

## OCCUPATIONAL RISKS IN A MEAT PRODUCTS FOOD COMPANY IN THE CITY OF CHIHUAHUA, MEXICO

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**Abstract:** Introduction: The diagnoses of risks to which workers are exposed are an important part of the daily work in any company, given that occupational health is necessary for proper functioning, therefore the purpose of this work was to identify the risks to which Workers at a meat food company in Chihuahua, Mexico are exposed.

Method: The diagnosis was carried out through the PROVERIFICA Model; To complement and visualize the worker's perspective, individual surveys were included; Noise, temperature measurements and load handling evaluations were carried out.

Results: The Model revealed that the company has an efficiency level of zero, with a percentage of 35.4%. Individual surveys show that workers detect physical risks (cold, noise and humidity), prolonged work without breaks, physical effort, lifting objects from the floor level, carrying, pulling or pushing loads of between 5 and 30 kg and forced positions.

Conclusions: The importance of carrying out health and safety diagnoses at work lies in the identification and subsequent application of interventions that really achieve significant changes for the health of workers; The present work allowed us to analyze the work situations of the workers, leaving a precedent to carry out interventions to eliminate the risks found.

**Keywords:** Occupational exposure; Risk management; Meat Industry

## INTRODUCTION

The health of workers is an issue of great importance. Every day more companies develop different strategies to detect, minimize and eliminate those conditions that endanger the health and lives of workers; who, in the fulfillment of their job duties, are exposed to different risks and work demands (1). Due to this, it is essential to carry out occupational health and safety (OSH) diagnoses, since these determine the appropriate combination of

resources to address the solution of a problem or need, to achieve the maximum benefit with less risk and possible cost (2).

Chiavenato and Sapiro in 2017 indicate that the diagnosis can vary according to the environmental and technological circumstances, so it is necessary to link the moment and the context where the organization is located (3). This brings with it the need to propose occupational health programs that lead to the improvement of quality of life and organizational productivity through an intervention that involves all levels. Callizo in 2015 refers to the right to a safe and healthy work environment at all levels, mentioning the participation of governments, employers and workers in initiatives aimed at ensuring conditions through a system of rights and responsibilities (4).

From the point of view of organizational development, intervention is viewed as the process that leads to change in a planned and systematic way; this arises from the diagnosis and is the watershed that guides the direction of the action to be taken (5).

The food industry is made up of a series of organizations that are based on different technological processes. Among the activities with the highest risk is food preparation, since 40% of accidents and work-related illnesses occur due to lack of strict regulation and appropriate prevention measures that prevent exposure to occupational risks in this industrial sector (6). Arenas and Cantú (2013) mention that musculoskeletal disorders affect a quarter of the European population, 25% of workers suffer from back pain, while 23% present muscle pain (7). In Mexico, statistics according to Rivera and collaborators indicate that 198,720 work accidents occurred in 2017; 43,793 categorized in risk class V (the highest). In the same year there were 298 deaths, 116 were in workplaces categorized in risk class V (8).

In a study carried out by Álvarez and Franco (2020) in a workplace in the food industry, it was found that possible health problems are associated with hearing loss, wounds, fractures, dislocations, sprains, bruises, respiratory diseases, fatigue and stress. The effects that work has on health are not easy to identify because they may go unnoticed by the worker and the doctor, or they are considered a response to factors independent of the occupational context (9). In a study related to musculoskeletal problems, it was found that 24.4% of the population exposed to the cold in working conditions reported having pain in the shoulder and arm and 19.5% in the hand and wrist (10).

Normally, industries use machinery to produce food products, which generates noise and can be harmful to hearing if it does not comply with the parameters established by the regulations, in a study in four companies in the city of Cartagena, showed noise exposure by job and determined that the daily equivalent continuous level ranges between 95.7 dB(A) and 101.9 dB(A) (11). Workers in these conditions had 20% hearing loss in different jobs. 5% of the workers had mild hearing loss, 5% had moderate hearing loss, and 10% had profound hearing loss, according to the criteria of the National Institute For Occupational Safety & Health (NIOSH). Among workers with hearing loss, 5% are between 41 and 45 years old, while 15% are over 46 years old, the latter group being the most affected, due to long periods of exposure and older ages.

Within the food industry, there is one dedicated to the manufacturing of meat products. In Mexico, there was a production of more than two million tons of beef carcass meat, 1,730,248 tons of pork meat and 792,273 tons of poultry meat (Government of the Republic, 2022). The state of Chihuahua is an important participant in this economic activity. The Agri-Food and Fisheries

Information Service (SIAP) reported beef carcass production that exceeded more than 385 tons than what had been forecast for 2021 (12).

