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Quantitative Original Article

Participatory Ergonomics in a bed manufacturing industry in Guatemala

Ergonomía participativa en una industria de manufactura de camas en Guatemala

Ergonomie participative dans une industrie de fabrication de lits au Guatemala

Ergonomia participativa em uma indústria de fabricação de camas na Guatemala

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ABSTRACT

Introduction: Musculoskeletal injuries, which are alterations of anatomical structures such as nerves, ligaments, tendons, etc., are a significant concern in various industries. Their genesis depends on multiple risks that can be mitigated using various methodologies. In this context, participatory ergonomics emerges as a crucial tool, proposing to reform working conditions and reduce the incidence of health conditions due to these injuries. Our objective was to identify workers' health damage and ergonomic risk factors in two areas of a bed manufacturing workplace in Guatemala City. Method: We conducted an observational, cross-sectional study on sewing and logistics workers in a bed manufacturing workplace, with a sample of 83 workers chosen at random. The workers participated voluntarily and anonymously. We used the free-to-use Ergopar software application version 2.1.0.0 for data processing. Results: The health damages identified by the workers were in the neck, shoulders and back, lumbar back, hands, and/or wrists and feet. The

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ergonomic risk factors identified as a priority were walking, tilting the head and neck forward, leaning the trunk forward, exerting pressure with one foot, and working on vibrating areas. Conclusions: Our study underscores the importance of participatory ergonomics in establishing a baseline diagnosis of health damage to workers, especially musculoskeletal injuries. It also highlights the role of volunteer commitment in optimizing working conditions.

Keywords: Ergonomics; Musculoskeletal pain; Workers; Participation of the workers.

RESUMEN

Introducción*: las lesiones musculoesqueléticas son alteraciones de estructuras anatómicas como nervios, ligamentos, tendones, etc. Su génesis depende de múltiples riesgos que pueden afrontarse utilizando diversas metodologías. La ergonomía participativa propone reformar las condiciones de trabajo y reducir la incidencia de afecciones a la salud por estas lesiones.* ***Objetivo:*** *identificar los daños a la salud y factores de riesgo ergonómicos en trabajadores de dos áreas de un centro de trabajo de manufactura de camas en la Ciudad de Guatemala.* ***Método****: se realizó un estudio observacional, transversal en trabajadores de las áreas de costura y logística de un centro de trabajo de manufactura de camas utilizando la ergonomía participativa. La muestra fue de 83 trabajadores elegidos de forma aleatoria. Los trabajadores participaron de forma voluntaria y anónima. Se utilizó la aplicación informática Ergopar versión 2.1.0.0 de uso libre para el procesamiento de datos.* ***Resultados:*** *los daños a la salud identificados por los trabajadores fueron en el cuello, hombros y dorso espalda lumbar, manos y/o muñecas y pies. Los factores de riesgo ergonómicos identificados como prioritarios fueron: caminando, inclinar la cabeza y cuello hacia adelante, inclinar el tronco hacia adelante, ejercer presión con un pie y trabajar sobre zonas vibrantes.* ***Conclusiones:*** *La ergonomía participativa permite establecer un diagnóstico de base sobre los daños a la salud en los trabajadores, especialmente lesiones musculoesqueléticas. Así mismo, orienta al compromiso de voluntario de distintos actores de un centro de trabajo para optimizar las condiciones de trabajo.*

Palabras clave*: Ergonomía; Dolor musculoesquelético; Trabajadores; Participación de los trabajadores.*

RÉSUMÉ

Introduction*: les blessures musculo-squelettiques sont des altérations des structures anatomiques telles que les nerfs, les ligaments, les tendons, etc. Sa genèse dépend de multiples risques auxquels il est possible de faire face grâce à diverses méthodologies. L'ergonomie participative propose de réformer les conditions de travail et de réduire l'incidence des problèmes de santé dus à ces blessures.* ***Objectif:*** *identifier les dommages à la santé et les facteurs de risque ergonomiques chez les travailleurs de deux zones d'un lieu de travail de fabrication de lits à Guatemala City.* ***Méthode****: Une étude observationnelle et transversale a été réalisée auprès d'ouvriers des zones de couture et de logistique d'un atelier de fabrication de lits en utilisant l'ergonomie participative. L'échantillon était composé de 83 travailleurs choisis au hasard. Les travailleurs ont participé volontairement et*

