaire to identify the manifestations of musculoskeletal disorders, which reaffirms the feasibility of the instrument for this type of inquiry.

On the other hand, other studies^(11, 12) used medical records for this purpose, while Hyunjin, et al.⁽¹²⁾ demonstrated the need for therapeutic interventions as a solution when the affectation is considerable. Their analysis confirms the coincidence in reporting a higher prevalence of musculoskeletal symptomatology in the upper part of the body in these populations studied in the metallurgical sector.

Another aspect to highlight is that, in the referred studies, the number of anatomical areas declared as painful by each subject was not taken into account, which could constitute an indicator to be evaluated in the case of applying a preventive or therapeutic intervention.



The results of the present investigation were limited by the subjectivity of the workers surveyed, and the memory bias that can occur in the collection of retrospective information should be taken into account. Nevertheless, it is a valuable contribution.

In the classification of professions, molders are in group 3, which includes jobs associated with significant physical exertion⁽¹⁴⁾ and the data obtained will make it possible to plan and implement interventions to prevent or mitigate these ailments, an aspect of utmost importance as noted in the study by Sundstrup, et al.⁽¹⁵⁾ This will prevent metallurgical workers who use pneumatic hammering tools in the smelting of ferrous and non-ferrous metals from being diagnosed with an occupational disease, with the repercussions that such a prescription entails. This work constitutes the starting point to carry out research in other foundries in the country and to deepen in the solution of the revealed problem.

CONCLUSIONS

The study shows that the prevalence of manifestations of musculoskeletal disorders in manual metallurgical casters of the foundry area of Holmeca Company in Holguin is high. Hand/wrist, shoulder, lumbar and elbow/forearm are identified as the most affected anatomical areas in this population group, which confirms the need to plan and implement preventive actions in primary health care in the labor context of the foundry.

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The authors declare that there are no conflicts of interest.

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