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Identification of Risk Factors from the Ergonomic perspective for the preservation of Occupational Health

Identificación de Factores de Riesgo desde la perspectiva Ergonómica para la preservación de la Salud Ocupacional

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Abstract

Descriptive study in order to identify ergonomic risk factors in workers of a manufacturing company, and implement a plan of preventive actions to minimize the damage. It began with a situational diagnosis to identify the job position with the highest risk through the Rula Method and the Check List OCRA index; In addition to an interview with each worker about their physical condition and if they presented any discomfort. The result of the RULA method identified the area of dies as the highest risk position, with 76 workers. In the results of the Check List OCRA index, high risk was found for the movements made with the wrist and a medium risk for those carried out with shoulder and elbows. With this information the analysis was carried out. The results showed that 43% will present shoulder damage, 67% in the elbow and 95% in the wrist; with these data, a plan of preventive actions could be justified to avoid medium and long-term effects; avoiding repetitive movements, uncomfortable positions and the application of excessive force by ergonomic instructions according to the activity performed.

Risk factors, Work station, Prevention

Resumen

Estudio descriptivo con el fin de identificar factores de riesgo ergonómico en trabajadores de una empresa manufacturera, e implementar un plan de acciones preventivas para minimizar el daño. Se inició con un diagnóstico situacional para identificar el puesto de trabajo con mayor riesgo a través del Método Rula y el índice Check List OCRA; además de una entrevista a cada trabajador sobre su condición física y si presentaban alguna molestia. El resultado del método RULA identificó como puesto de mayor riesgo el área de troqueles, con 76 trabajadores. En los resultados del índice Check List OCRA, se encontró riesgo alto para los movimientos que se realizan con la muñeca y un riesgo medio para los que se realizan con hombro y codos. Con dicha información se llevó a cabo el análisis. Los resultados arrojaron que el 43% presentarán daño en hombro, el 67% en codo y 95% en muñeca; con dichos datos se pudo justificar un plan de acciones preventivas para evitar afectaciones a mediano y largo plazo; evitando movimientos repetitivos, posiciones incomodas y la aplicación de fuerza excesiva mediante instrucciones ergonómicas de acuerdo a la actividad desempeñada.

Factores de riesgo, Estación de trabajo, Prevención

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Introduction

In recent years the number of companies worldwide has increased in both the manufacturing and services sector. The International Labor Organization (ILO, 2016) reports that more than 317 million accidents occur at work each year and 6,300 people die each day due to work-related accidents or illnesses. Every 15 seconds, a worker dies because of work-related accidents or illnesses. Every 15 seconds, 153 workers have an accident at work and many of these accidents result in absenteeism. (OIT, 2018)

The cost of this daily adversity is enormous and the economic burden of poor safety and health practices is estimated at 4 percent of the Gross Domestic Product (GDP), global each year, implying in addition to human losses, financial losses. In 2008, the ILO adopted the Occupational Health and Safety and Environment Program, which aims to create global awareness of the magnitude and consequences of work-related accidents, injuries and illnesses and disergonomic risks. (OIT, 2018)

The International Ergonomics Association (IEA, 2016), defines ergonomics as the scientific discipline that deals with the understanding of the interaction between human beings and the other elements of a system, among the objectives of ergonomics is the achievement of the satisfaction at work, considering the responsibilities, attitudes, beliefs and values for personal development as well as individual and cultural differences.

Ergonomics as a scientific discipline, is related to the development of knowledge about the capabilities and limitations of human beings in the process and performance of their activities in the context of interface between people, machines, systems and their environment. For Ergonomics, the focus is to optimize the functioning of work systems through the interface of organizational design, with technology, the environment and people. (Aguayo & Lama, 2016).

In the present work, the approach is oriented towards the Organizational Ergonomics, and for this investigation the definition of Hendrick is considered

"The organizational ergonomics or macro ergonomics is the approach of the socio-technical systems for the organizational design and finally of the systems of work and the design of the related interfaces: man-machine, man-environment and user ". (Hendrick, 1991).

