

Ergonomic analysis in public markets in Cortazar Guanajuato.

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Abstract: the study was realized in a public market in the city of Cortazar, Guanajuato. A typical work day is more than 12 hrs, the realized activities cause that the workers adopt positions that can damage the physical integrity. With method LEST a general diagnosis of the work areas was obtained, the activities evaluated with method REBA were: to load structures, to load merchandise, joint of, to accommodate merchandise, and with equation NIOSH evaluated the rises of structures and bags with merchandise. The method LEST shows the dynamic load, illumination, thermal environment and social status like factors that can cause fatigue. The method REBA shows the activities accommodate merchandise and to assemble structures, with a final score of 5 and an action level of 2, the activity to load merchandise, obtained a final score of 8 and an action level of 3, and the activity to load structures a final score of 4 and an action level of 2. The activities of to lift structures and to lift merchandise, obtained a lifting index 1.16 and 2.26 respectively. With the risk levels obtained, is necessary to use devices to diminish the risk levels, as well as, to reduce the time or work.

Keywords: public market, dynamic load, back pain.

Resumen: el estudio fue realizado en un mercado ambulante (tianguis) en la ciudad de Cortázar, Guanajuato. La duración típica de las jornadas de trabajo es de más de 12 hrs; en el desarrollo de las actividades se adoptan posturas que pueden dañar la integridad física de los trabajadores. Con el método LEST se obtuvo un diagnóstico general de las áreas de trabajo, las actividades evaluadas con el método REBA fueron: cargar estructuras, cargar mercancía, ensamblar estructuras, acomodar mercancía, y con la ecuación NIOSH se evaluaron los levantamientos de estructuras y de bolsas de mercancía. EL método LEST, nos da como resultado que los factores que generan fatiga a los trabajadores son la carga dinámica, la iluminación, el ambiente térmico y el status social. Del método REBA

se obtuvo para las actividades de acomodar mercancía y armar estructuras, puntuaciones finales de 5 y un nivel de actuación de 2, para la actividad de cargar mercancía, una puntuación final de 8 y un nivel de actuación de 3, y para la actividad de cargar estructuras una puntuación final de 4 y un nivel de actuación de 2. Con la ecuación NIOSH se obtuvo un índice de levantamiento de 1.16 y 2.26 para las de cargar estructuras y cargar mercancías, respectivamente. Con los niveles obtenidos por los métodos aplicados, resulta necesaria la utilización de dispositivos para disminuir los niveles de riesgo, así como también, disminuir el tiempo de las jornadas de trabajo.

Palabras clave: mercado ambulante, carga dinámica, dolor de espalda.

1. INTRODUCTION

The traveling commerce in Mexico has had a considerable increase in the last years, this due to the difficult economic situation and the difficulties to establish a business. In this investigation the ergonomic evaluation of the activities that the workers doing in the traveling markets was realized, some of these are the joint and assembly of the structures of the position, the arrangement of merchandise until the load of the bags and boxes at the end of the labor day.

The markets public appear in all the Mexican territory, sometimes are established in fixed places with floors and solid ceilings and the work place never changes, nevertheless in other occasions the markets are mounted in the streets of the cities.

The majority of the establishments are making by detachable metallic structures on which tables are placed to show products. Nevertheless, also the products can be placed directly on folding tables or directly on the floor.

2. MATERIAL AND METHOD

2.1 Activities and workers.

The activities evaluated were: to load structures, to load bags with merchandise, to assemble structures and arrangement of merchandise. The following chart show pictures relating with the activities.



To load structures



To load bags with merchandise



To joint structures
Figure 1. Activities evaluated



To accommodate merchandise

A total of 60 workers was interviewed, all of them while they were realized their activities in the public market. The rank of ages was of 15 to 35 years, and all the interviewed were men.

2.1LEST method

The method Lest was developed by F. Guélaud, M.N. Beauchesne, J. Gautrat and G. Roustang, members of the Laboratoire d'Economie et Sociologie du Travail (L.E.S.T.), of the C.N.R.S., in Aix-in-Provence in 1978 and it carries out the evaluation of the conditions of work in the possible more objective and more global way, a final diagnosis that indicates if each one of the situations considered in the position is satisfactory, bothersome or noxious.

The method is of global character considering each aspect of the position of work in a general way. It is not deepened in each one of those aspects, a first valuation is only obtained to determine if a deeper analysis is required with specific methods. The objective is, according to Guelaud (1977), to evaluate the group of relative factors to the content of the work that it can have repercussion so much about the health as envelope the personal life of the workers. Before the application of the method they should have been considered and resolved the relating labor risks to the Security and Hygiene in the Work because they are not contemplated by the method.

