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INVESTIGACIONES Y APLICACIONES

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RISK CONDITIONS AND DISCOMFORT BY BODY REGION WITHIN A LABORATORY OF TOXIC WASTE IN HERMOSILLO, MEXICO

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Resumen: El presente trabajo tiene como finalidad la medición y análisis de síntomas de incomodidad por región corporal presentados por el personal de un laboratorio dedicado a analizar residuos tóxicos en alimentos, ubicado en Hermosillo, México. Asimismo, se hace identificación preliminar de riesgos mediante visitas de diagnóstico. Los resultados de esta investigación, forman parte de la primera etapa de estudio y medición del trabajo de una tesis de investigación en el laboratorio. Este estudio se llevó a cabo mediante la aplicación de cuestionarios al personal de todas las áreas de trabajo del laboratorio, para conocer los síntomas de incomodidad presentados; y recorridos de observación y toma de evidencia fotográfica, para la identificación de riesgos.

Palabras Clave: Incomodidad por región corporal, condiciones riesgo.

Abstract: The purpose of this paper is to measure and analyze discomfort symptoms by body region manifested by the staff of a laboratory dedicated to analyze toxic residues in food, located in Hermosillo, Mexico. Similarly, there is a preliminary identification of risks through diagnostic visits. The results of this research are part of the first stage of study and work measurement of a research thesis in the laboratory. This study was carried out through the application of questionnaires to the staff from all work areas from the laboratory, to know the symptoms of discomfort submitted, observation, for the identification of risks.

Keywords: Body region discomfort, risk conditions.

1. INTRODUCTION

This paper has been developed as part of the preliminary study and measurement of laboratory work activities of a laboratory where a research thesis is performed on occupational health. The instruments used are assumed for the initial collection of information and priorities definition.

1.1 Diagnosing the problem

There is a need for certainty about the validity of the safety criteria implemented in the laboratory. The risks, to which personnel are exposed by the nature of their activities, are not monitored or

evaluated as an internal control. There are only minimum guidelines used as an instructive and visits by the Health and Safety Commission, to the laboratory system regarding to safety, however, within these guidelines are not considered precise specifications for the conditions under which they should work given the tasks performed in the laboratory. A diagnostic visit to facilities was made to observe generally critically workspaces. The findings of that visit are shown by photographic evidence. Besides, discomfort symptoms questionnaires were applied, submitted by the staff, to prioritize the analysis and future strategies interventions.

1.2 Delimitations

The present research was conducted in a laboratory dedicated to the analysis of toxic waste, located in Hermosillo, Mexico.

This study involves laboratory work areas that can be seen in illustration 1, involving 13 workers representing the entire population of study within the laboratory areas. All staff is female and their ages range from 23 to 54 years, with work experience of 3-25 years.

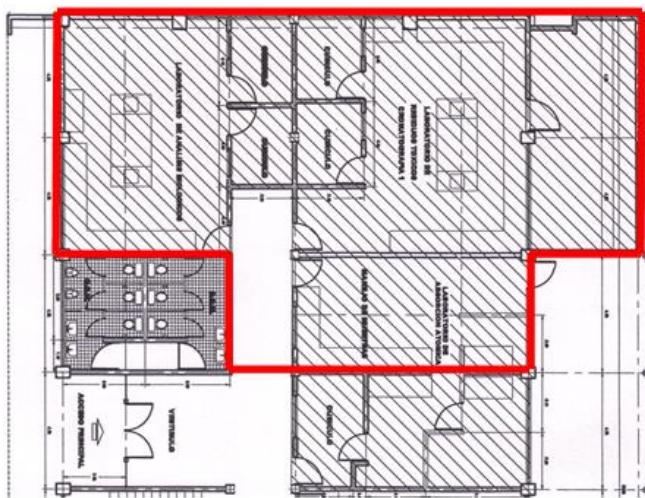


Illustration 1. Layout and presentation of toxic waste analysis laboratory areas.

Visits were made to the institution, where general walks of the facilities were made to identify hazardous conditions. Furthermore, for measurement of bodily discomfort symptoms, questionnaires where applied to demonstrated their bodily ailments.

1.3 Evaluation method by body map

A discomfort survey by body region can give more information when trying to identify workstations or high-risk tasks. The Body Map Evaluation Method proved to be a "reliable indicator" of work related musculoskeletal disorders. The body map is based on the evaluation of the frequency and the degree or level of discomfort that are indicated by the worker (Fernandez, et al., 2011).

With this model of Marley and Kuman (1996), it is possible to have an assessment of the worker categorized according to the following: (1) most likely to seek for treatment, (2) is somewhat likely to seek for treatment; (3) it is unlikely to seek for treatment.

