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Ergonomic Risk Reduction in the Balanced Unloading Area in a Poultry Microenterprise

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ABSTRACT

An ergonomic study was carried out to evaluate the manual handling of loads and identify possible musculoskeletal conditions to establish preventive actions to reduce risk in the worker of the balancing unloading area of an Ecuadorian agricultural microenterprise. To identify the risk factors, information was collected through direct observation and photographs, to establish the ergonomic risk in the manual handling of loads, the OWAS (Ovako Working Analysis System) evaluation method was applied with respect to the positions to which it is exposed, in carrying out the evaluation, encodings of the postures of the back, arms, legs and load were applied. Positions 9, 10 and 11 shown in Figure 1 are the ones with the highest risk for the worker, obtaining a risk category 4, it is interpreted that it is necessary to adopt corrective actions immediately. The Snook and Ciriello method was applied for the evaluation of cargo handling, using the ERGOSoft PRO software for Windows used in ergonomics for information processing, facilitating the work of the prevention specialist with data collection from mobile technology. The results for the initial force gave a level of risk between 1.5 - 2.0 with a value of 1.82 having a high risk because it has been exposed to a significantly high force, for the sustained force the level of risk is > 2.0 with a value of 3.33 having a very high risk due to having been exposed to a force of more than 30 kg and overexertion, it is recommended that the budget should include complementary examinations every six months for the control and prevention of musculoskeletal injuries due to activities that involve efforts in the postures of the back, arms and legs.

Keywords: Load, Ergonomic, Handling, Methods, Risk

INTRODUCTION

Ergonomics is a discipline that involves the interaction between people and work, tools and the work environment in genera (Velázquez, Caballero, & Espinoza, 2020) that allows us to understand the functioning and behavior of man (Cisneros Rodríguez, 2016). One of its objectives is to adapt devices, tasks and tools to the needs and abilities of human beings, improve their efficiency and comfort, thus reducing injuries and illnesses, reducing disability

Figure 1: Sixteen postures that the worker adopts when carrying out the balancing unloading activity in the poultry microenterprise.

and compensation costs, improving productivity, quality and safety (Sánchez, 2016) (Stashchuk, 2021)

There are characteristics within the work environment that can cause a series of disorders or injuries: the so-called ergonomic risks, these can be of different types, such as excessive physical and physical effort, psychosocial aspects related to poor work organization (Pons Castillo, 2019) (LiangTangun, Volumen 87, 2022). Ergonomic Risk Factors are a set of multifactorial characteristics of the work or activity carried out by employees who may have injuries, which we will call Musculoskeletal Disorders (Estuardo, 2018) (Panigrahi, 2021). Los estudios ergonómicos han demostrado que una mala postura puede conducir a un trastorno de trauma acumulativo (ATD), which occurs when people perform repetitive and stressful exercises (Melania, 2016) (Boriboonsuksri, Taptagaporn, & Kaewdok).

In the workplace, a "forced posture" is defined as a work position in which one or more anatomical areas are no longer in a natural comfortable position to move into a (forced) position, the obsessive posture that is generated by making hypotheses (qualitative research) or guiding questions (qualitative research), if necessary, can cause musculoskeletal diseases in different parts of the body: neck, shoulders, spine, upper and lower limbs, in various impacts more or less in their occupations or work tasks (Alexander, 2017)

(Saeid Yazdanirad, 2022). The OWAS Method is an excellent postural loading method based on the simple and systematic classification of work postures and the observation of tasks (Marcelo, 2019) (Alexander, 2017). La manual handling of loads is considered one of the main risk factors in the appearance of back injuries (Piedrabuena, 2017). With the research methodology, researchers can demonstrate that the basic data can use the corresponding evaluation method (Irene, 2016).