The information that is necessary to pick up to apply the method has a double objective-subjective character. On one hand quantitative variables they are used as the temperature or the sound level, and for other, it is necessary to pick up the worker's opinion regarding the work that he/she carries out in the position to value the mental load or the aspects psychosocial. Guelaud, 1997

The valuation given and dimensions and factors considered by the method LEST is shown in the following charts.

Table 1. Valuation and Meaning in LEST method

Color and punctuation	Meaning
0, 1, 2	Satisfactory situation
3, 4, 5	Weak annoyances
6, 7	Average annoyances. Risk of fatigue exists.
8, 9	Strong nuisances. Fatigue exists
10	Harmfulness

Table 2. Dimensions and factors in LEST method

		DIMENSIONS				
		PHYSICAL LOAD	PHYSICAL ENVIRONMENT	MENTAL DEMANDS	PSYCOSOQAL DEMANDS	TIME DEMANDS
FACTORS	Static load		Thermal environment	Time pressure	Iniative	Time demands
	Dynamic load		Noise	Complexity	Social Status	
			Ilumination	Attention	Communication	
			Vibrations		Relation with the head	

2.2 REBA method

The method REBA (Rapid Entire Body Assessment) it was proposed by Sue Hignett and Lynn McAtamney and published by the specialized magazine Applied Ergonomics in the year 2000. The method is the result of the combined work of an ergonomists team, physiotherapists, occupational therapists and nurses that identified around 600 postures for its elaboration.

The method allows the combined analysis of the positions adopted by the superior members of the body (arm, forearm and wrist), trunk, neck and the legs. Also, it defines other factors that it considers determinant for the final valuation of the posture, as the load or managed force, the type of coupling or the type of muscular activity developed by the worker. It allows to evaluate static as dynamic postures, and it incorporates as novelty the possibility to point out the existence of abrupt changes of posture or unstable postures.

The method REBA is a tool of specially sensitive analysis of postures with the tasks that bear unexpected changes of position, as consequence usually of the manipulation of unstable loads.

Their application prevents the analyst about the risk of lesions associated to a posture, mainly of muscle-skeletal type, indicating in each case the urgency with which correction actions should be applied. It is, therefore, of an useful tool for the prevention of risks able to alert on inadequate work conditions.

Table 3. REBA Method Punctuation

Final puntuation	Action level	Risk level	Situation
1	0	No risk	Changes are not necessary
2, 3	1	Low	Changes are possible
4, 5, 6, 7	2	Half	Changes are necessary
8, 9, 10	3	Nigh	Changes are necessary and quickly
11, 12, 13, 14, 15	4	Very High	Changes are urgent

2.3 Equation of NIOSH

Equation of NIOSH allows to evaluate tasks in which lifts are realized, being offered as result the Recommended Weight Limit (RWL) that is possible to lift in better conditions to avoid problems of back (Niosh, 1981).

In 1981 the Institute for the Occupational Security and Health of the Department of Health and Human Services published one first version of equation NIOSH; later, in 1991 one second version in that was made public the new advances in the matter took shelter, having allowed evaluate asymmetric rises, with you take hold of the load non optimal and with a greater rank of times and frequencies of rise. In addition, in that year the lifting Index was introduced (LI), an indicator that allows to identify dangerous rises (Niosh, 1981).

The reviewed equation of NIOSH (REN) considers 6 factors, which are the following: • Factor of horizontal range (HM) • Factor of vertical range (VM) • Factor of displacement (DM) • Factor of asymmetry (A.M.) • Factor of frequency (FM) • Factor of takes hold (CM) These multiplied factors to the being to each other and by a constant of load (K=23 kg), provide as result the weight limits recommended that the worker must handle in the evaluated activity, according to is indicated in Equation. Niosh, 1994.

$$REN=AH*VM*DM*AM*FM*CM*K \tag{1}$$

3. RESULTS

3.1 Application of LEST method

The following chart shows the general diagnosis in the public market, this results was obtained after apply the LEST Method.