This classification scheme has been statistically validated in large industrial populations. Body Map users have found it useful in early assessment of the impact of redesigning workstations and other ergonomic interventions. This map also has proven useful and valid as regular audits and supervision tool. In practice, this tool has been used by ergonomists and safety professionals to prioritize the analysis and intervention strategies (Fernández, et al., 2011).

To sort the priority attention of the body regions, the worker should select and qualify in a Body Map, the level of discomfort and perceived frequency in each region. According to their evaluation are cataloged in priority areas. Illustration 2 shows the reference to ratings body map of Marley and Kumar (1996).

N/Frec	0	1	2	3
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Symbol:

Light Gray	"Green Zone", is unlikely to seek treatment
White	"Yellow Zone", is something likely to seek treatment
Dark Gray	"Red Zone", is likely to seek treatment
Medium Gray	Unlikely Zone (no record)

Illustration 2. Reference for body map ratings by Marley and Kumar (1996).

All three areas have a realistic chance to help ergonomics, safety or medical professional to prioritize ergonomic intervention. It suggests that individuals and their respective work activities that have scores in the red zone receive the highest priority, the values of the yellow zone receive a medium priority, and the values in the green zone receive lower priority for ergonomic intervention (Marley and Kumar, 1996).

2. OBJECTIVES

1. Identify key observed risks through diagnostic walks.
2. Identify symptoms of increased level of discomfort and frequency.
3. Locate work areas with higher priority bodily discomforts presented.
4. Identify priority areas to assess with global ergonomic evaluation, based on the symptoms presented.

3. METHODOLOGY

3.1 Observation and tours to identify unsafe conditions

We performed a walk-around by the laboratory facilities where hazardous conditions were observed for female workers taking photographic evidence

3.2 Process of measuring symptoms of discomfort by body region

It was applied the body map evaluation method proposed by Marley and Kuman (1996), to 13 laboratory workers. To evaluate workers, they were asked to select the areas marked on the instrument where symptoms of discomfort are presented of discomfort, assessing their level and frequency.

4. RESULTS

4.1 Observation and tours to identify unsafe conditions



Illustration 3. Office areas with electrical hazard conditions.



Illustration 4. Test areas with electrical hazard conditions.



Illustration 5. Office areas with ergonomic risk conditions.



Illustration 6. Test areas with hazardous conditions due to improper storage.

4.2 Process of measuring symptoms of discomfort by body region

Table 1. Evaluation results of Body Map by Marley and Kumar (1996) in the laboratory.

Body Region	Number of people with discomfort	Porcentaje			
		Unlikely Zone	Green Zone	Yellow Zone	Red Zone
1 Neck	12	7.7	30.8	38.5	23.1
2 Left Shoulder	7	46.2	15.4	23.1	15.4
3 Left Arm	7	46.2	30.8	7.7	15.4
4 Left Elbow	4	76.9	15.4	7.7	0.0
5 Left forearm	4	69.2	0.0	23.1	7.7
6 Left Wrist	5	69.2	23.1	7.7	0.0
7 Left Hand	6	61.5	38.5	0.0	0.0
8 Buttocks	5	69.2	15.4	15.4	0.0
9 Left Thigh	3	84.6	0.0	15.4	0.0
10 Left Knee	5	61.5	23.1	7.7	7.7
11 Left Leg	4	69.2	15.4	7.7	7.7
12 Left Ankle or Foot	4	69.2	23.1	7.7	0.0
13 Eyes	10	23.1	15.4	38.5	23.1
14 Upper Back	12	7.7	30.8	46.2	15.4
15 Right Shoulder	5	69.2	7.7	15.4	7.7
16 Right Arm	4	76.9	15.4	7.7	0.0
17 Right Elbow	2	92.3	0.0	7.7	0.0
18 Right Forearm	3	76.9	7.7	7.7	7.7
19 Right Wrist	7	53.8	15.4	23.1	7.7

20 Right Hand	7	46.2	23.1	23.1	7.7
21 Lower Back	10	23.1	38.5	23.1	15.4
22 Right Thigh	2	84.6	7.7	7.7	0.0
23 Right Knee	5	61.5	7.7	30.8	0.0
24 Right Leg	5	61.5	15.4	7.7	15.4
Right Ankle or 25 Foot	5	61.5	15.4	15.4	7.7