OWAS, SNOOK AND CIRIELLO METHODS

The classification by the OWAS method covers the most common and easily recognizable work postures, which are described below in Table 1. Each combined digital code related to work posture and use of force is accompanied by work phase information, which is also encoded. Several techniques can be used to distribute the observations over time, for the OWAS method a system of equal intervals is recommended, where the interval is 30 or 60 seconds, when it is continuous it should last from 20 to 40 minutes. There should be at least 10 minutes of rest between each observation period, calculate the frequency of the working posture and its relative proportion (%) during the working time based on the observation results. The random system formula is used to calculate the error limit related to the average relative proportion of the working posture with a probability of 95%. The error limit decreases as the total number of observations increases. The error range based on the average of 100 observations is 10%. The error ranges based on the average of 200, 300, and 400 observations are 7%, 6%, and 5%, respectively. When the error limit is less than 10%, the mean value obtained by observation can be considered sufficiently reliable.

RESULTS

Ergonomic Risk in the Manual Handling of Loads With the OWAS Assessment Method

Based on the coding of Table 1, the results of Table 2 were obtained after making several observations that satisfied the sampling error of the sixteen postures of Figure 1 in the positions of the back, arms, legs and the load or force. In the case of postures 3, 6, 13, 14, 15 and 16 the risk category of 1 indicates that it has a normal natural postural effect and has no harmful effects on the musculoskeletal system, therefore no actions are required. The risk category of postures 1, 2, 4, 5, 7, 8 and 12 is 3, they have harmful effects on the musculoskeletal system and it is necessary to take corrective actions as soon as possible. Risk category 4 of postures 9, 10 and 11 is a very devastating effect on the musculoskeletal system, therefore immediate corrective actions are required.

Table 3 shows that risk category 3 has the highest percentage, being 43.75%, with harmful effects on the musculoskeletal system as it is a high category.

Table 1. Position coding: back, arms, legs and load or force.

Back position	Code	Arm position	Code	Leg position	Code	Load or force	Code
Right back	1	Both arms lowered	1	Sitting	1	Less than 10kg	1
Bent back	2	One arm low and the other raised	2	Stand with both legs straight	2	Between 10 and 20kg	2
Twisted back	3	Both arms raised	3	Stand with one leg straight and the other one bent	3	More than 20kg	3
Bent back with twist	4			Standing or squatting with both legs bent and weight balanced between both	4		
				Standing or squatting with both legs bent and weight unbalanced	5		
				Kneeling	6		
				Walking	7		

Table 2. Analysis of postures.

Position	Back	Arms	Legs	Load	Frequency	Risk
1	2	1	5	3	100%	3
2	2	1	2	3	100%	3
3	1	1	2	1	100%	1
4	2	1	2	3	100%	3
5	2	1	2	3	100%	3
6	1	1	2	3	100%	1
7	2	1	7	3	100%	3
8	2	1	7	3	100%	3
9	4	1	5	3	100%	4
10	3	1	5	3	100%	4
11	2	3	4	3	100%	4
12	3	1	4	3	100%	3
13	1	1	7	3	100%	1
14	1	1	7	3	100%	1
15	3	1	7	3	100%	1
16	3	1	3	1	100%	1

The points in Figure 2 are connected with a stepped line, and the plot includes a fitted line corresponding to the fitted cumulative distribution function (CDF).

Table 3. Summary of the results of the posture analysis with the OWAS method.

Risk category	Percentage
1	37.50%
3	43.75%
4	18.75%

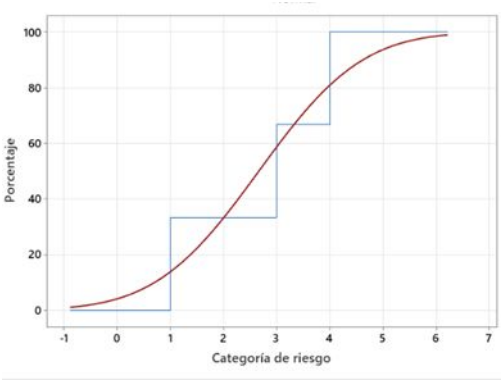

Figure 2: CDF intuitive empirical of risk.

Table 4. Risk Levels.