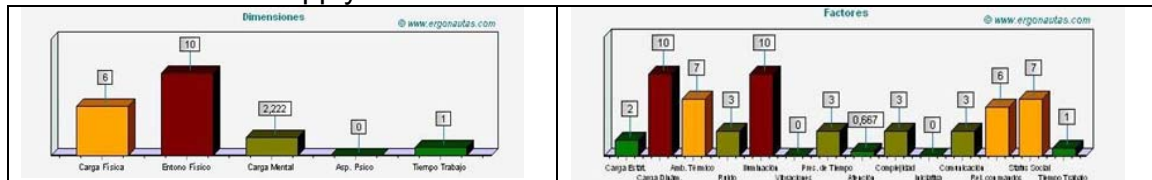


Figure 1. Result LEST Method

3.2 Application of REBA method

With the REBA method was evaluated the activities of to load structures, to load merchandise, to assemble structures, to accommodate merchandise.

3.2.1 Load structures activity.

After to apply REBA method in this activity, it was obtained a final punctuation of 4 and actuation level of 2, therefore the risk level is medium and it's necessary the changes in the activity.

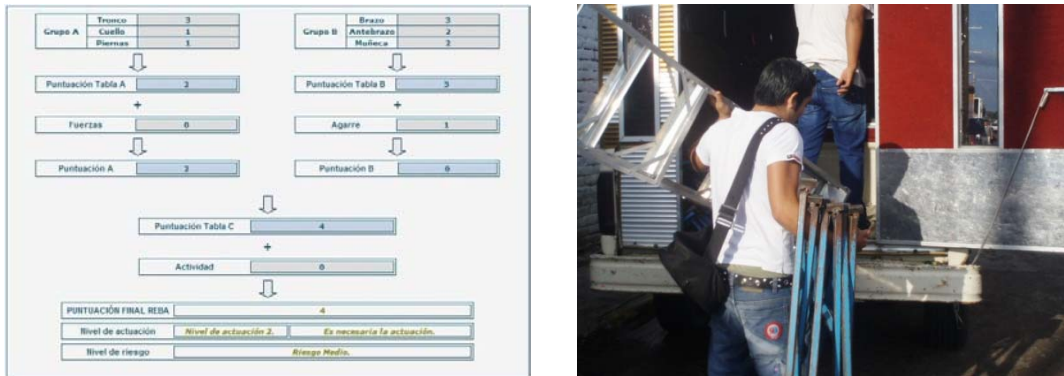


Figure 2. To load structures. Picture and Method REBA punctuation.

3.2.2 Load bags activity.

In this activity, REBA method shows a final punctuation of 8 and actuation level of 3, therefore, the changes are necessary as soon as possible because the risk level is high.

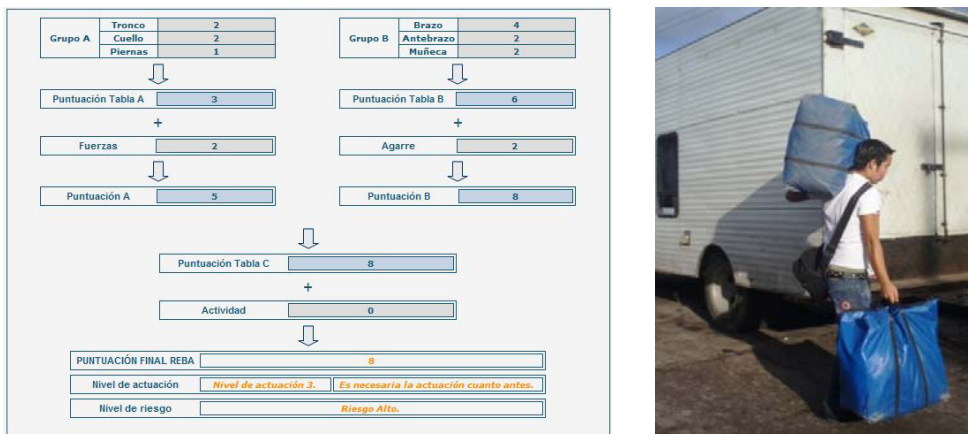


Figure 3. To load bags. Picture and Method REBA punctuation.

3.2.3 Joint of structures.

After apply REBA method in this activity, it was obtained a final punctuation of 5 and actuation level of 2, therefore the risk level is medium and it's necessary the changes in the activity.

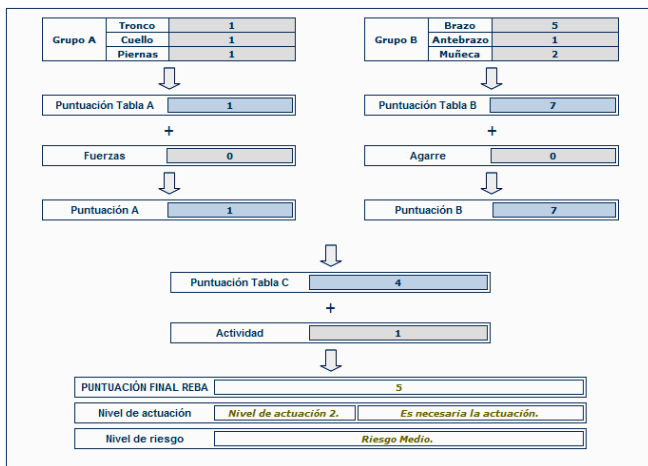


Figure 4. To joint structures. Picture and Method REBA punctuation.

