



Relevant occupational health and safety risks in the Portuguese food processing industry

Pedro D. Gaspar^a, Tânia M. Lima^b, Mariana Lourenço^c

^aCentre for Mechanical and Aerospace Science and Technologies, University of Beira Interior, Covilhã, PT (dinis@ubi.pt) ORCID: [0000-0003-1691-1709](https://orcid.org/0000-0003-1691-1709). ^bCentre for Mechanical and Aerospace Science and Technologies, University of Beira Interior, Covilhã, PT (tmlima@ubi.pt) ORCID: [0000-0002-7540-3854](https://orcid.org/0000-0002-7540-3854). ^cUniversity of Beira Interior, Covilhã, PT (marianalr@outlook.pt).

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Abstract

The Agrifood Industry is the largest Portuguese Industry, constituted mainly by micro, small and medium-sized enterprises (SMEs). It is noted that more than any other type of organization SMEs have their own specificities that make it particularly appropriate to develop tools to facilitate communication and knowledge sharing for employers and workers. To this extent, identifying critical success factors is the key to increase SMEs productivity. Likewise, Occupational Safety and Health (OSH) in SMEs have their own characteristics, which difficult the prevention strategies implementation and aggravate the problematic of work accidents. This study analyses a fieldwork in 60 food processing companies in Portugal, related to the dairy, meat processing, bakery and horticultural subsectors. The analysis of the results allowed to identify that, at the national and regional level, the main failures are concerned with (1) lack of risk assessments regarding occupational noise, lighting, thermal environment and vibrations; (2) safety signaling, the circulation ways are not identified with appropriate safety colors; (3) general lighting, with too many shade areas and finally (4) complementary presence of associated risks to falls at the same level, falling of objects, thermal burns, the use of machines and equipment, fire, mechanical, ergonomic hazards and incorrect body postures. This study assesses the most relevant occupational health and safety risks in the Portuguese food processing industry to contribute to the improvement of OSH management and prevention of work accidents.

1. INTRODUCTION

By 2016, micro, small and medium-sized enterprises (SMEs) accounted for 98.8% of all non-financial enterprises in the European Union (EU), equivalent to 22.7 million enterprises (Muller *et al.*, 2016) employing around half of EU workers, which justifies the need for effective management of Occupational Safety and Health (OSH) in these enterprises, in order to provide the well-being of workers as well as a work environment with harmonized rules, which will enable high-quality products to be obtained, benefiting consumers and businesses, and ensuring their long-term survival (Netto, 2014).

However, statistics show that most of the workers do not have adequate safety and health protection in their workplace, and the percentage of work-related injuries is higher within SME workers (Sousa *et al.*, 2005). The resources available to SMEs have multiple limitations, which leads companies to opt for cost reduction strategies in order to ensure their economic viability (Hasle *et al.*, 2009). It is apparent that many workers in these enterprises are more likely to have worse working conditions, less job quality and proportionately greater risks to health, safety and well-being. Taking into account the numbers, the size of the company becomes an organizational risk factor, and the importance of effective means to prevent damage to the health and safety of its workers is evident (EU-OSHA, 2018).

Thus, the reasons that identify the poor adherence to OSH management measures in these companies include (Walters and Wadsworth, 2016):

- The weak economic situation of many SMEs and the poor investment they can make in OSH infrastructures;
- The limited level of knowledge, awareness and competence of their owners/managers in relation to OSH, as well as their regulatory requirements; Limited ability to manage the business systematically;
- Their attitudes and priorities, given their limited resources and concern for the economic survival of their company, which make SST unimportant.

According to the National Authority for Working Conditions (ACT), the Portuguese Manufacturing Industry corresponds to the sector of activity that presented in the year 2014 the largest number of accidents at work, about 54,000 accidents. Regarding fatal accidents, this sector occupied the second economic activity with more accidents, with a total of 25.

In addition to work-related accidents, several occupational diseases have been linked to work. According to ACT, in 2016, it is also the Manufacturing Industry, which presents the largest number of occupational diseases, about 2,150 records. The most frequent work-related diseases, depending on the risk factor, are the ones caused by physical agents that register the highest number of certified occupational diseases, followed by the respiratory system and skin diseases (ACT, 2017).