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anonymement. Le logiciel gratuit Ergopar version 2.1.0.0 a été utilisé pour le traitement des données. ***Résultats:*** *les atteintes à la santé identifiées par les travailleurs étaient dans cou, épaules et dos, dos lombaire, mains et/ou poignets et pieds. Les facteurs de risque ergonomiques identifiés comme prioritaires étaient: marcher, pencher la tête et le cou vers l'avant, pencher le tronc vers l'avant, exercer une pression avec un pied et travailler sur les zones vibrantes.* ***Conclusions:*** *L'ergonomie participative permet d'établir un diagnostic de base des atteintes à la santé des travailleurs, notamment les blessures musculo-squelettiques. De même, il oriente l'engagement bénévole des différents acteurs d'un lieu de travail pour optimiser les conditions de travail.*

Mots clés*: Ergonomie; Douleurs musculo-squelettiques; Ouvriers; Participation des travailleurs.*

RESUMO

Introdução: *As lesões musculoesqueléticas são alterações de estruturas anatômicas, como nervos, ligamentos, tendões, etc. Sua gênese depende de vários fatores que podem ser solucionados com diversas metodologias. A ergonomia participativa propõe reformar as condições de trabalho e reduzir a incidência de problemas de saúde devido a essas lesões.* ***Objetivo:*** *identificar danos à saúde e fatores de risco ergonômicos em trabalhadores de duas áreas de um centro de fabricação de camas na Cidade da Guatemala.* ***Método:*** *foi realizado um estudo observacional transversal com trabalhadores das áreas de costura e logística de um centro de fabricação de camas utilizando a ergonomia participativa. A amostra engloba 83 trabalhadores escolhidos aleatoriamente. Os trabalhadores participaram de forma voluntária e anônima. Foi utilizado o Manual Ergopar versão 2.1.0.0 de uso livre para o processamento de dados.* ***Resultados:*** *os danos à saúde identificados pelos trabalhadores foram no pescoço, ombros e parte inferior das costas, mãos e/ou pulsos e pés. Os fatores de risco ergonômicos identificados como prioritários foram: caminhar, inclinar a cabeça e o pescoço para frente, inclinar o tronco para frente, exercer pressão com um pé e trabalhar em áreas vibratórias.* ***Conclusões:*** *A ergonomia participativa permite estabelecer um diagnóstico de base sobre os danos à saúde aos trabalhadores, especialmente lesões musculoesqueléticas. Além disso, orienta o compromisso voluntário de todos os funcionários para otimizar as condições de trabalho.*

Palavras-chave: *Ergonomia; Dor musculoesquelética; Trabalhadores; Participação dos trabalhadores.*

INTRODUCTION

In government agreement 229-2014 and its reforms (33-2016 and 57-2022) of the Ministry of Labor and Social Welfare of Guatemala, it is established that every employer must adapt and apply occupational health and safety measures so that workers can provide their services, preserving their integrity, health and protecting their lives.[1] Said government agreement offers a legal and technical framework to avoid accidents and occupational diseases in the workplaces of Guatemala.

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However, the guidelines of this agreement do not include a standardized and effective methodology to prevent occupational diseases such as musculoskeletal injuries. Musculoskeletal injuries are alterations of anatomical structures such as nerves, joints, tendons, ligaments, muscles, and bones, which are caused by cumulative trauma due to overload and repeated use of a specific part of said structures.[2]

These types of injuries cause economic losses for public health since they reduce productivity, absenteeism from work, and increase accident rates and disability.[3] In Europe, the economic cost of accidents and occupational diseases is 2.6% to 3.8% of the Gross Domestic Product (GDP), where approximately 50% correspond to musculoskeletal injuries. In the United States, the Bureau of Labor Statistics indicated that these injuries are responsible for 29 to 35% of occupational injuries and that in Canada, a direct annual cost is estimated at 20 million dollars.[4] In Guatemala, the economic impact of work-related injuries and illnesses is unknown, and even less is the impact of musculoskeletal injuries of work-related origin.

In the genesis of musculoskeletal injuries, various risk factors are considered that predispose workers to suffer these injuries. Individual, biomechanical, psychosocial, behavioral, and workplace environment factors have been raised.[5-7] Through ergonomics, evaluating and controlling the risks that lead to these injuries is possible.