The above figures show the relevance of this type of industry in the country's economy. However, regarding the bibliographic search carried out by the authors, specifically no records were found of investigations carried out in these workplaces that included carrying out an occupational health and safety diagnosis. Therefore, the objective of this research was to identify the occupational risks of a meat food company in the city of Chihuahua through the diagnosis of health, occupational safety and working conditions.

## METHODS

Study with a quantitative, non-experimental approach of a descriptive, observational and transversal type, the population was made up of workers in the meat production area, the information was collected in the months of January 2021 to May 2022, it was carried out in two phases, in the first the occupational health diagnosis of the company was carried out in which the risks and demands existing in the work process were identified and a second corresponding to the measurements of noise, temperature and load handling. The inclusion criteria were the employees who wanted to participate in the study and who presented a higher risk, the exclusion criteria were those who did not agree to participate.

For the first phase, the instrument was applied: the Model for the Verification, Diagnosis and Monitoring of Occupational Health (PROVERIFICA)(13) of companies and the Individual Survey for the Evaluation and Monitoring of Workers' Health (14). It is integrated with the following sections: a) Company General Information Card (CIGE) consisting of Work Process Flow Diagrams (DFPT), Work Process Flow Description

(DDFPT). b) Verification Questionnaire. (CV) consisting of 10 chapters with a total of 668 questions distributed in 53 sections.

The Individual Survey for the Evaluation and Monitoring of Workers' Health (14) was applied with the purpose of considering the worker's perspective. In the second phase, the following methods were used to quantify risks, carrying out the procedure in accordance with the parameters established by the Secretary of Labor and Social Welfare, through its regulations: NOM-011-STPS-2001, Conditions of safety and hygiene in workplaces where noise is generated (15) and NOM-015-STPS-1994, relating to occupational exposure to high or low thermal conditions in workplaces (16).

The instruments used were: For noise, a 3M brand integrative sound level meter, model Soundpro SE/DL with NS: BFM050002, was used. For temperature: a QUEST TECHNOLOGIES thermal stress monitor equipment, model Quest Temp 34 with NS: TED120031, was used, which allowed the measurements to be calculated in one worker per evaluated area.

NOM-036-STPS-2018 was also applied, which describes ergonomic risk factors at work – identification, analysis, prevention and control. Part 1: manual load handling. The ergonomic study was carried out in accordance with the Standard, with production workers who were under some physiological demand such as carrying, pulling or pushing manually (17).

Due to the results of the diagnosis based on NOM-011-STPS-2001, audiometries were performed on 12 workers in the production area, with a MAICO brand digital audiometer, model: MA41.

## RESULTS

The results of PROVERIFICA revealed that it has a zero level of effectiveness, with a percentage of 35.4%, Figure 1 shows the total verification, in which all chapters are integrated, being chapter IV. Safety and hygiene the lowest with 0% effectiveness and the highest VIII. Supply of materials, engineering and maintenance with 60.7%.

The individual surveys showed that workers detect as risks: cold, noise, humidity, not being able to stop work, physical effort, lifting objects from the floor level, carrying, pulling or pushing from 5 to 30 kg and forced positions. For noise, a level of health risk was detected, in some cases close to the maximum limit allowed by Mexican regulations, which is why it was decided to perform audiometry on workers in the production area (Table 1).

The results of the audiometry show that the pure auditory tonal average exceeds 20 decibels (dB) for each ear, for the frequencies 0.5-1-2-4 Kilo-Hertz (KHz). While workers who have less exposure time presented normoacousis; Although conversational frequencies are not affected, they present scotomas to different degrees. Therefore, the results of the workers subjected to audiometry (Table 2) were compared with the WHO criteria where hearing loss is considered when the pure auditory tonal average exceeds 20 decibels (dB) for each ear for frequencies 0.5-1-2-4 Kilo-Hertz (KHz) (18).

Table 2 shows the age, seniority, diagnosis by Pure Tonal Average (PTP) and diagnosis by graph of the workers who underwent audiometry.

Based on the results obtained, it is recommended to follow the guidelines according to NOM-011-STPS-2001 such as: recognize and evaluate the work areas where the NSA is equal to or greater than 80 dB(A), provide the Personal Protective Equipment (PPE) as established by NOM-

017-STPS-2001(19), establish a hearing conservation program where workers are exposed to more than 85 dB (A), inform workers about the risks to health from exposure to noise and monitor the health of workers.

Regarding temperature, low temperatures are present, being a food company; uses cold rooms where its workers are exposed (Tables 3 and 4 respectively).