Faced with these high accident rates, the safety and health issue in the Manufacturing Industry is of particular relevance. Despite all the existing prevention techniques and standards, it is essential that companies have OSH management systems that help to anticipate, assess and control risks by preventing occupational accidents and occupational diseases associated with them (OIT, 2010).

Increasingly, issues related to the health and safety of workers are valued, as the inclusion of OSH preventive measures in companies, can prevent occupational diseases and occupational accidents, considering all productive activities and technological processes involved (Mendes *et al.*, 2017). It will contribute not only to the reduction of the number of fatalities but also to the reduction of the number of deaths, incapacities, lost workdays, also for the resulting economic and social costs.

As well as equipment and a working environment appropriately adapted to the needs of the work process, whose maintenance is ensured, improve quality and reduce health and safety risks by increasing productivity (EU-OSHA, 2002).

In addition, good practices in the field of health and safety at work are powerful tools to stimulate productivity (Kriebel *et al.*, 2011; Pietilä *et al.*, 2018). Healthy workers can influence company performance: fewer absences from work due to illness, minimizing downtime in the production cycle, higher productivity and quality of work. As well as equipment and a working environment appropriately adapted to the needs of the work process, whose maintenance is ensured, improve quality and reduce health and safety risks by increasing productivity (EU-OSHA, 2002). Therefore, more efficient production processes become more value-added products/services, competitiveness and, consequently, the conquest of markets. Despite the huge global economic recession, many employers are committed to OSH standards (OIT, 2010).

The Agrifood Industry is one of the strategic poles of the Portuguese economy, for the essentiality of the goods it produces and for the value and employment, it generates, and it is in the EU, the largest Industry with a turnover of 1,048 billion euros, of which 51.6% of this figure comes from SMEs (FoodDrinkEurope, 2017).

In 2017, SMEs represented 99.9% of the Portuguese business sector and according to statistics, the Agrifood Industry in Portugal represents 20% of the Manufacturing Industry and consists of about 12,000 companies, mostly SMEs, employing around 112,000 workers and representing a turnover of approximately 16,000 million euros (FIPA, 2017).

Therefore, since the Agrifood Industry is one of the strategic poles of the Portuguese economy and plays an increasingly important role (Matias *et al.*, 2013), this study aims to address the essential elements in a perspective of occupational risk prevention in Portuguese SMEs.

2. METHODOLOGY

The study analyzes the data collected under the +AGRO project - Organizational Management, Energy Efficiency and Occupational Health and Safety in Agrifood Industry, in particular those contained in the report “Characterization and Analysis of the Conditions of Safety and Health at Work in Agrifood Enterprises” (Gaspar *et al.*, 2018), available at: <https://maisagro.pt/sst/caracterizacao/>.

In the scope of the study, the sample analyzed shows a distribution of 60 companies distributed among the following subsectors (Figure 1): 15 companies belong to the subsector of meat processing, 12 to the subsector of horticultural products, 16 to the subsector of dairy products and 17 to the subsector of bakery products.

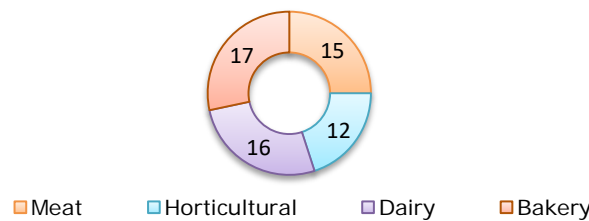


Figure 1. Distribution of companies by subsector (Gaspar *et al.*, 2018).

This study covers the main topics of an OSH risks assessment carried out in industries. To survey the OSH conditions in the workplace, an inquiry guide was applied to identify the main risks that exist in the company, as well as the main improvement actions to be implemented. In addition to the measurements referred to in the following points, the script included:

- Framework and organization of OSH services;
- Results of risk assessments in the company;
- Characterization of occupational accidents;
- Safety signs, firefighting and emergency response;
- Specific risk analysis: falls in height; level drops; Radiation; burns; machinery and equipment; mechanical; fire; falling objects; exposure to chemical agents and its use; biological; psychosocial; ergonomic and postural hazards (including manual handling of loads and repetitive work); and other risks detected in a specific subsector.

The data collected was compiled into tables that showed the values by subsector and region.