Haines and Wilson define participatory ergonomics as "a strategy to involve people in the planning and controlling their work, with sufficient mastery and knowledge to influence its processes and achieve desired goals." [8-9] The main objective of participatory ergonomics is to reduce the incidence and prevalence of musculoskeletal injuries and optimize the physical conditions of work.

In 2008, the Trade Union Institute of Work, Environment and Health and the Trade Union Confederation of Workers' Commissions created and perfected a participatory ergonomics method (ERGOPAR) to prevent workplace ergonomic risks. [10-11] This method has been widely used in Europe, Canada, and some Latin American countries, demonstrating its effectiveness in reducing workplace ergonomic risks. It allows obtaining information on identifying ergonomic risk factors, priority damages, and causes of exposure to them. It also allows for establishing preventive interventions to reduce the identified risks.

Manufacturing beds demands a high physical load when performing tasks that involve lifting, dragging, and pushing loads, repetitive movement, and postural overload. The occupational epidemiological surveillance system implemented in this study's workplace reported a prevalence of 17% of musculoskeletal pain in workers who consulted health services in the last semester of 2022.

Therefore, this study aimed to identify health damage and ergonomic risk factors in workers of a bed manufacturing company in Guatemala City from November 2022 to January 2023.

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METHOD

The study was observational, descriptive, and cross-sectional, conducted in a bed manufacturing workplace in Guatemala City between November 2022 and January 2023. The population of workers in the sewing and logistics areas was 166, and the sample comprised 83 workers from the sewing and logistics areas of said center in Guatemala City. 50% of the total workers in each area were selected to participate in the study.

The study variables were divided into personal and work variables, health damage and ergonomic factors. The personal and work variables were age, sex, work schedule, type of contract, and seniority in the job. The variables that identified health damage were pain according to body area: neck, shoulders and/or back, lumbar back, elbows, hands and/or wrists, legs, knees, and feet. The variables that identified the ergonomic risk factors were whole body posture, head/neck and back/trunk postures, the posture of arms, hands, and feet, hand actions and vibrations, manual manipulation of loads, and perception of the physical demand.

The questionnaire on ergonomic risk factors and damages generated by the computer application of the ERGOPAR method was used to collect information on personal and work data (5 questions), health damages derived from the workplace (1 question), and postures. and actions specific to the job (7 questions) and physical demands (1 question). The answers to the questions are dichotomous or categorical for personal data and health damage, and use a Likert scale for the postures and actions of the workplace. The questionnaire has been validated in other studies using the Kappa index, obtaining a high agreement >0.60.[12-13]

Initially, the ERGOPAR method was presented to the industry's occupational health and safety committee to identify ergonomic risk factors and health damage and subsequently establish preventive measures based on the findings. After approval, the Ergo Group was created, comprised of representatives of the occupational health and safety committee and workers from different workplace areas, whose main mission was to organize and direct information collection through the questionnaire. In the end, information was disseminated to all workers in these areas about the ERGOPAR method and the study's objectives.

The questionnaire generated by the computer application was applied physically. It was self-administered, and each worker was given 30 minutes to respond. Data processing was carried out using the free-to-use Ergopar software application version 2.1.0.0. Frequencies, proportions, and averages were calculated for the quantitative variables, and the results were stratified by sex and area.

The workers participated voluntarily and anonymously; the questionnaire did not include personal data about the workers, so the confidentiality of the responses was respected. The criteria of the Declaration of Helsinki for scientific research in humans were met.

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RESULTS

The company where this study was carried out belongs to the manufacturing sector and is dedicated to producing beds. At the time of the study, it had a workforce of 517 workers. Due to the high prevalence of musculoskeletal pain in workers in the sewing and logistics areas, the ERGOPAR method was presented to the Occupational Health and Safety Committee. The method was approved in October 2023, and the first activities were the promotion, presentation, and formalization of the method's application.

The second activity was constructing the Ergo group, which consisted of four people: an industrial safety assistant, a quality department monitor, the occupational health and safety coordinator, and the occupational doctor.

Subsequently, the training activities for said group and the preparation of the intervention report were planned. Group training utilized resources available on the method's website.

Table 1 shows the personal and work variables of the studied population, where the male sex represented 85.54% and the female sex 14.46% of the population. The average age of the workers in the sewing area was 35.7, and in the logistics area, it was 31.6; 81.93% worked split shifts (morning and afternoon), and 18.07% worked rotating shifts. The split shift implies 8 working hours, and the rotating shift implies 7 hours for the afternoon shift and 6 hours for the night shift. The type of contract was indefinite. For 96.39% of the population, 3.61% worked with a temporary contract, 60.24% reported a length of service between 1 and 5 years, 21.69% more than 5 years, and 16.87% less than one year.