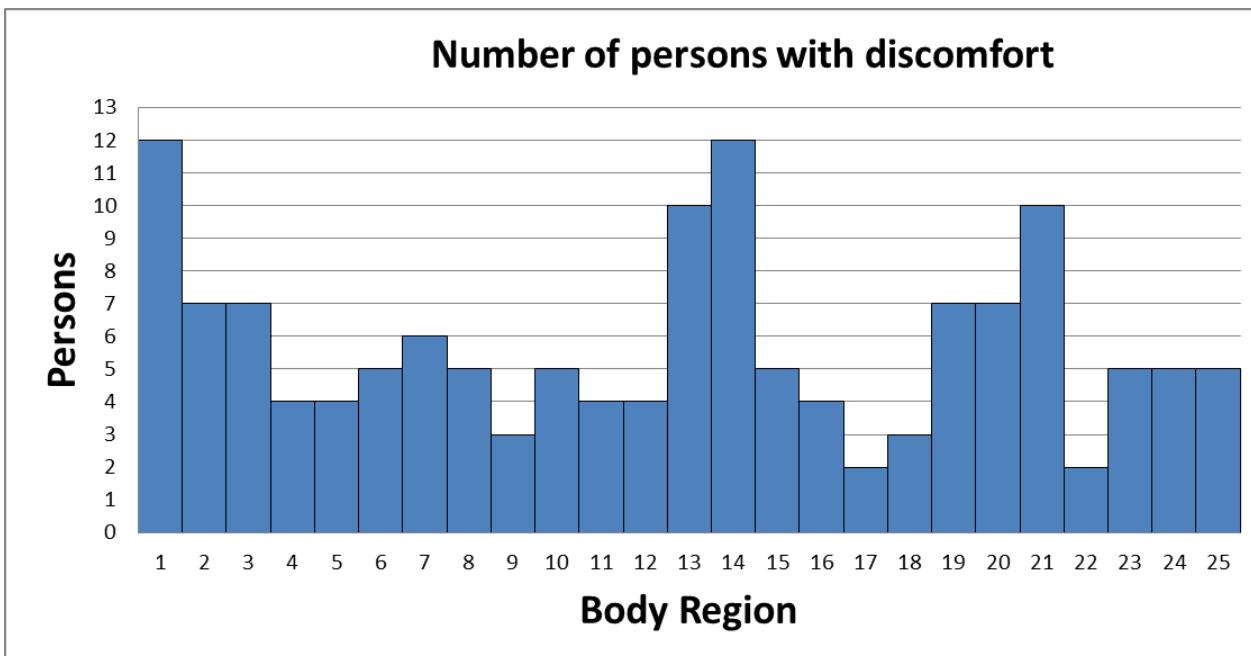


Chart 1. Number of persons with body region discomfort.

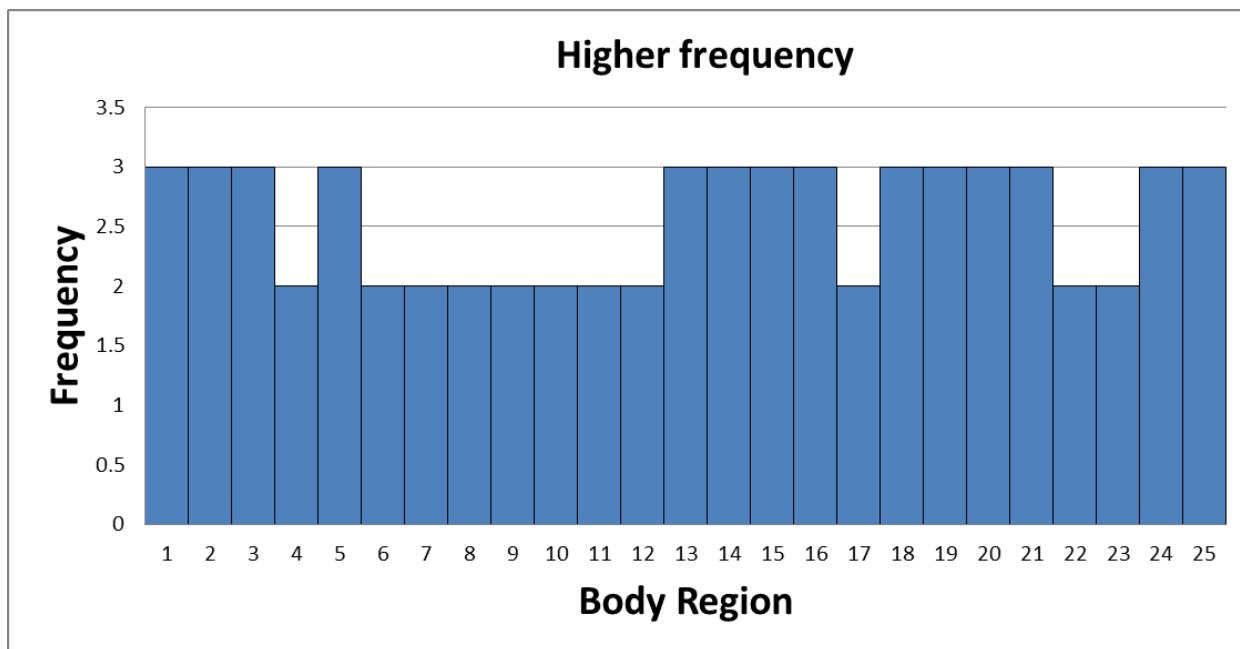


Chart 2. Higher frequency by body region.