In order to systematize the data analysis, it was defined an hierarchy of occupational safety and health conditions, to identify the main risks in the subsectors. Tables have a caption with a color code that represents the percentage of companies where the parameters of health and safety at work are according to regulations (Table 1). The percentage refers to the amount of companies analyzed. The absence of non-conformity in the parameters of occupational safety and health conditions is given by a value of 0%. In other words, all companies find themselves with the regularized parameters. The green color was assigned for this condition. If 1% to 49% of the companies do not meet the parameters of occupational safety and health conditions, i.e. it is considered to be at an acceptable level, the yellow color is assigned.

The red color indicates that between 50 and 100% of the companies are not within the parameters of occupational safety and health conditions, so it is considered as a level unacceptable.

Table 1. Legend of colors for defining OSH conditions

Percentage	Definition	Color
0%	Regularized	Green
1% ≥ 49%	Acceptable	Yellow
50% ≤	Unacceptable	Red

3. RESULTS AND DISCUSSION

The interpretation of the results was performed by subsector. It must be taken into account that subsectors results should not be compared as each one has different productive conditions. The most relevant risks were identified for each subsector.

3.1. Organization of occupational health and safety services

Portuguese and European Law gives all workers the right to have safe work conditions. Thus, the employer must ensure that risk assessments are carried out, to subsequently adopt preventive and/or corrective measures. According to this legislation, companies have at their disposal three types of organization of OSH services: (1) internal services; (2) External services; and (3) Common services. In order to ensure a continuous, day-to-day practice, companies should preferentially adopt internal services. However, if there is no legal impediment, they may opt for external or common services. The Portuguese legislation sets that micro-enterprises (up to 9 employees) and whose activity is not of high risk, such as many agrifood industries, OSH services may be provided by the employer, or by a designated worker. Internal service modality becomes mandatory in industries with at least 400 employees. There are few cases of agrifood industries with such a number of employees.

Overall, most of the companies (87%) of the four subsectors have organized occupational health and safety services, although 5% of these companies do not have the services according to the legal requirements, as shown in [Table 2](#).

Table 2. Audited companies with organized occupational health and safety services

	Percentage of answers				According to legal requirements			
	Dairy	Meat	Bakery	Horticultural	Dairy	Meat	Bakery	Horticultural
Yes	94%	93%	94%	58%	100%	93%	100%	83%
No	6%	7%	6%	42%	0%	7%	0%	17%

3.2. Documented risks assessments

Companies are required to carry out risk assessments on the parameters defined in the legislation. One of those parameters is noise. Noise is an unpleasant or undesirable sound that can cause nuisance or an obstacle to concentration and communication. Additionally, noise can cause deafness and other effects to circulatory system (increased blood pressure, increased heart rate, peripheral vasoconstriction); respiratory system (change in respiratory rhythm); digestive tract (digestive disorders, burning, etc.); muscle apparatus (increased tension and fatigue); nervous system (disorders of memory, attention, reflexes, loss of intellectual faculties); metabolic disorders; psychological disorders (illness, displeasure, nervousness, aggression, etc.); and stress. Directive 2003/10/EC lays down the minimum health and safety requirements regarding the exposure of workers to noise. The methodology provided in ISO 9612: 2009 was followed for occupational noise monitoring.

Other risk assessment that should be analysed is related to vibrations. The human body is constantly exposed to mechanical vibration in all sectors of activity, with greater or lesser disruption to the well-being, safety and health of the most exposed workers. The vibrations that occur in the workplace can be divided into whole-body vibration (particularly low back pain and spinal injuries) and vibrations transmitted to the hand-arm system (vascular, neurological or muscular disorders or osteoarticular injuries). Directive 2002/44/EC defines the minimum requirements for the protection of workers' health and safety in case of exposure to risks due to vibration. As noise, most of vibrations in the agrifood industries come from equipment and machines.

The environmental conditions (air temperature, humidity and velocity) to which the worker is subjected during his work activity will influence the biological operation of the workers' body. Environmental conditions outside thermal comfort conditions will affect the worker capabilities and health, thus these conditions should also be assessed.

Although most of the companies in these subsectors have OSH services organized, only 60% of the companies carried out risk assessments as shown detailed in [Table 3](#) for noise, illumination, thermal environment, vibrations and chemical agents risk assessments. As far as occupational noise risk assessment is concerned, only 37% of the companies in the 4 subsectors carried out this type of studies, and according to the project measurements, it was found that in all

subsectors there are jobs with noise levels which exceed 87 dB(A), which corresponds to the daily personal exposure limit value. In the case of the thermal environment, only 5% of the companies analyzed in the totality evaluated this parameter. The vibrations assessment is also very neglected by the companies, since only 3% of the companies carried out assessments.