Occupational safety and health conditions differ enormously among countries, economic sectors and social groups, including between types of work and professions. In the case of Mexico, the Ministry of Labor and Social Security (STPS) establishes the mechanisms (Laws, Regulations, Norms, among others), by means of which the Occupational Health and Safety labor relations are governed, to keep them updated and to monitor their compliance. (DOF, 1978).

On November 13, 2014, amendments to the Federal Regulations on Safety and Health at Work were published in the Official Gazette of the Federation (DOF, 2014), to enter into force on February 13, 2015. (DOF,2014)

Which abrogated the Federal Regulation of Safety, Hygiene and Work Environment of January 21, 1997. With the aim of establishing the provisions on Occupational Health and Safety to be observed in the Work Centers, in order to have the conditions that allow to prevent risks and in this way, to guarantee workers the right to perform their duties activities in environments that ensure their life and health, based on what is stated in the Federal Labor Law.

Among the relevant aspects of the Regulation is the inclusion of new concepts as mentioned below:

Unsafe Conditions: Those that derive from the non-observance or inattention of the procedures or safety measures provided in the Regulations and Rules, which may lead to the occurrence of incidents, Accidents and Work-related Illnesses or material damage to the Work Center.

Diagnosis of Safety and Health at Work: The identification of unsafe or dangerous conditions; of physical, chemical or biological agents or ergonomic or psychosocial risk factors capable of modifying the conditions of the work environment.

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Of the dangers surrounding the Work Center, as well as the regulatory requirements in matters of occupational safety and health that are applicable.

Favorable Organizational Environment: One in which the sense of belonging of the workers to the organization is promoted; training for the proper performance of the tasks entrusted; the precise definition of responsibilities for the members of the organization; proactive participation and communication among its members; the adequate distribution of workloads, with regular working hours, and the Evaluation and Recognition of performance.

Conformity Assessment: The determination of the degree of compliance with the Standards

Psychosocial risk factors: Those that can cause anxiety, non-organic disorders of the sleep-wake cycle and severe stress and adaptation, derived from the nature of the functions of the job, the type of work day and exposure to events severe traumas or acts of workplace violence because of the work.

Workers with Disabilities: Those who, for congenital or acquired reasons, have one or more deficiencies of a physical, mental, intellectual or sensory nature, whether permanent or temporary.

Workplace violence: Those acts of harassment, harassment or mistreatment against the worker, which may damage their integrity or health.

Ergonomic risk factors: Those that may involve repetitive movements or forced postures in the work carried out, with the consequent fatigue, errors, accidents and work diseases derived from the design of the facilities, machinery, equipment, tools or job.

At this point it should be noted that in Mexico ergonomics is a subject with many gaps in the legislation; in the Federal Regulation of Occupational Safety, Hygiene and Environment. Issued by the Ministry of Labor and Social Welfare and published in the Official Gazette of the Federation on January 21, 2015, Ergonomics is specifically mentioned in two Articles:

First chapter, General provisions, Article 2. it will be understood:

Ergonomics: It is the adequacy of the workplace, equipment, machinery and tools of the worker, according to their physical and mental characteristics, in order to prevent accidents and occupational diseases and optimize the activity of the latter with the least effort, as well as avoid fatigue and human error. Chapter ten, Article 102.

The Secretariat will promote that in the facilities, machinery, equipment or tools of the work center, the employer takes ergonomic aspects into account, in order to prevent accidents and work-related illnesses. (DOF, 2015).

Problem Statement

At present it is very difficult to know the amount of damage suffered by workers due to bad or no ergonomic practices, unfortunately one of the biggest problems is that not all countries in the world have data on occupational accidents and diseases, and lack of information represents a generalized problem; in addition to that Ergonomics is not given importance as part of the work culture to follow up on the real figures of injuries, accidents, and work-related illnesses caused by disergonomic factors in the work centers because it is not documented. (Ramirez, 1991)

In the case of Mexico, not all companies have insured their workers and those with insurance do not always record the number of injuries caused by disergonomic causes in the workplace or the penalty for accidents, injuries and occupational diseases. (Osorio, 2008)