Occupational exposure to cold environments depends mainly on temperature and air speed. The company's cold rooms generate temperatures of  $-19^{\circ}\text{C}$  to  $-23^{\circ}\text{C}$ , with wind gusts of  $-19.7^{\circ}\text{C}$ , a situation that puts The health of workers who do not have personal protective equipment (PPE) or any program to establish time inside the chambers is at risk (20). The results force the company to offer PPE for low temperatures.

For the physiological demands, the standard instrument was applied in the areas where production personnel were present. Figure 2 shows the results of the sausage area, where the lifting task presents a very high level with 21 points, while transport and load are placed at the high level with 19 and 15 respectively

It is proposed to meet the guidelines of NOM-036-STPS-2018 such as: having an ergonomic study, adopting prevention and/or control measures on ergonomic demands, carrying out monitoring of the health of workers and providing training.

## **DISCUSSION AND CONCLUSION**

The world of work has undergone changes over the years, resulting in risks and demands for the health of workers. Among the risks that are present were low temperatures, being a meat food company; To preserve your products, it is necessary to use cold rooms where your workers are exposed to low temperatures.

Physiological demands are one of the main risk factors present in the work process, which agrees with the study carried out in 2000 where repetitive tasks were found to have a high risk of generating musculoskeletal injuries in the neck-shoulder and in the hand-wrist area in this type of industry (21).

The human body generates energy through biochemical reactions based on the compounds that form food and the oxygen in inhaled air. The energy that is created is used to maintain vital functions, make efforts, movements, among others, much of this energy is heat, the heat generated keeps the body's temperature constant, when the power generated cannot be triggered in the necessary amount Because the environment is hot, the body temperature increases and there is talk of risk due to thermal stress. If, on the other hand, the flow of heat given to the environment is excessive, the body temperature drops and there is said to be a risk of cold stress (22).

Occupational exposure to cold environments depends mainly on the temperature and air speed; the company's cold rooms generate temperatures of  $-19^{\circ}\text{C}$  to  $-23^{\circ}\text{C}$ , a situation that puts the health of workers who do not have with PPE or some program to establish time inside the chambers (20). If workers who work in cold rooms did so with the appropriate protective equipment and according to the regulated exposure times, they would not find themselves in a situation that puts their health at risk.

Finally, it is important to mention that being a company dedicated to food processing, it has production machinery, which generates a large amount of noise, which according to NOM-011-STPS-2001 indicates that when a company generates noise above 83 dB, the recommendation is made to use hearing protectors, with 90 dB being a level capable of causing damage to workers' hearing, although 90 dB is the maximum permissible limit, from

80 dB onwards it can be have hearing problems; The company in question has a working day of 8 hours a day with a level of 89 dB without any PPE, so considering Mexican regulations the levels generated represent a serious problem for the hearing health of workers.

For this reason, the exposed workers were subjected to an audiometry study in which it was validated that exposure time is a factor in developing hearing loss, in these cases it occurs from mild to profound, according to the WHO criteria they mention that it is considered hearing loss. when the pure auditory tonal average exceeds 20 decibels for each ear for the frequencies 0.5-1-2-4 Kilo-Hertz (KHz) (18). While workers who have less exposure time presented normoacusis; An important fact is that, although conversational frequencies are not affected, they present scotomas to different degrees.

Chávez (2013) refers that noise-induced perceptual hearing loss (HIR) is a hearing loss that is generally bilateral, permanent, slowly installed and progressive over years, which

results from exposure to intense, continuous or intermittent noise. (2. 3).

Considering HEALTH (24), it must be mentioned that, to make a conclusive diagnosis of an auditory scotoma due to exposure to noise, it must have the following characteristics: first, the frequencies with the most impact must be 4000 and/or 6000 Hz. As a second characteristic, the 8000 Hz frequency must produce recovery, to eliminate cases of presbycusis. We can consider that the above mentioned provides a basis for the diagnosis of the different types of scotomas that workers present, as well as the statistical result that shows us that exposed workers with more years of seniority present greater hearing problems compared to those who are new; Therefore, it is urgent that a hearing rest be carried out, helping with PPE during the work day, in order to preserve the workers' hearing.

## CONFLICT OF INTERESTS

There is no conflict of interest in the publication of these results.