Table 3. Audited companies with specific risk assessment

Risk Assessments		Yes	No
Percentage of answers	Dairy	62%	38%
	Meat	80%	20%
	Bakery	71%	29%
	Horticultural	17%	83%
Noise	Dairy	0%	100%
	Meat	13%	87%
	Bakery	6%	94%
	Horticultural	8%	92%
Illumination	Dairy	31%	69%
	Meat	53%	47%
	Bakery	35%	65%
	Horticultural	25%	75%
Thermal environment	Dairy	0%	100%
	Meat	20%	80%
	Bakery	24%	76%
	Horticultural	8%	82%
Vibrations	Dairy	0%	100%
	Meat	0%	100%
	Bakery	18%	82%
	Horticultural	0%	100%
Chemical agents	Dairy	0%	100%
	Meat	0%	100%
	Bakery	12%	82%
	Horticultural	0%	100%

3.3. Health and safety signs

Health and safety signs are mainly intended to alert and advise in advance workers to certain hazards that they may be exposed or to condition certain behaviors.

Table 4. Audited companies with signaled security routes

Signalization of circulation routes	Yes	No	
Is there health and safety signs?	Dairy	87%	13%
	Meat	100%	0%
	Bakery	100%	0%
	Horticultural	58%	42%
Are the health and safety signs adequate and enough?	Dairy	75%	25%
	Meat	80%	20%
	Bakery	59%	41%
	Horticultural	50%	50%
Are the signs clear and visible?	Dairy	87%	13%
	Meat	87%	13%
	Bakery	76%	24%
	Horticultural	50%	50%
Are the signs luminescent?	Dairy	87%	13%
	Meat	87%	13%
	Bakery	76%	24%
	Horticultural	50%	50%
Are there sign posted traffic lanes?	Dairy	19%	81%
	Meat	13%	87%
	Bakery	6%	94%
	Horticultural	17%	83%
When there are signs of circulation, are they appropriate in color?	Dairy	0%	100%
	Meat	7%	93%
	Bakery	0%	100%
	Horticultural	0%	100%

Safety and health signs should be used whenever there is a need to draw workers' attention to the existence of certain risks, prohibitions or obligations. It also alerts workers when there is a particular emergency situation that needs urgent protection or evacuation measures.

The signaling of circulation routes, which is an important factor to prevent accidents, is not

considered an important factor by companies. As shown in Table 4, only in 13% of companies in all subsectors there are circulation routes signaled, emphasizing that only 2% of these companies painted the circulation routes of the appropriate color, that is, yellow or white.

3.4. Emergency

One of the factors that can endanger a company is the occurrence of emergency situations such as fires and explosions. Emergency situations, in addition to causing material loss, can also endanger lives. To avoid or minimize these losses, companies should identify potential emergency situations that may occur on their premises (fire, explosion, spills, floods, etc.), and then suit themselves in terms of human and material support to deal with these emergency situations, that is, companies must define and implement self-protection measures appropriate to the reality of their companies.

The existing emergency equipment and were analyzed in each of the companies for the different subsectors analyzed. Table 5 shows a detailed description of the emergency prevention, preparedness and response in the audited companies. Most of the companies comply with emergency and evacuation regulations.

Table 5. Emergency prevention, preparedness and response in the audited companies

Emergency		Yes	No
Are there emergency signs?	Dairy	94%	6%
	Meat	80%	20%
	Bakery	76%	24%
	Horticultural	75%	25%
Is there any fighting fire equipment?	Dairy	100%	0%
	Meat	93%	7%
	Bakery	100%	0%
	Horticultural	83%	17%
Are there enough fighting fire equipment?	Dairy	94%	6%
	Meat	87%	13%
	Bakery	82%	18%
	Horticultural	75%	25%
Are there emergency exits?	Dairy	100%	0%
	Meat	93%	7%
	Bakery	82%	18%
	Horticultural	67%	33%
Are the existing emergency exits sufficient?	Dairy	94%	6%
	Meat	80%	20%
	Bakery	82%	18%
	Horticultural	67%	33%
Are emergency exits flagged?	Dairy	87%	13%
	Meat	73%	27%
	Bakery	76%	24%
	Horticultural	50%	50%
Are the emergency exits unobstructed?	Dairy	81%	19%
	Meat	87%	13%
	Bakery	82%	18%
	Horticultural	58%	42%
Is there any first aid equipment?	Dairy	100%	0%
	Meat	87%	13%
	Bakery	94%	6%
	Horticultural	100%	0%
Are the first aid equipment appropriate and have instructions?	Dairy	87%	13%
	Meat	87%	13%
	Bakery	59%	41%
	Horticultural	75%	25%