The importance and importance, of the Ergonomics and Psychosocial Factors, lies in the Prevention of Work Risks, promoting its application and dissemination in companies and educational institutions to minimize the accident rate, deterioration of health and underutilization of machinery. (Llaneza, 2008)

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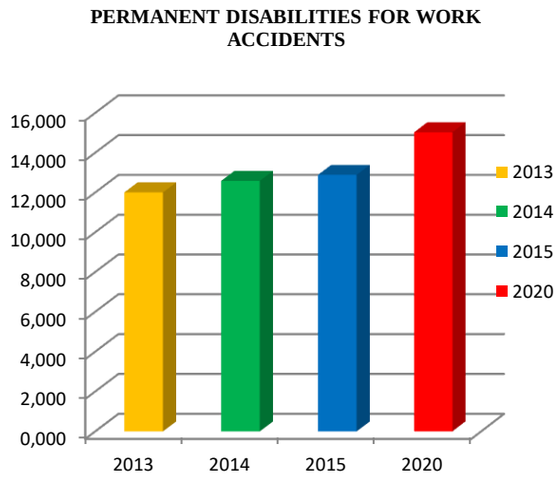
Based on the above, it was necessary to legislate and regulate the ergonomic practice and on this basis, on January 4, 2018, the Official Mexican Standard NOM-036-STPS was published, and cites that the ergonomic risk factors can lead to an over physical effort, repetitive movements or forced postures in the developed work, with the consequent fatigue, errors, accidents and work diseases derived from the design of the facilities, machinery, equipment, tools or work station.

Memories of the IMSS, 2016, reports that the State of Mexico, there are approximately 39,848 companies, with 53,414 cases of occupational hazards, occupying after Coahuila, the 2nd place nationwide.

Involving 26,520 disabilities and of which 14,790 are permanent disabilities due to work accidents, previously in 2013, there were 12,000, in 2014, it grew to 12,579 and in 2015 it increased to 12,881, with a prognosis for 2020 of 15,024 permanent disabilities due to work accidents. . As shown in Graphic 1.



Graphic 1 Disabilities generated in the State of Mexico
Source: (IMSS, 2016)

By digging a little deeper into this information it was found that there are various discomforts in workers, back pain, neck pain, wrists, lumbago and work accidents; resulting in absenteeism and disabilities, having an impact on productivity.

There are several factors of great relevance in the design of a job such as anthropometry.

Because the dimensional characteristics of a human being are determined from the ergonomic perspective, other important factors are age, sex, ethnicity, nutritional status and, in the case of a working population, the occupation itself.

However, although there is information from other countries, there is currently very little information regarding anthropometric charts of the Mexican population, whose results are reliable due to ethnic differences and variability of dimensional features, limiting the usefulness of the information for its scientific validation.. (Alfaro, 2006).

In the researches reported by the University of Guadalajara, in the book Anthropometric Dimensions: Latin American Population (Ávila, Prado, & González, 2007), anthropometric results of the population of the Federal District, Guadalajara, Jalisco and León, Guanajuato, cities are shown they are from the center of Mexico, however, these anthropometric data can not be generalized for the whole country. The book by Ávila (2007) also contains a small sample of working women from the Mexican border with the United States of America.

Objectives

General

Establish methods and procedures to reduce accidents and improve the productivity of companies.

Specific

1. Identify if the environmental conditions and procedures favor the presence of occupational diseases CTD'S (Accumulative Traumatic Disorder), in the operators.

2. Study the behavior of risk factors associated with inadequate postures, cargo handling and their interrelation to determine the effect of such environmental conditions on exposed workers.

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Work hypothesis

Based on the above, we have the hypothesis that when considering the anthropometric dimensions of the population in the design of work stations, include ergonomics principles in the production methods, evaluate and control environmental conditions, decrease the accident rate and increase the productivity of companies. (López, Marín, & Alcalá, 2009)

Justification of the Study

The present work focuses mainly on identifying the incidence of ergonomic factors in productivity; the form and level of impact of the same and the obtaining of a functional relation to give alternatives of solution in the raised situation besides the prevention of illnesses, especially those recognized in the Federal Regulation of Security and Health in the Work, apara create and establish a preventive culture. The investigation will allow to acquire knowledge in the study of disergonomic risks, such as the possibility that a worker suffers damage derived from the execution of his work.