Risk level	Risk	Exposition	Recommended action
≤ 0.50	Inappreciable	No exposure	It is not required
0.5 - 1.0	Low	Very low exposure	It is not required
1.0 - 1.5	Medium	Significantly high strength. Probable overexertion for people with reduced capacity	Job improvement, medical supervision and training are recommended
1.5 - 2.0	High	Significantly high strength. Probable overexertion for people with normal capacity.	Job improvement actions are essential.
> 2.0	Very high	High force. Very likely overexertion	There are urgent actions to improve the position

Analysis Based on the Snook and Ciriello Tables Method

The ERGOSoft PRO Software was used to evaluate the level of risk in the forces, that the value of the initial force is 22 kg and the sustained force is 12 kg are recommended, the processed data was that the sex of the worker is Female, starts the process with a load of 40 kg and it is sustained throughout the study process, the height of application of the force is 160 cm, the distance traveled is 5 m with a frequency of 12 movements per hour. The result obtained from a risk level value of 1.82 was analyzed according to Table 4 to identify the risk and the recommended actions.

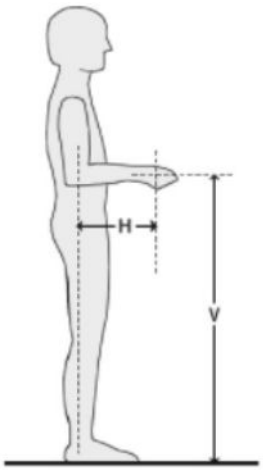

Figure 3: Horizontal distance (H) and vertical distance (V).

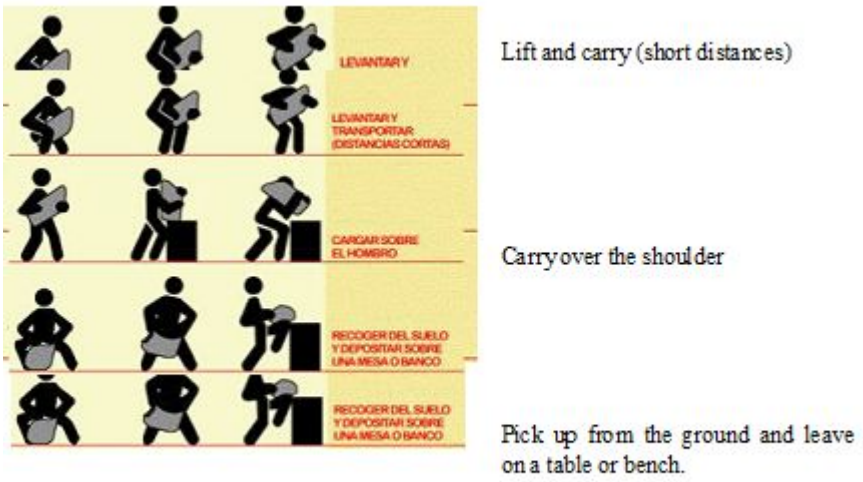

Figure 4: Lifting of loads by the international labor organization.

When the load is close to the person's center of gravity, the basic factor in the dangerous appearance due to manual handling of the load is the distance between the load and the person's center of gravity. Two factors affect this distance: In Figure 3, we see the horizontal distance (H) and the vertical distance (V), which will give us the "coordinates" of the load situation. The further the load is from the body, the greater the compressive force generated in the spine and, therefore, the greater the risk of injury, which is what happens in this case study. The ideal vertical displacement of the load is a maximum of 25 cm, the displacement between "the height of the shoulders and the height of the middle of the legs" is acceptable. Whenever possible, the task should be designed to handle the load without turning. The twisting of the torso will increase the pressure on the lower back.

CONCLUSION

Sixteen postures were analyzed by means of the OWAS method using the encodings of both the back, arms, legs and in the load, postures 9, 10 and 11 are the ones with the highest risk for the worker, obtaining a category of risk 4 whose effect is extremely harmful on the worker. musculoskeletal system. When evaluating the risk levels in the ERGOSoft PRO Software, two incident forces were obtained, in the initial force the risk level was 1.82 which is significantly high with a probable overexertion for people of normal capacity, for the sustained force it gave a value of 3.33 having a very high risk due to being exposed to a force of 40 Kg and very probable overexertion, the recommended actions are to immediately redesign the job using auxiliary mechanical equipment or lift the current weight between two people by reducing the weight of the load even with the same frequency of movements and using correct ways to lift, load and collect the balancing quintals as shown in Figure 4.

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