3.5. General Ventilation

The workplace environment must have good air quality. To help maintain air quality, its renewal should be sufficient. Companies should use artificial ventilation whenever natural ventilation is not enough, or when technical working conditions require it. The average fresh and fresh air flow shall be 30 to 50 m³/h per worker and hazardous or disruptive air drafts should be avoided. Artificial ventilation can be divided into general ventilation and localized ventilation. The results of the measurements related to general ventilation are presented in this section. None of the agrifood companies audited required localized ventilation, as no chemical or hazardous biological agents were airborne.

In each of the different subsectors, the values of air temperature, air humidity and air velocity levels were monitored at the workplaces. The results related to the general ventilation values are shown in Table 6. Like in the previous assessment, the overall general ventilation values are acceptable.

Table 6. General ventilation analysis of the audited companies

Illumination		Yes	No
The workplace has not air circulation?	Dairy	6%	94%
	Meat	7%	93%
	Bakery	24%	76%
	Horticultural	8%	92%
Does the work environment have many drafts?	Dairy	13%	87%
	Meat	0%	100%
	Bakery	0%	100%
	Horticultural	25%	75%

3.6. Illumination

Inadequate illumination in the workplace is a major risk factor as 80% of human stimuli are visual. To perform any work activity there should be a recommended value of illumination levels in order to eliminate manufacturing defects and prevent work accidents. Thus, workplaces illumination must be appropriate to the visual requirements of the tasks to be performed. Illumination level values depend on the several factors that go from the size of the details, distance to the object, to the age of the worker. Thus, greater the difficulty for visual perception, greater the required illumination level. Given the light source, it can be divided into natural or artificial illumination. Artificial lighting can be further subdivided into: (1) general lighting; (2) spot lighting; (3) Mixed lighting; (4) Combined lighting; and (5) Special lighting (emergency, signage, decorative, etc.). This section surveys the levels and characteristics of the illumination of the audited companies. The methodology set out in ISO 8995:2002 was used for the illumination monitoring.

Table 7. Compliance of lighting with OSH for the audited companies

Illumination		Yes	No
Is general lighting adequate?	Dairy	100%	0%
	Meat	87%	13%
	Bakery	82%	18%
	Horticultural	83%	17%
Are there any fused light bulbs?	Dairy	13%	87%
	Meat	13%	87%
	Bakery	0%	100%
	Horticultural	0%	100%
Are there shaded areas?	Dairy	69%	31%
	Meat	60%	40%
	Bakery	53%	47%
	Horticultural	67%	33%
Is there natural light?	Dairy	100%	0%
	Meat	53%	47%
	Bakery	53%	47%
	Horticultural	100%	0%

Table 7 provides further details concerning the analysis of the compliance of lighting with OSH. 63% of companies in the various sub-sectors companies have not carried out any study of lighting levels in their companies. Thus, it is not surprising that most companies have illuminance levels below the recommended values. In addition, the lighting factor is not considered a primary factor by companies, as 7% of companies in the various sub-sectors have fused lamps and 62% of companies have shadow areas in the workplace. This condition should be considered by the companies one of the main risks. Low lighting levels can lead to work accidents, increases workers visual fatigue and manufacturing defects, which in this case may give rise to non-compliant food products or with labelling mistakes.

3.7. Manual handling of loads

Manual handling of loads (MHL) involves all lifting, transporting and placing operations at the new location. In the agrifood industry it is very usual, given the type of activities, to be manual handling of loads in various operations, such as sausage carts, meat, bread, cheese, etc., from

the reception of raw materials to dispatch and delivery to the end customer. In the subsectors analyzed, as they still are labor intensive, there are some complementary systems to ease the tasks and at the same time to minimize the consequences of manual handling of loads.