Methodology to be developed

Quantitative, observational, descriptive and transversal research was carried out in the northern zone (municipalities of Tultitlán, Coacalco, and Ecatepec of the State of Mexico).

To carry out this study, the post evaluation methods and the environmental conditions (lighting, temperature and noise) were used. The systems to be evaluated are made through the virtual ergonomics laboratory, METRIXX VR. Y Module of measurement and analysis of anthropometric and biomechanical measurements Asia Tech, began with the study of the methodological working conditions, analyzing the processes and procedures; times, movements and postures were evaluated.

Based on the Standard NOM-035-STPS-2016 that talks about the psychosocial risk factors, their identification and prevention that is currently in force and indicates what action to take if they exist in the workplace. (Barrios, 2014)

There are several methods that allow the evaluation of the risk associated with the postural load, differing by the scope of application, the evaluation of individual postures or by sets of postures, the conditions for its application or by the parts of the body evaluated or considered for evaluation. . RULA and OCRA are the observational methods for the evaluation of postures more widespread in practice. (Diego, 2015)

The RULA (Rapid Upper Limb Assessment) method was developed in 1993 by McAtamney and Corlett, of the University of Nottingham (Institute for Occupational Ergonomics), RULA is the acronym of (Quick Rating of the Top Members). Although the application of the method requires data from other parts of the body such as the trunk and legs, the evaluation is of the risk in the extremities supercon the objective of evaluating the exposure of workers to risk factors that cause a high postural load and that can cause disorders of the upper limbs of the body. (Diego, 2015)

For the evaluation of the risk the method is considered the position adopted, the duration and frequency of this and the forces exerted when it is maintained. In the case of this particular investigation, the RULA method was chosen as the evaluation method because most of the load received by the body during the task is in the upper part of the body.

The OCRA (Occupational Repetitive Action Method) studies the effort, duration and frequency required by each part of the body to perform a certain task. The interaction of the level of effort, duration of effort before relaxation (or before moving to a lower level of effort), and the frequency of activation of muscles per minute for each group of muscles is evaluated. From these parameters a prediction of muscle fatigue is made.

It is applied in the evaluation of the risk of repetitive movements in upper extremities, and allows a weighting to identify the percentage of workers at risk of acquiring potential cumulative damages, visible with the decrease in productivity gradually leading to an occupational disease. (Diego, 2015)

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An ergonomic evaluation was carried out in the work stations of the galvanizing process of the metalworking company to identify the existence of cumulative trauma disorders (CTD`s). In the sample, a group of 6 people of the male gender was considered, because they complained of discomfort in the chest, rashes and spots on the skin as well as joint pain in the hands back and feet. Based on the above, the study is carried out in the workplace in order to identify the risks in the joint evaluation.

The main risk factors in each work station were evaluated, considering factors such as: work environment, work methods and individual factors. (Castro, 2016)

Results

A visit was made to each of the selected jobs based on the workers who presented discomfort or damage to their health, to know the methods, the tasks performed and the characteristics of the work, visits were made randomly during the working day three days a week for a semester.

In the interviews, greater relevance was given to the perception of the worker, analyzing the process directly and in the workplace, as can be seen in Figure 1.

RULA Method

Once the processes were identified and the movements were analyzed for each activity; the application of the Rula Method was carried out, which is used as an initial phase of rapid diagnosis to identify if there is a risk in the performance of the activities and the level of the same, based on an analysis of sections of the body mostly exposed or contact with factors that can represent potential damage in the short, medium and / or long term, starting at the upper extremities, considering: hands, twists of the wrist, arm movements, forearm and lifts. (Diego, 2015)

For its evaluation, the angles that determine the natural or extreme effort are measured depending on the anthropometric characteristics of the worker.

The movements are identified with the ranges pre-established by the method and partial summations of the score reached are taken based on the work performed and its value is identified in Table 1, where the final evaluation for the arms and hands section is specified.

