From perception to risk assessment in the food industry: creation and administration to workers of surveys relating to risk perception and comparison between perceived risk, assessed risk and INAIL accident data

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Abstract

The development of legislation, technological progress and the activities of the supervisory authorities are necessary but not sufficient instruments to combat accidents. In fact, in the following study, analysis accidents in a food industry, INAIL accident data and data collected by developing a simple questionnaire, it has been observed that it is necessary to act also on the perception of the risk in order to reach an ulterior and meaningful reduction of accidents.

INTRODUCTION

In Italy, the focus on safety at work has grown steadily over the years, however despite technical and regulatory progress, Data on accidents at work are still high and stable above 500,000 reported accidents per year (564,089 in 2021; 697,733 in 2022; 210,234 in the first five months of 2023), of which over 1000 fatalities (1,361 in 2021; 1,090 in 2022 and 232 in the first five months of 2023), which equates to about 13 million days of absolute temporary disability, with a "direct" economic impact on the country that is close to 3% of GDP and the European Agency for Safety at Work EU-OSHA in the past estimated the impact on our country in about 45 billion euros. In order to reduce the scale of the problem, therefore, continuous research on the prevention of occupational accidents is necessary, both from a purely technical-engineering point of view (with investigations at the level of instrument design) but also from an ergonomic point of view (research on the compatibility of human beings, machinery and the environment), medical (studies on the prevention and treatment of damage caused by occupational accidents and diseases) and, above all, the impact of the so-called human factor in the production of the harmful event should be analysed, where by human factor, it must be understood the set of psychophysical components that influence the behaviour of man in different working circumstances. Therefore, this aspect is the basis of this work, and particularly the understanding of the role of risk perception in determining the trend of accidents in the food sector, which is almost constant in the five-year period 2017-2021 (11,406 in 2017; 11,823 in 2018, 12,000 in 2019; 10,539 in 2020; 11,107 in 2021).

MATERIALS AND METHODS

The work was carried out taking as the object of study a confectionery industry of about 150 employees, with different locations, engaged in the production and wholesale and retail of croissants and frozen baked goods, in different flavors and formats.

In particular, the study was carried out at a site employing about 90 employees, the initial phase of which was analysed the company's organisation, with particular reference to the departments and their activities, which are shown in Table 1.

Department	Activity carried out
Offices	*Coordination, management and administration activities*
Kneading room	*Dough preparation*
Deposits	*Management of raw materials*
Production lines	*Product processing (2 active lines)*
Packaging	*Control and packaging of finished products*
Cold rooms	*Finisched products warehouse and logistics management*
Means of transport	*Driver*
Repair workshop	*Maintainer*

Table 1 – *Business organization*

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In addition, the following homogeneous groups of workers we identified:

- Production workers
- Cold storage workers
- Packaging staff
- Storekeeper
- Maintainer
- Driver
- Technical staff
- Office staff
- Cleaners

Then downstream of the analysis of the organizational context of the company and the accidents occurred was developed a questionnaire to bring out information on the workers' interest in occupational safety and on the perception of the associated risk to behaviour that actually caused an accident, and the perception of other major risks in the food industry. This questionnaire, shown in Table 2, consists of 14 questions, which were deliberately structured in a very simple way, in order to overcome language barriers and thus to allow greater understanding and has been administered anonymously by computer to all homogeneous groups of workers mentioned above, with the exception of drivers, technical and office employees.

Table 2 – *Questionnaire*

1	**Age**
2	**Gender**
	Male *Female*
3	**Education**
	Elementary (primary) *Junior high* *High school* *University*
4	**How long have you been in the food industry?**
	Less than 1 year *From 1 to 3 years* *From 3 to 5 years* *From 5 to 10 years* *More than 10 years*
5	**How important for your health and safety do you think knowledge of the correct working procedures is?**
	1 – *little* 2 – *enaugh* 3 – *very*
6	**For your health and safety how important do you think the knowledge of the laws for the prevention of accidents and occupational diseases?**
	1 - *little* 2 - *enaugh* 3 - *very*
7	**How long has it been since you last took a course training in occupational health and safety?**
	Less than 1 year
	From 1 to 3 years
	From 3 to 5 years
	More than 5 years
	I never participated
8	**Working in the food industry have you had occupational accidents?**
	Yes, only one
	No
	More than one