Manual handling operations, if not performed correctly or if the load is too heavy, can cause back injuries. In addition, when the load is too large, it may prevent proper viewing of the movement path and may cause falls of the object being moved and/or the person performing the same movement.

Regarding the MHL, the result analysis shown in Table 8 indicates that there is in all the analyzed companies a high risk related to the manual transport/lifting of loads (82%) and repetitive movements of the hands and/or arms (68%).

Table 8. Risks related to the Manual handling of loads in the audited companies

Manual handling of loads		Yes	No
Tasks involving manual transport/lifting of loads?	Dairy	81%	19%
	Meat	93%	7%
	Bakery	82%	18%
	Horticultural	69%	31%
Tasks with repetitive movements of the hands and/or arms?	Dairy	56%	44%
	Meat	56%	44%
	Bakery	53%	41%
	Horticultural	54%	46%

3.8. Complementary risks

The following aspects were considered as complementary risks with significant importance in the agrifood industry:

- All chemicals pose risks to the health and physical integrity of workers as well as to the environment. The analysis of the safety data sheets is essential to know the risks of the chemicals used and to adopt possible preventive measures.
- The danger of inhaling some chemical contaminants, whether in solid-state (dust, fibers and fumes), liquid (fog and aerosols) or in the gaseous state (vapors and gases), has been set as a major OSH risk. The main route of chemical contaminants in the human body is via the airway, however they can also enter our body via the dermal, digestive or parenteral routes.
- Biological organisms such as viruses, bacteria, fungi, exist everywhere. However, under certain conditions of temperature, humidity, these organisms can endanger the health and well-being of workers.
- Work machinery and equipment must operate without causing injury or damage to the health of workers. Thus, it must comply with a broad set of rules/measures and legal and normative requirements.
- The mechanical risks more significant in the agrifood industry are falls, pinches, shock with objects and perforations. Any of these risks can lead to work accidents and damage to work equipment. Height falls can occur whenever a work platform such as stairs, does not have guard rails and/or handrails. Most falls at the same level involve slippery or damaged pavement, that is usual in the agrifood industry.
- Cuts, perforations, and pinches are the most frequently occurring accidents and are usually on the hands and fingers. These accidents usually involve the handling of sharp objects (such as knives) and the use of machinery and equipment. Improper use of some machines and equipment or lack of protection on these machines can lead to more serious work accidents involving loss of body members (fingers, hands, arms, etc.).

Table 9 indicates the most relevant complementary risks per subsector. The possibility of falls at the same level occurrence, due to the existence of slippery or inadequate floor, was detected in 82% of the companies under study. Another risk that occurs in most companies of the various subsectors analyzed is of the occurrence of thermal burns (77%). Regarding the risks associated with machinery and equipment, 88% of the companies in all subsectors presented this risk, which may entail risks to the physical integrity of workers. The risk of entrapment, shocks with objects, cuts or perforations was observed in 92% of companies.

Table 9. Complementary risks in the audited companies

Complementary risks		Yes	No
Risks associated with falls in height?	Dairy	44%	56%
	Meat	40%	60%
	Bakery	29%	71%
	Horticultural	25%	75%
Risks associated with falls at the same level?	Dairy	100%	0%
	Meat	87%	13%
	Bakery	82%	18%
	Horticultural	50%	50%
Risks associated with radiation?	Dairy	0%	100%
	Meat	0%	100%
	Bakery	0%	100%
	Horticultural	0%	100%
Other mechanical hazards?	Dairy	88%	12%
	Meat	100%	0%
	Bakery	94%	6%
	Horticultural	83%	17%
Risks associated with fires?	Dairy	38%	62%
	Meat	47%	53%
	Bakery	88%	12%
	Horticultural	58%	42%
Risks associated with falling objects?	Dairy	88%	12%
	Meat	100%	0%
	Bakery	94%	6%
	Horticultural	58%	42%
Risks associated with exposure to chemical agents?	Dairy	0%	100%
	Meat	13%	87%
	Bakery	24%	76%
	Horticultural	17%	83%
Risks associated with exposure to the use of chemicals?	Dairy	13%	87%
	Meat	20%	80%
	Bakery	12%	88%
	Horticultural	25%	75%
Biological risks?	Dairy	19%	81%
	Meat	27%	73%
	Bakery	6%	94%
	Horticultural	17%	83%
Psychosocial risks?	Dairy	6%	94%
	Meat	20%	80%
	Bakery	35%	65%
	Horticultural	17%	83%
Ergonomic and posture risks?	Dairy	94%	6%
	Meat	93%	7%
	Bakery	100%	0%
	Horticultural	75%	25%
Risks associated with burns?	Dairy	63%	37%
	Meat	67%	33%
	Bakery	100%	0%
	Horticultural	58%	42%
Risks associated with machines and equipment?	Dairy	88%	12%
	Meat	100%	0%
	Bakery	88%	12%
	Horticultural	67%	33%