	Trunk score											
	1		2		3		4		5		6	
	Legs		Legs		Legs		Legs		Legs		Legs	
Neck	1	2	1	2	1	2	1	2	1	2	1	2
1	1	3	2	3	3	4	5	5	6	6	7	7
2	2	3	2	3	4	5	5	5	6	7	7	7
3	3	3	3	4	4	5	5	6	6	7	7	7
4	5	5	5	6	6	7	7	7	7	7	8	8
5	7	7	7	7	8	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

Table 1 RULA method 1st evaluation (Diego, 2015)

As soon as it was concluded, the upper part of the body proceeded to evaluate the neck, trunk and lower extremities as the results are shown in Table 2.

Up arm	Low Arm	Wrist							
		1		2		3		4	
		Twist		Twist		Twist		Twist	
		1	2	1	2	1	2	1	2
1	1	1	2	2	2	2	3	3	3
	2	2	2	2	2	2	3	3	3
	3	2	3	3	3	3	4	4	4
2	1	3	3	3	3	3	4	4	4
	2	3	4	4	4	4	4	5	5
	3	3	4	4	4	4	4	5	5
3	1	3	3	4	4	4	4	5	5
	2	3	4	4	4	4	4	5	5
	3	4	4	4	4	4	5	5	5
4	1	4	4	4	4	4	5	5	5
	2	4	4	4	4	4	5	5	5
	3	4	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	8
	2	8	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

Table 2 RULA method 1st evaluation (Diego, 2015)

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To evaluate the workspaces, measurements of the following work elements were made:

1. Work table (width, length and height of the surface).
2. Seat.
3. Job space (access and exit).

Figure 1 shows the workplace and the position that the operator needs to adopt.

Figure 1 Worker in the Process
Source: Self Made

The luminous intensity was evaluated in the selected work stations, using as a luxometro equipment, with the following scale:

1. Inadequate
2. Insufficient
3. Enough
4. Adequate
5. Very adequate

The evaluation of the thermal environment measured the wet bulb temperature, dry bulb temperature and balloon temperature, then the data obtained were entered into a software called METRIXX, which is a calculation tool that allows us to know the Average Valuation Index d Thermal Comfort, based on the Fanger method (ISO 7730) which is managed the following scale:

1. Dejected
2. Average
3. high

The results were carried out during the two shifts to facilitate comparison when changing weather and climate; as you can see in Table 3.

Variable	1st shift	2nd shift
Noise	64	108.9
Relative humidity	97.2	62.76
Illumination	107.52	158.92
Temperature	4.3	4.4
Vibration	101.21	108.9

Table 3 Environmental conditions evaluation

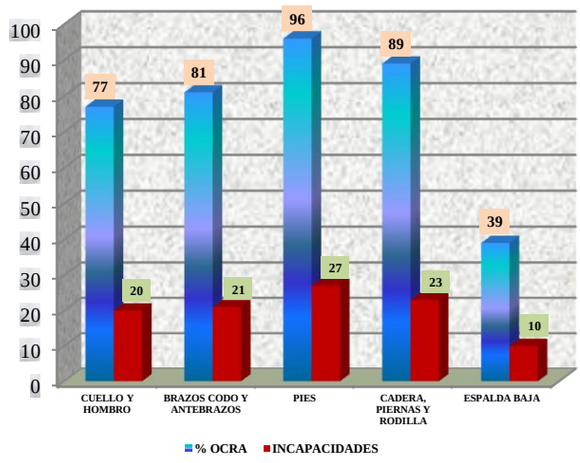
Finally, the evaluation of risk factors and worker damage was carried out.

The people who participated in the study report that they suffer from discomfort and pain in the joints, back and neck that has sometimes prevented them from working or performing their activities in a normal way.

Some if they attend the medical service and manage to have an inability to rest and recover; however, they also mentioned that most of the times they feel bad they have had to miss the intensity of the pain without being able to attend the medical service assuming the cost of absenteeism; which prevents identifying the postencial risk of a work-related illness and tracking it.

Although one of the comments that draws attention is that after returning from a disability they feel more exhausted and the pain does not diminish with therapy or medication.