Table 1 Personal and work characteristics of workers in the sewing and logistics areas.

Variable	Sewing		Logistics		Total population studied	
	n	%	n	%	n	%
Sex						
Female	10	29.41%	2	4.08%	12	14.46%
Male	24	70.59%	47	95.92%	71	85.54%
Total	34	100.00%	49	100.00%	83	100.00%
Average age	35.7		31.6		31.2	
Schedule						
Split shift	34	100.00%	34	69.39%	68	81.93%
Rotating schedule	0	0.00%	15	30.61%	15	18.07%
Total	34	100.00%	49	100.00%	83	100.00%
Contract						

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Undefined	33	97.06%	47	95.92%	80	96.39%
Temporary	1	2.94%	2	4.08%	3	3.61%
Total	34	100.00%	49	100.00%	83	100.00%
Length of service						
Less than 1 year	3	8.82%	11	22.45%	14	16.87%
Between 1 and 5 years	20	58.82%	30	61.22%	50	60.24%
More than 5 years	1	32.35%	7	14.29%	18	21.69%
Does not answer	0	0.00%	1	2.04%	1	1.20%
Total	34	100.00%	49	100.00%	83	100.00%

Regarding health damage, such as pain or discomfort in any of the study body areas (Table 2), workers in the sewing area presented the highest frequencies of pain or discomfort in the neck, shoulders and back, lumbar back, and feet. Workers in the logistics area presented the highest frequencies of pain in the neck, shoulders, and back, lumbar back, and hands and/or wrists.

Table 2 Damage to health: pain or discomfort in study body areas in workers in the sewing and logistics areas.

Pain in body area	**Sewing**		**Logistics**		**Total population studied**	
	n	**%**	**n**	**%**	**n**	**%**
Neck, shoulders and back						
YES	29	85.29%	36	73.47%	65	78.31%
No	5	14.71%	13	26.53%	18	21.69%
Lumbar Back						
YES	23	67.65%	29	59.18%	52	62.65%
No	11	32.35%	20	40.82%	31	37.35%
Elbows						
YES	4	11.76%	4	8.16%	8	9.64%
No	30	88.24%	45	91.84%	75	90.36%
Hands and/or wrists						
YES	15	44.12%	22	44.90%	37	44.58%
No	19	55.88%	27	55.10%	46	55.42%
Legs						
YES	16	47.06%	15	30.61%	31	37.35%

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No	18	52.94%	34	69.39%	52	62.65%
Knees						
YES	6	17.65%	16	32.65%	22	26.51%
No	28	82.35%	33	67.35%	61	73.49%
Feet						
YES	17	50.00%	17	34.69%	34	40.96%
No	17	50.00%	32	65.31%	49	59.04%

The ergonomic factors to which workers in the sewing area are exposed for more than four hours (priority) are walking, tilting the head and neck forward, leaning the back/trunk forward, applying pressure with one of the feet, gripping or holding objects or tools and working on vibrating surfaces. The ergonomic factors to which workers in the logistics area are exposed for more than four hours (priority) are sitting, walking, tilting the head and neck forward, tilting the head and neck to one side, tilting the back/trunk towards one side, side, twisting the back/trunk, hands above the head, bending the wrists, manually lifting loads and manually carrying loads. These factors are prioritized according to the duration of a work day.

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Table 3 Ergonomic risk factors reported by workers in the study areas (priority).