The risk of fall of objects that can hit and injure workers was identified in 79% of companies. Finally, another risk found in most of the companies studied is due to inadequate and poorly ergonomic postures. These situations were observed in 93% of companies.

3.9. Concluding remarks

Focusing on the four subsectors studied, it is concluded that the subsector of horticultural products is the most problematic subsector with high percentages in most of the analyzed parameters. Besides the risks common to all other subsectors of activities, it presents some others that require special attention, for example, in only 58% of companies there are OSH services organized. In relation to the regions covered by the project, it is complex and difficult to identify the most affected region of intervention, even in each subsector.

Carrying out risk assessments, tests and measurements procedures during the activities to characterize and analyze the OSH conditions it is still possible through a great progression

margin to guarantee the workers' safety and health. As shown in Table 10, the most relevant risks in the four subsectors analyzed are the lack of risk assessments per workstation, specifically, noise level, thermal environment and vibrations. Secondly, the health and safety signs, since most of the circulation routes were not signaled and in the cases that they were in majority of them the color was not appropriate. Thirdly, the illumination with the existence of areas with shadows. Finally, in relation to the existence of complementary risks, such as the ones associated with falls, thermal burns, machinery and equipment, mechanical hazards, falling objects and ergonomic risks and incorrect body postures. It is also concluded that among the four subsectors studied, the subsector of horticultural products is the most problematic subsector, since it has presented high percentages in most of the parameters analyzed, and besides the risks common to all other subsectors of activities, have presented some other ones that require their due attention.

Table 10. Most relevant OSH risks in the audited companies

Order	Most relevant risks
1	Lack of risk assessments
2	Security signaling
3	Illumination
4	Complementary risks

4. CONCLUSIONS

The conclusions of this study indicate that risks may be better managed in this group of companies, where good OSH conditions are associated with business success. The size of an enterprise limits its resources, its financial capacity and its technical means to analyze risks and to adopt preventive practices, however, prevention is essential for a healthy workplace in every company, regardless its category or size. Then, it is a priority to carry out periodic risks assessments either to identify hazards, to implement measures to eliminate or reduce them, in order to protect the workers properly.

A well-implemented OSH service guarantees the reduction of accidents, occupational diseases, absenteeism and consequently improves the quality of work, resulting in an increase in productivity and greater competitiveness of the company. But however important an OSH program may be, and the better the tools it provides for the diagnosis and resolution of work risks, if there is no willingness, participation and commitment of all involved in these actions, especially employers and workers, the results will be limited, both qualitatively and quantitatively. Work in the industry requires concentration and a sense of responsibility. The worker must possess the technical, physical and psychological skills necessary to comply with safety standards and adopt a preventive approach in order to avoid work-related accidents and future work-related illnesses. These capabilities should be part of the measures proposed in the information and training programs for OSH promotion, sensitizing workers to the risks they are exposed in order to increase their awareness of them.

One of the key elements of success is how stakeholders, from employers and workers to government agencies, approach this thematic. Creating a new policy framework will help SMEs to grow, reducing the bureaucratic process to avoid the discouragement associated with the predictability of rising costs; facilitating access to finance; improving access to third-country markets; supporting the acquisition of skills and encouraging investment in innovation. In order to protect workers, where health and safety interventions can affect productivity and profits, these can be some of the ways to level the field of professional action to ensure that all businesses operate in a similar and safe way for workers and consumers.

There are still opportunities for a more detailed investigation, provided by the greater sample of companies in each subsector, as well as the measurements in all workstations, reflecting a deeper comparative analysis, with stricter quantitative data with international benchmarking. It would be advantageous to include also ergonomics and psychosocial risk evaluations.

Given the increasing importance of OSH related topics, the increasing scope of the agrifood industry and its companies' dimension, i.e., micro and SMEs, there is still long research ahead to improve the management and prevention of work accidents.

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