With the OCRA method the risk was carried out by sections of the body and a comparison was made with the recurrence of disabilities and the affected body sections, finding a total coincidence as can be seen in the results shown in Graphic 2.



Graphic 2 Results OCRA method (Diego, 2015)

Conclusions

Musculoskeletal injuries of occupational origin are disorders characterized by an abnormal condition of the muscle, tendons, nerves, vessels, joints, bones or ligaments that results in an alteration of motor or sensory function caused by exposure to risk factors: repetition, strength, inadequate postures, contact stress and vibration.

The score obtained in the Rula Method was 7 the highest in level of risk, which represents a high degree of damage in the worker, which requires immediate action to improve working conditions.

With respect to noise, the Standard indicates a level of 99dB maximum in a time not exceeding 60 minutes during the 8 hours, but the results show that they are exceeding the permissible limit of exposure in both shifts to have 64 Db and 108.9 Db, in the morning and evening shift respectively. (DOF, 2014)

The lighting levels were adequate; and with respect to the temperature they are working at 22.50 ° C; according to the NOM they are in stable conditions to be able to carry out their tasks. (DOF, 2014)

With the analysis of Processes, prolonged times were identified in a static position and with a high degree of repetitiveness, causing nervous tension and fatigue in the workers; which is a physiological process that affects the muscles involved in the effort and recovers with the rest of them. If this rest is not done or is insufficient, musculoskeletal disorders can develop. (Fernandez, 2012)

Another effect derived from static work is the increase in heart rate since the heart must pump more quickly to try to send more oxygen and nutrients to the contracted muscle. For this reason, static work could be a risk factor for diseases of the heart or heart disease. (Alfaro, 2006)

In the study it was possible to identify the risk factors and the environmental conditions that impact on the performance of the workers' functions.

However, it could be observed that they are not the only elements of impact, there are also the methods, procedures and the physical and personal characteristics of the worker, which will have a high degree of significance in their performance depending on how they perceive their environment. (Barrios, 2014)

After having analyzed the environmental conditions to which these people are working and that in many of them according to the Official Mexican Standard NOM-011-STPS-2001, noise exceeds the acceptable limits for which workers are exposed to stress, irritability, high blood pressure and may be associated with other risk situations, in addition to that may also lose appetite, and be a victim of aerophagia. (DOF, 2014).

Another important point is the heart rate of workers due to the increase it has to perform the activity, and the vibration to which they are exposed which can cause heart disease as well as dizziness and excessive tiredness that greatly damage the health of these. (Alfaro, 2006)

Although in the points of temperature and illumination they are within the range according to the NOMRMA-015-STPS-2001 and to the NORMA-025-SPTS-2008. The appropriate protective equipment should be worn, such as goggles, overalls, and a vest, since they are in an outdoor area. (DOF, 2014)

– Sunburn.
– Photo aging.
– Vascular carcinoma
– Affective disorder
– Eye irritation.

The data obtained allowed us to carry out the following proposals in the damage forecast:

– That the operator has more work roles and does not spend much time doing the same task.
– Avoid flexing the back.
– Take small breaks during the activity
– Avoid making sudden movements with the wrist part of the hand.
– Find the correct position for each job.
– Minimize fatigue

- Continuous changes of postureMaintain comfortable working conditions, as well as avoid exposing the worker to excessive temperatures.
- Rotation of work position.
- Operate all machines safely and use both hands.
- Use the appropriate protective equipment such as plugs, goggles, overalls and vest.

Taking into consideration the points mentioned in the industrial plant, resulted in great benefits that helped protect the health of workers who are exposed to various risk factors and where the application of ergonomics is a great tool to obtain a better comfort in the work areas, reducing discomfort in the vast majority of participants. (Fernandez, 2012)

Recommendations

For this research, only one section of the industrial plant was considered as a sample of the total population, which can serve as a basis for subsequent studies that include the entire population and even other institutions, fostering an ergonomic culture from an integral design perspective. in any process to identify if the environmental conditions and procedures favor the presence of occupational diseases CTD'S (Traumatic Accumulative Disorder), in the operators, likewise, other jobs must be studied in different conditions with a larger sample size to know the behavior of risk factors associated with inadequate postures, the handling of loads and their interrelation to determine the effect of said environmental conditions on exposed workers. (Castro, 2016)