3.2.4 To accommodate merchandise

In this activity, the result of REBA method was a final punctuation of 5 and actuation level of 2, therefore, changes are necessary and the risk level is medium.

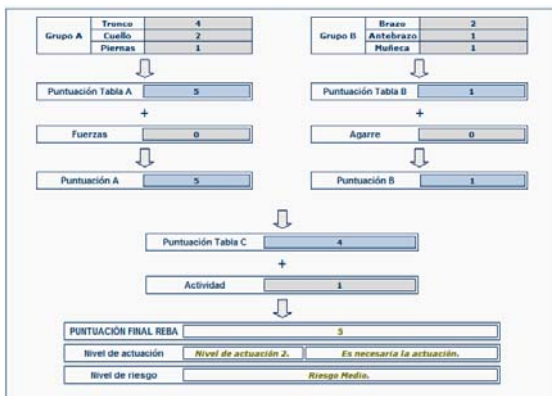


Figure 4. To accommodate merchandise. Picture and Method REBA punctuation.

3.3 Application of Equation NIOSH

3.3.1 Lifting structures

In this activity, the Recommended Weight Limit (RWL) was 17.2 kg, and lifting index of 1.16.

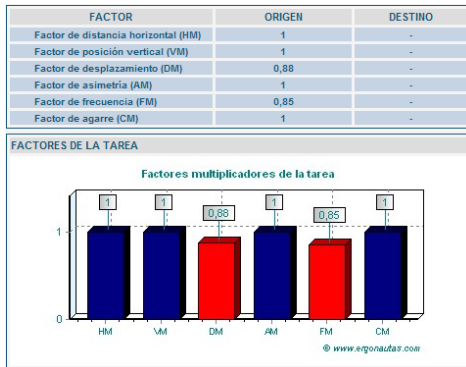


Figure 5. Lifting structures. Picture and Eq. NIOSH punctuation

3.3.2 Lifting bags with merchandise

In this activity, the Recommended Weight Limit (RWL) was 15.48 kg, and lifting index of 2.26.

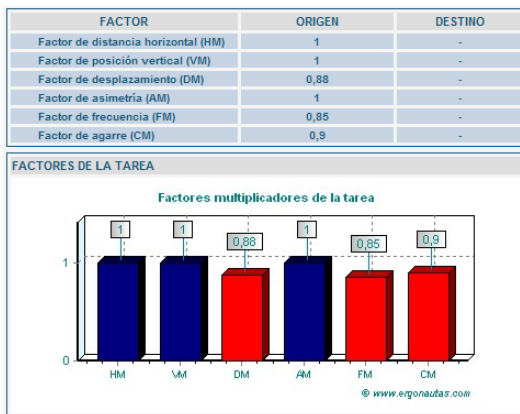


Figure 6. Lifting bags with merchandise. Picture and Eq. NIOSH punctuation

4. DISCUSION AND CONCLUSIONS

After the application of Method LEST, the factors with higher risk level were dynamic load, illumination, thermal environment and social status. The obtained level of dynamic load (10), is because the workers must walk and at the same time, they must to load structures, bags and/or boxes with merchandise with weights about 15 kg. The static load was with a low level, because the weight of the individual products is little significant, nevertheless we do not have to forget the positions in which they realize the joint of the structures.

The illumination obtained a level of 10 and the thermal environment of 7, this must to that the workers outdoors realize their activities and without but protection that a cap. Finally the social status obtained a level of 7, which is considered like upper middle risk, this because the level of studies and the time that a person requires to realize those activities are very little and with a simple instruction can begin to work.

All these activities showed at least average points in the REBA method scale, this meaning that changes are necessary in the activities done by the workers and to consider the use of tools in order to diminish the ergonomics risk.

Activities analyzed by NIOSH equation, they got lifting index up to 1, this meaning that the weight lifted is higher than RWL and there is risk that the workers suffer musculoskeletal disorders due to the weight of each lifting.

With the levels of risk obtained, it's necessary to modify the activities, to consider the use of carts to move merchandise, and probably the simple solution to do the activities with two persons.

5. REFERENCES

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