Factor de riesgo ergonómico / Área	Costura		Logística	
Postura adoptada durante la jornada de trabajo				
Sentado	14% más de 4h	2% entre 2 y 4 h	38% más de 4 h	2% entre 2 y 4 h
Caminando	56% más de 4 h	3% entre 2 y 4 h	60% más de 4 h	12% entre 2 y 4 h
Postura del cuello/cabeza durante la jornada de trabajo				
Inclinar el cuello/cabeza hacia delante	50% más de 4 h	9% entre 2 y 4 h	35% más de 4 h	2% entre 2 y 4 h
Inclinar el cuello/cabeza hacia un lado o ambos			45% más de 4 h	14% entre 2 y 4 h
Postura de la espalda/tronco durante la jornada de trabajo				
Inclinar la espalda/tronco hacia delante	41% más de 4 h	6% entre 2 y 4 h		
Inclinar la espalda/tronco hacia un lado o ambos			43% más de 4 h	4% entre 2 y 4 h
Girar la espalda/tronco			24% más de 4 h	8% entre 2 y 4h
Posturas de hombros, muñecas y tobillos/pies durante la jornada de trabajo				
Las manos por encima de la cabeza o los codos por encima de los hombros			41% más de 4 h	4% entre 2 y 4 h
Una o las dos muñecas dobladas hacia arriba o hacia abajo, hacia los lados o giradas (giro del antebrazo)			51 % más de 4 h	6% entre 2 y 4 h
Ejerciendo presión con uno de los pies	41% más de 4 h		16% más de 4 h	2% entre 2 y 4 h
Acciones de las manos durante la jornada de trabajo				
Agarrar, sujetar con fuerza objetos o herramientas con las manos	30% más de 4 h	20% entre 2 y 4 h	24% más de 4 h	6% entre 2 y 4 h
Exposición a vibraciones y/o impactos durante la jornada de trabajo				
Trabajar sobre superficies vibrantes (asiento de vehículo, plataforma o suelo vibrante)	73% más de 4 h	3% entre 2 y 4 h	28% más de 4 h	2% entre 2 y 4 h
Levantamiento de cargas durante la jornada de trabajo				
Levantar manualmente cargas mayores a 3 KG	20% más de 4 h	15% entre 2 y 4 h	41% más de 4 h	10% entre 2 y 4 h
Transportar manual de cargas mayores a 3 KG	18% más de 4 h	6% entre 2 y 4 h	57% más de 4 h	6% entre 2 y 4 h

*NR: Does not respond.

Regarding the perception of physical demand, the workers in the sewing area responded that the physical demand for the jobs in said area is moderate (50.00%). Likewise, 40.82% of the workers in the logistics area considered moderate physical demand (Table 4).

Table 4 Perception of physical demands in the workplace.

Physical demands in the workplace	Sewing		Logistics	
	n	%	n	%
Very low	0	0.00%	0	0.00%
Low	2	5.88%	2	4.08%
Moderate	17	50.00%	20	40.82%
High	4	11.76%	13	26.53%

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Very high	11	32.35%	14	28.57%
Total	34	100.00%	49	100.00%

DISCUSSION

Participatory ergonomics does not have a single definition. However, many authors have agreed that the participation of key actors in problem-solving allows the creation and implementation of a significant control strategy to influence work objectives. Especially in processes and results, with a focus on preventing musculoskeletal disorders.[14-16]

The ERGOPAR method was developed by Haines and Wilson and validated by themselves and Koningsveld E. in 2002, thus establishing a conceptual framework that defines nine dimensions for implementing an ergonomics program. [16-18] In execution, the method follows a logical order for its application composed of three phases: pre-intervention, intervention, assessment, and continuity. This study shows the results of applying the ergonomic damage and risk factors questionnaire in the intervention phase.

The Ergo Group "is the central and common element of all intervention experiences in participatory ergonomics. This group must comprise 4 to 8 people with different profiles; representatives of workers and management must participate in equal numbers.[19] The intervention phase in this company differs from the experience reported by García AM *et al.* in Spain in 2010, belonging to the chemical sector in which the Ergo Group was made up of the production manager, a manager, coordinator prevention, and three prevention delegates.[20]

In addition, this group was advised by a union technical advisor, a Union Institute of Labor, Environment, and Health (ISTAS) technician, and Unimat Prevention.[20] In the same way, the experience of León MY in Chile in 2010, Grupo Ergo was made up of 8 workers and an ergonomic expert. The group had a representation of the company (retail sector) and the workers with the same number.[19] This difference is explained because there is no union in the bed manufacturing company, and in Guatemala, it is not known if there are ergonomics experts who have recognition for this advice.

Regarding the personal and work variables, similarities were found with a study carried out by García AM *et al.* on hospital orderlies; the majority were men with permanent contracts organized in shifts.[21] On the other hand, in a study carried out by Sweeney K *et al*., 70% of sonographers in New South Wales were female workers.[22] Tasks that require moving loads are carried out mostly by men. The company hires mostly male people due to the particularity of the manufacturing process.