References

Aguayo, F., & Lama, J. (2016). La holónica como marco paradigmático para la Ingeniería de la prevención. Aplicación al diseño macroergonómico. Recuperado el 10 de Octubre de 2016, de Biblioteca de la Universidad de Sevilla: http://hdl.handle.net/11441/40880

Alfaro, K. (2006). La Ergonomía: Productividad y la prevención de riesgos a la salud. Copersa ingenieria, Vol.I pp13-19.

Ávila, R., Prado, L. R., & González, E. L. (2007). Dimensiones antropométricas: Población Latinoamericana. México: CUAAD.

Barrios, M. (2014). Efectos de desgaste laboral, como riesgo psicosocial, en la productividad. Universidad de Carabobo. Estudios de psgrado. Barbula, Venezuela.

Carrasquero, E., & Seijo, C. (2009). La ergonomía organizacional y la responsabilidad social incclusiva y proactiva: Un compromiso dentro de los objetivos de la organización. Clío América, V-1. Pp. 183 - 192.

Castro, V. (2016). Propuesta de un programa de Salud en el Trabajo, basado en el estudio de riesgos disergonómicos para mejorar la productividad económica. USAT. Chiclayo, Perú.

Diego-Mas, J. A. (2015). Evaluación Postural mediante el Método OWAS. (<universidad Politécnica de Valencia) Recuperado el 06 de enero de 2017, de: http://www.ergonautas.upv.es/metodos/owas/owas-ayuda.php

DOF, D. (1978). Reglamento Interior de la Secretaría de Educación Pública. Recuperado de http://sep.gob.mx/work/models/sep1/Resource/3f9a47cc-efd9-4724-83e4-0bb4884af388/r1.pdf

DOF. (2014). Diario Oficial de la Federación. Recuperado de:http://www.diputados.gob.mx/LeyesBiblio/regla/n152.pdf

DOF. (2016). Diario Oficial de la Federación. Reglamento Interior de la Secrataría de Educación Pública Recuperado de: http://sep.gob.mx/work/models/sep1/Resource/3f9a47cc-efd9-4724-83e4-0bb4884af388/reglamento_interior_sep.pdf

Fernandez, A. (2012). Condiciones Ergonómicas, un Factor Primordial para el Desarrollo Laboral del Contador. Universidad Veracruzana. Xalapa, Veracruz.

Hendrick, H. (1991). Macroergonomics: A Better Approach to Work System Design.Revista IEA, Vol. 11.pp. 76-81.

IEA. (2006). Asociación Internacional de Ergonomía. Recuperado de Asociación Internacional de Ergonomía: www.iea.cc/whats/index.html

RINOE® All rights reserved.

Llaneza, J. (2008). Ergonomía y psicosociología aplicada. Manual para la formación del especialista. Valladolid: Lex Nova.

López, V. G., Marín, E., & Alcalá, M. C. (2009). Ergonomía y Productividad: variables que se relacionan con la competitividad de las plantas maquiladoras.Revista de Ingeniería Industrial. Actualidad y Nuevas Tendencias, Vol. III, num 9. pp. 17-32

OIT. (22 de Diciembre de 2016). Organización Internacional del Trabajo. Obtenido de http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/occupational-safety-and-health/lang--es/index.htm?ssSourceSiteId=empent

Osorio, J. (2 de 11 de 2008). La Rentabilidad de la Ergonomía . El Portal de la Seguridad, Productor, & El Portal de la Seguridad, la Prevención y la Salud Ocupacional de Chile. Recuperado el 5 de julio de 2016, de http://www.paritarios.cl/: http://www.paritarios.cl/ergonomia.htm

Ramirez Cavassa, C. (1991). Ergonomia y Producividad. México: Limusa.

SEMAC. (8 de Octubre de 2016). Sociedad de Ergonomistas de México, A.C. Recuperado de: http://www.semac.org.mx/index.php/ergonomia.html

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