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## TABLES AND FIGURES

Chapters	total expected	Total SÍ	% SÍ	Total PM	% PM	Total NO	% NO	Index expected	Real Index	Percent age of efficiency	Level of efficiency
I – Preliminary evaluation of the company	91	43	47.2	13	14.2	35	38.4	182	99	54.3	N
II – Intervention of management levels	64	6	9.3	0	0	58	90.6	128	12	9.3	N
III – Induction and training	43	22	51.1	4	9.3	17	39.5	86	48	55.8	MM
IV – Safety and Hygiene	48	0	0	0	0	48	100	96	0	0	N
V – Ecology and environment	37	18	48.6	1	2.7	18	48.6	74	37	50	MM
VI – Health of employees	73	21	28.7	1	1.3	51	69.8	146	43	29.4	N
VII – Civil protection	36	13	36.1	0	0	23	63.8	72	26	36.1	N
VIII – Supply of materials, engineering and maintenance	28	17	60.7	0	0	11	39.2	56	34	60.7	MM
IX – Inspection and audit	24	5	20.8	1	4.1	18	75	48	11	22.9	N
X – Legal framework, studio methodologies and preventive programs	163	53	32.5	4	2.4	106	65	326	110	33.7	N
Total	607	198	32.6	23	3.7	385	63.4	1214	420	34.5	N

Figure 1. Percentages and levels of effectiveness according to verification chapters. meat food company

\* Efficacy levels: Very Bad (MM) and Nil (N)

NOM-011-STPS-2001	Official Mexican STANDARD	COMPANY VALUE	REGULATORY VALUE
Band	88.2 dB		90 dB
Cut	89.4 dB		90 dB
Iqf entry	85.6 dB		90 dB
Iqf output	85.4 dB		90 dB
Marinated	85.5 dB		90 dB
Built-in products	81.8 dB		90 dB

Table 1. Noise recognition results. Meat food company, Chihuahua, Chihuahua.

\* Iqf.- individual rapid freezing area

Audiometry	Age	Antiquity	Diagnosis by PTP*
1	65 years	11 years	Normoacusia
2	42 years	2 years and 8 months	Right ear: mild hearing loss Left ear: moderate hearing loss
3	57 years	2 years and 6 months	Mild bilateral hearing loss
4	52 years	2 years and 6 months	Normoacusia
5	40 years	2 years and 3 months	Severe bilateral hearing loss
6	48 years	2 years	Mild bilateral hearing loss
7	42 years	1 year and 5 months	Left ear: mild hearing loss
8	28 years	3 months	Normoacusia
9	32 years	1 month	Normoacusia
10	30 years	1 month	Left ear: cophosis Right ear: Normoacusia
11	30 years	1 month	Normoacusia
12	36 years	1 month	Normoacusia

Table 2. Audiometry data, meat food company.



AREA	TGBH ENTERPRISE VALUE IN °C	REGULATORY VALUE OF TGBH IN °CNOM-015-STPS-2001
Band	14.6	25
Cut	14.5	25
Iqf entry	14	25
Iqf output	12.5	25

Table 3. Temperature recognition results, Meat foods company, Chihuahua, Chihuahua.

Source: Temperature measurements according to NOM-015-STPS-1994, Chihuahua, Chihuahua.

AREA	VALUE
Freezer 1	Rafaga 19.7 temperature: -19.4°C
Freezer 2	Rafaga 19.7 temperature: -17.1°C

Table 4. Results freezing temperatures. Meat food company, Chihuahua, Chihuahua.

Source: Temperature measurements according to NOM-015-STPS-1994, Chihuahua, Chihuahua.

RISK ESTIMATION FOR THE LIFT AND TRANSPORTATION OF LOADS AND MANUAL LOADING OPERATIONS IN THE WORK GROUP						
AREA: BUILT IN PRODUCTS						
Risk factors	To raise		To transport		Equipment	
	Color	Value	Color	Value	Color	Value
Weight and lifting of the load / transportation frequency	Yellow	3	Yellow	3	Yellow	3
Horizontal distance between hands from lower back	Yellow	3			Red	3
Vertical lift region	Red	2	Green	0	Red	2
Torsion and lateral flexion of the torso; asymmetric torso loading (transport)	Red	3	Red	3	Red	3
Postural restrictions (uncomfortable, awkward, or restricted postures)	Red	2	Red	2	Green	0
Hand-load coupling (fastening elements)	Red	2	Red	2	Red	2
Work surface	Red	2	Red	2	Red	2
Other environmental factors	Red	2	Red	2	Red	2
Transport distance			Green	0		
Obstacles on the route (only in transportation)			Red	3		
Communication, coordination and control (only manual handling of loads in equipment)					Green	0
		21		19		15
Score of risk	Level					
		VERY HIGH		HIGH		HIGH

Figure 2. Area of inserts. Meat food company, Chihuahua.