Regarding health damage, a similarity was found for workers in both areas studied with what was reported by León MY, a study carried out on cashiers in which 100% of the cashiers reported pain or discomfort in the neck, lumbar region, right wrist, and shoulders. The damage meant that 40% of

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the cashiers were absent from work on leave.[19] Similarly, in a study conducted by García AM *et al.,* in packaging area workers, more than half reported pain or discomfort in the neck, shoulders, back, lumbar back, and hands and/or wrists.[20] Workers in the sewing area also reported foot damage due to using machines with pedals.

For ergonomic risk factors, the ERGOPAR Method applies criteria based on the duration of daily exposure, with priority given to those that accumulate the longest exposure time. Two criteria stand out: scenarios in which 30% or more of the workers report an exposure for 2 hours or more and scenarios in which 20% or more of the workers report an exposure for more than 4 hours of the workday.

Regarding ergonomic risk factors, similar results were found in a study by the Trade Union Institute of Work, Environment and Health (ISTAS) *et al.* in the automotive sector in Spain, in which static posture, walking, tilting the head and neck forward and backward, tilting the trunk forward and backward, rotating the trunk, wrists up and grab or hold objects with your hands.[23]

Likewise, García AM *et al*. reported as priority factors: sitting posture, neck leaning forward, turning the neck, back leaning forward, hands above the head, bent wrists, and manually lifting loads greater than 3 Kg.[20] On the other hand, a study carried out by Hauke A. et al. on teachers of a daycare center found that the postures identified were static posture, kneeling, sitting posture, inclination of the trunk, and manual lifting of loads greater than 3 Kg (loads between 10 to 15kg).[24]

Regarding the physical demands of the workplace for the logistics area, similar results were found in the study carried out by Sormunen E et al. in workers treated in Occupational Health Services in Finland, in which half of the workers reported a burden of high and very high working conditions.[25] Regarding the physical demands of the workers in the sewing area, these were perceived as moderate, similar to what was reported by the workers in the study carried out by García AM et al., in which the workers reported moderate and high demands.[20]

These divergences can be understood by the different processes that take place in these areas. The logistics area delivers the finished product (beds) to the end customer and must transport it over long distances, and in the sewing area, the preparation of semi-finished products is carried out. The semi-finished products correspond to the fabric parts of a bed.

It is worth mentioning that the application of the ERGOPAR Method in its three phases could not be completed because the company's management did not follow up on the identification of ergonomic damage and risk factors. However, the generation of a baseline on ergonomic damage and risk factors reflects the need to raise awareness among all people involved in a company to improve the health situation in the workplace.

The approach to ergonomic risk factors varies depending on each country's regulations. For example, there are Basic Ergonomics Regulation laws in Spain, including internationally standardized standards

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such as ISO TR 12295 for ergonomic risk management.[26-27] However, in developing countries such as Guatemala, the approach through the ERGOPAR method allows obtaining a first experience to improve work environments.

CONCLUSIONS

Workers in the bed manufacturing industry presented pain in the neck, shoulders and back, lumbar back, hands, and/or wrists and feet. The ergonomic risk factors identified by the workers were walking, head and neck postures such as leaning forward or to one side, postures of the back or trunk such as leaning forward or to one side, turning of the back or trunk, hand posture above the head, bent wrists, hand actions such as grabbing or holding objects or tools, working on vibrating surfaces, and manual handling of loads such as manual lifting or carrying of loads greater than 3 Kg.

FINANCING

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CONFLICTS OF INTEREST

No conflicts of interest are declared.