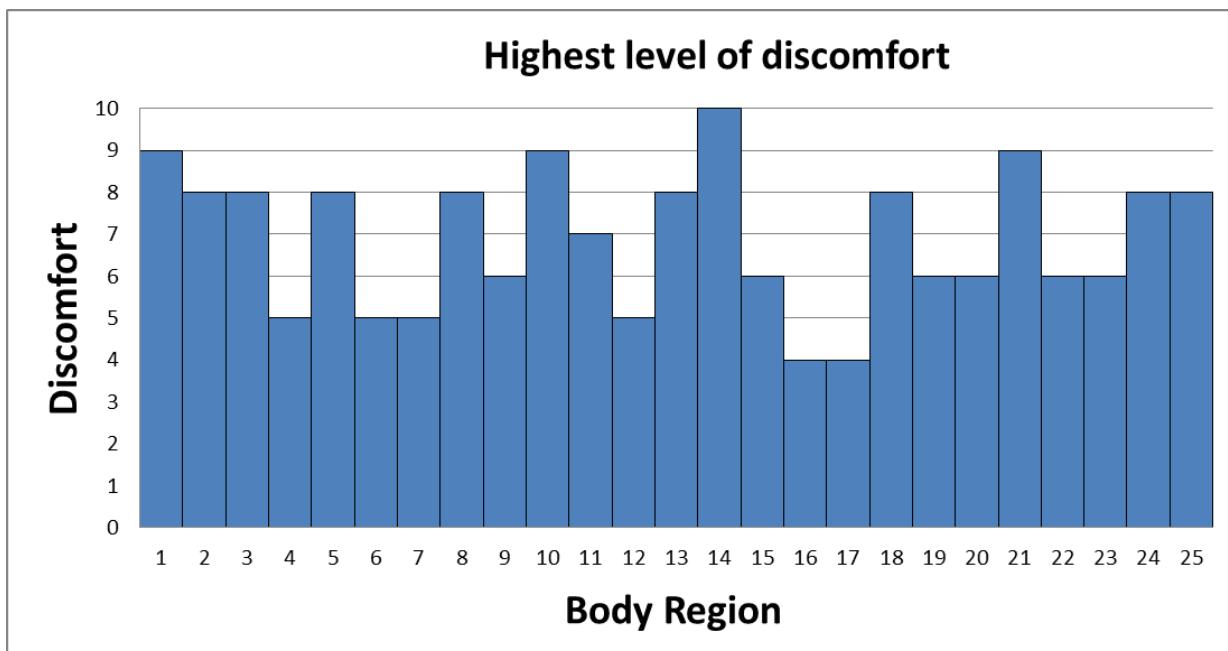


Chart 3. Highest level of discomfort by body region.

5. CONCLUSIONS

As results of observation and tours to identify unsafe conditions, is shown in the Image 3 and 4 that in the workplace are unsafe electrical conditions on office ant test areas in the laboratory.

On the other hand, in images 5 and 6, were observed for positions ergonomic risks while using computer equipment due to the design of jobs. Finally, risks were also found improper storage of waste materials and work areas.

The results of the discomfort survey by body region shown in Table 1 and Charts 1, 2 and 3 indicate that the presented symptoms are discomfort in upper back and neck with a reference frequency of 12. Secondly, they are manifestations of eye discomfort and low back/medium with a reference frequency of 10 persons.

It also shows that the higher frequencies in discomfort are presented in: neck, shoulder, arm and both forearms; eyes, upper and lower back; wrist and right hand, right leg and ankle/right foot. Moreover, the highest level of discomfort occurs in the upper back, followed by neck and back left knee low /medium.

6. BIBLIOGRAPHY

- Fernández J., Marley R., Noriega S. e Ibarra G. (2011). *Ergonomía Ocupacional: Diseño y Administración del Trabajo*. 1era ed. México: Universidad Autónoma de Ciudad Juárez.
- Marley, R., y Kumar, N. (1996). An improved musculoskeletal discomfort assessment tool. International Journal of Industrial Ergonomics. Vol. 17, pp. 21-27.