BIBLIOGRAPHIC REFERENCES

1. Acuerdo Gubernativo 229-2014 y sus reformas 33-2016 Reglamento de Salud y Seguridad Ocupacional. Ministerio de Trabajo y Previsión Social; 2014.
2. Organización Mundial de la Salud [Internet] Washington DC: Organización Mundial de la Salud; 2021 [cited on January 3, 2024]. Trastornos musculoesqueléticos; Aprox. 2 pantallas. Available at: https://www.who.int/es/news-room/fact-sheets/detail/musculoskeletal-conditions
3. Russo F, Di Tecco C, Fontana L, Adamo G, Papale A, Denaro V, et al. Prevalence Of Work Related Musculoskeletal Disorders In Italian Workers: is there an underestimation of the related occupational risk factors? BMC Musculoskelet Disord [Internet] 2020 [accessed January 3, 2024]; 21(1):1–16. Available at: https://doi.org/10.1186/s12891-020-03742-z
4. Regalado García GN, Regalado García KG, Arevalo Rojas JA, Escalona León D. Musculoskeletal disorders associated with occupational activity. Salud, Cienc y Tecnol [Internet] 2023 [cited on January 5, 2024]; 3(441):1–15. Available at: https://revista.saludcyt.ar/ojs/index.php/sct/article/view/441/862
5. Tuček M, Vaněček V. Musculoskeletal disorders and working risk factors. Cent Eur J Public Health [Internet] 2020 [accessed January 5, 2024]; 28(88):6–11. Available at: https://doi.org/10.21101/cejph.a6183
6. Tavakkol R, Karimi A, Hassanipour S, Gharahzadeh A, Fayzi R. A multidisciplinary focus review of musculoskeletal disorders among operating room personnel. J Multidiscip Healthc [Internet] 2020 [accessed January 5, 2024]; 13:735–41. Available at: https://www.dovepress.com/getfile.php?fileID=60216

*Corresponding author: Ana-Gabriela Méndez-de-León. Email: gaby.mendez0707@gmail.com

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7. Darvishi E, Ghasemi F, Sadeghi F, Abedi K, Rahmati S, Sadeghzade G. Risk assessment of the work-related musculoskeletal disorders based on individual characteristics using path analysis models. BMC Musculoskelet Disord [Internet] 2022 [accessed on January 8, 2024]; 23(1):1–12. Available at: https://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/s12891-022-05573-6
8. Instituto de Salud Pública de Chile. Publicaciones de referencia. Guía para implementar la ergonomía participativa en los lugares de trabajo. Chile: Instituto de Salud Pública [Internet]. 2020 [cited on January 8, 2024]. Available at: https://www.ispch.cl/wp-content/uploads/2021/02/Guía-Técnica-Ergonomía-Participativa-v0.pdf
9. Instituto Nacional de Seguridad y Salud en el Trabajo [Internet] Nota Técnica de Prevención 137 Ergonomía participativa: un enfoque diferente en la gestión del riesgo ergonómico. España: INSST; 2020 [cited on January 8, 2024]. Available at: https://www.insst.es/documents/94886/706209/NTP+1137+Ergonomía+participativa+un+enfoque+diferente+en+la+gestión+del+riesgo+ergonómico+-+Año+2020.pdf/66dd329f-e4d1-4b0c-b6fa-3850a78b9e26
10. Instituto Sindical de Trabajo Ambiente y Salud. España [Internet]. España: ISTAS; 2021 [consultado el 15 Enero de 2024]. El Instiuto Andaluz de PRL promueve la ergonomía participativa; Aprox. 2 pantallas. Available at: https://ergopar.istas.net/noticias/50-El%20Instituto%20Andaluz%20de%20PRL%20promueve%20la%20ergonom%C3%ADa%20participativa
11. European Agency for Safety and Health at Work [Internet] España: EU-OSHA; 2022 [consultado el 15 Enero de 2024]. ErgoPar - a participatory ergonomics approach to preventing risks in the workplace; Aprox. 2 pantallas. Available at: https://osha.europa.eu/en/publications/ergopar-participatory-ergonomics-approach-preventing-risks-workplace
12. García Ana M., Gadea Rafael, Sevilla María José, Ronda Elena. Validación de un cuestionario para identificar daños y exposición a riesgos ergonómicos en el trabajo. Rev. Esp. Salud Pública [Internet]. 2011 Aug [cited January 13, 2024]; 85(4): 339-349. Available at: http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1135-57272011000400003&lng=es
13. Stock SR, Fernandes R, Delisle A VN. Reproducibility and validity of workers' self-reports of physical work demands. Scand J Work Env Heal [Internet]. 2005 [accessed January 13, 2024];31(6):409–37. Available at: https://www.sjweh.fi/show_abstract.php?abstract_id=947
14. Burgess-Limerick R. Participatory ergonomics: Evidence and implementation lessons. Appl Ergon [Internet] 2018 [cited January 16, 2024]; 68 (2018): 289-293. DOI: 10.1016/j.apergo.2017.12.009
15. European Agency for Safety and Health at Work [Internet] España: EU-OSHA; 2021 [consultado el 5 de febrero de 2024]. Ergonomics: carrying out participatory ergonomics; Aprox. 2 pantallas. Available at: https://oshwiki.osha.europa.eu/en/themes/carrying-out-participatory-ergonomics
16. Sevilla MJ, Álvarez T. Impulso de la ergonomía participativa para la gestión del riesgo ergonómico. Seguridad y Salud en el Trabajo [Internet]. 2021 [cited 2024-02-05]; 108(23):1-74. Available at: https://www.insst.es/documents/94886/0/Revista SST - Numero 104.pdf

***Corresponding author**: Ana-Gabriela Méndez-de-León. Email: gaby.mendez0707@gmail.com

Received on March 28, 2024. Accepted on May 15, 2024.

17. European Agency for Safety and Health at Work [Internet] España: EU-OSHA; 2021 [accessed February 10, 2024]. Participatory ergonomics and preventing musculoskeletal disorders in the workplace; Approx. 2 pantallas. Available at: https://osha.europa.eu/en/publications/participatory-ergonomics-and-preventing-musculoskeletal-disorders-workplace
18. Sevilla MJ. Pasos a seguir en una experiencia de ergonomia participativa. Revista Andaluza de Ergonomía Participativa [Internet]. 2019 [cited February 15, 2024]; 1(3): 1- 14. Available at: https://www.juntadeandalucia.es/sites/default/files/2022-07/003.RevistaErgoParticipativaJAnd%20%281%29.pdf
19. León M. Ergonomía Participativa en Cajeras de Una Gran Tienda. [Internet]. Cienc Trab. [Internet]. 2021 [accessed February 28, 2024];13(39):57–63. Available at: www.cienciaytrabajo.cl
20. García AM, Sevilla MJ, Gadea R, Casañ C. Intervención de ergonomía participativa en una empresa del sector químico. Gac Sanit [Internet]. 2012 [cited March 3, 2024]; 26(4):383–6. Available at: http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S0213-91112012000400016
21. García AM, Boix P, G. Benavides F, Gadea R, Rodrigo F, Serra C. Participación para mejorar las condiciones de trabajo: evidencias y experiencias. Gac Sanit [Internet] 2016 [cited March 3, 2024]; 30:87–92. Available at: https://www.gacetasanitaria.org/es-pdf-S0213911116300346
22. Sweeney K, Ginn K, Spurway J, Clarke J, Mackey M. Does participatory ergonomics reduce musculoskeletal pain in sonographers? A mixed methods study. Ultrasound [Internet]. 2022 [cited March 10, 2024]; 30(2):105–16. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9058385/pdf/10.1177_1742271X211023981
23. Instituto Sindical de Trabajo, Ambiente y Salud CO. Riesgos ergonómicos y trastornos musculoesqueléticos en el sector de automoción [Internet]. Spain; 2017 [cited March 3, 2024] . Available at: https://istas.net/sites/default/files/2018-11/Guía encuadernada.pdf
24. European Agency for Safety and Health at Work [Internet] Spain: EU-OSHA; 2021 [accessed March 10, 2024]. ERGOKITA: An example of an ergonomic intervention in the education sector; Aprox. 2 pantallas. Available at: https://osha.europa.eu/en/publications/ergokita-example-ergonomic-intervention-education-sector
25. Sormunen E, Mäenpää-Moilanen E, Ylisassi H, Turunen J, Remes J, Karppinen J, et al. Participatory Ergonomics Intervention to Prevent Work Disability Among Workers with Low Back Pain: A Randomized Clinical Trial in Workplace Setting. J Occup Rehabil [Internet]. 2022 [cited March 11, 2024]; 32(4):731–42. Available at: https://doi.org/10.1007/s10926-022-10036-9
26. Castellucci HI, Viviani C, Hernández P, Bravo G, Martínez M, Ibacache J. Developing countries and the use of ISO Standard 11228-3 for risk management of Work-Related Musculoskeletal Disorders of the Upper Limbs (WRMSDs-ULs): The case of Chile. Appl Ergon [Internet]. 2021 [cited March 11, 2024]; 96(103483):1–4. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0003687021001307?via%3Dihub
27. Flores RD, Palomino JC. Cambio Del Nivel De Riesgo Ergonómico En Posturas Forzadas Y Movimiento Repetitivo Por Rediseño De Máquina Sopladora De Botellas De Plástico. Rev Asoc Esp

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Med Trab [Internet]. 2022 [cited March 11, 2024];32(4):1–8. Available at: https://hdl.handle.net/20.500.12805/2571

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