Continues…

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8	**Working in the food industry have you had occupational accidents?**
	Yes, only one *No* *More than one*
9	**Do you think it's normal for a food industry worker to have accidents at work?**
	Yes *No*
10	**Attribute a value to the risk associated with the following behavior: The mixer is equipped with two workers winches (arms) that cross in the terminal part, work the dough. During processing notice the presence of a foreign body and with the machine running circles to remove it, disassembling the grid on the machine and using a pallet**
	1 - *low* 2 - *middle* 3 - *high*
11	**How do you judge the risk of cutting yourself while using knives, blades or other tools?**
	1 - *high* 2 - *moderate* 3 - *low* 4 - *negligible*
12	**The use of knives, blades and cutting tools presents obvious risks, do you think you can avoid them?**
	Yes *No*
13	**The risk of tripping or slipping while you are working, consider it**
	1 - *high* 2 - *moderate* 3 - *low* 4 - *negligible*
14	**How important do you think the personal protective equipment provided for the work you do?**
	1 - *little* 2 - *enaugh* 3 - *very*

RESULTS

Analysis of INAIL data relating to accidents occurring in the food sector

The results reported in a document of the National Institute for Insurance against Occupational Accidents, which deepens the accident dynamics and risk factors in the food industry, were examined on the basis of 168 fatal and serious accidents which occurred in the period 2002-2020, selected from the database of the national surveillance system for fatal and serious accidents Infor.MO. In particular, it emerged that:

- among the characteristics of the injured, the share of female workers stand out;
- 309 risk factors were identified, first of all procedural aspects, which could be summarised in incorrect operational sequences.
- production environments are the place where accidents mainly occur (74.4%), followed by areas dedicated to the storage and loading and unloading of goods (15%);
- the most common lesions are amputations, followed by crushing and fractures.
- the contact with moving working organs, is between the three primary modes of occurrence, together with the unexpected/inappropriate start-up of vehicles, machines or equipment and the escape/contact with gases, fumes, aerosols, and liquids. According to the document the contact with moving working parts essentially involves machines such as kneaders, crushers, baggers, while the unexpected or inappropriate start-up mainly concerns presses, mills, packaging and handling plants. In addition, another publication on the trend of accidents at work and occupational diseases in June 2023 was also considered, in which INAIL reports that in the five-year period 2017-20172021, the number of complaints of occupational accidents in the food industry is 11,406 in 2017; 11,823 in 2018, 12,000 in 2019; 10,539 in 2020; 11,107 in 2021. In particular, it specifies that in 2021, the sectors in which several complaints were registered are those of meat processing (3,249), bakery production (2,749) and dairy industry (2,121), which together comprise 73% of the cases. Moreover,

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this publication tells us that the injured are mainly men (two out of three), who are also the dominant gender among victims at work, in fact more than nine out of ten cases are men and over 30% of such deaths were caused by falling from a height or from stumbling/slipping. However, it points out that within the compartments there are clear gender differences, in fact for the female component, it is the production of bakery products and the dairy industry that have registered a considerable number of complaints. For men, it is the processing of meat that is most affected by accidents.

Analysis of accidents that occurred in the company under study

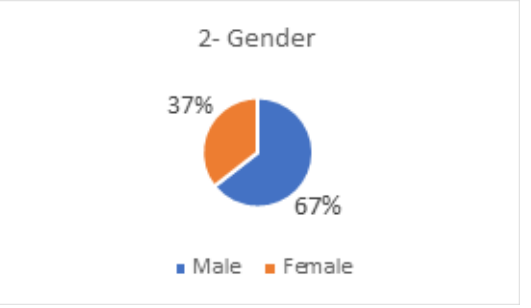
Among the accidents that occurred within the company under study during the current year, three accidents were analysed:

- The first accident analysed was caused by the improper use of a forklift. In particular, a worker persuaded a colleague of his to be lifted with such equipment to pour packaging into a caisson, instead of using the ladder that was located nearby. Once this operation was carried out, in the descent phase, in order to hold more firmly or following a slight loss of balance, the employee who had climbed on the forks of the trolley placed his hand in one of the moving gears of the trolley, causing a lacerative wound. The analysis of the causes concluded that the event was caused by the misuse of the forklift, which is not suitable equipment to carry out work above the normal work plan, being a mechanical means used exclusively for the handling of goods placed on pallets.
- The second accident analysed was caused by the improper use of a pallet truck. In particular, a worker while cleaning the part counter machine, to reach the highest part of that machine, preferred to use a pallet truck as a step, instead of the ladder that was present, functional and available in the department, probably because it was closer to the place of work and when moving on such equipment, it caused its horizontal displacement which in turn caused the loss of balance and the fall of the worker. The analysis of the causes has evidenced that the accident has happened for the improper use of the transpallet, which does not constitute suitable equipment to carry out raised intense activities regarding the normal worktop, being a means used for the handling of the cargos.
- The third accident analysed concerns an employee who was regularly trained in occupational safety and who suffered a finger injury while demonstrating to a customer at a trade fair. The analysis of the causes concluded that the event was caused by the non-use of the accident prevention glove, which had been regularly supplied to the worker but which the worker did not use because he felt it was not very inviting for the public to see him use it, preferring a simple latex glove.

Analysis of data collected through the questionnaire

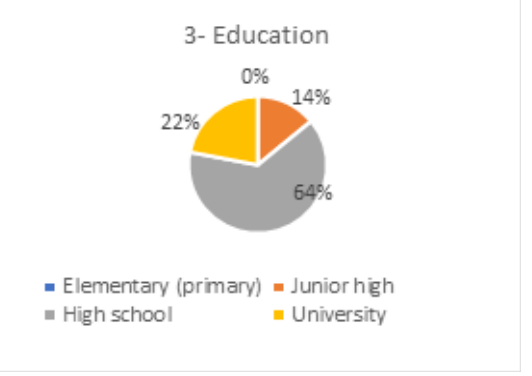
As regards the questionnaire, the number of participants was 53 and it appeared that:

1. The average age of participants was 43.
2. Our "type" worker was male, in fact 63% are men and 37% are women.



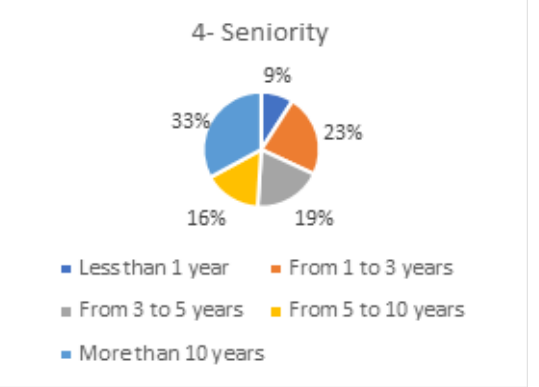
Graphic n.1

3. Most of the participants have a level of education "middle high" in fact, 14% said they have a level of secondary education of first degree, 64% said they had a secondary education level and 22% said they had a university education level.



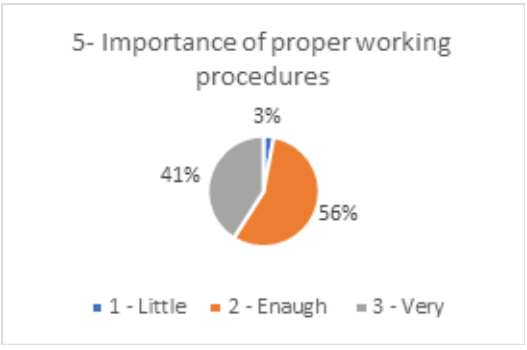
Graphic n.2

4. Most of the participants have been working in the food industry for more than 10 years (33%).



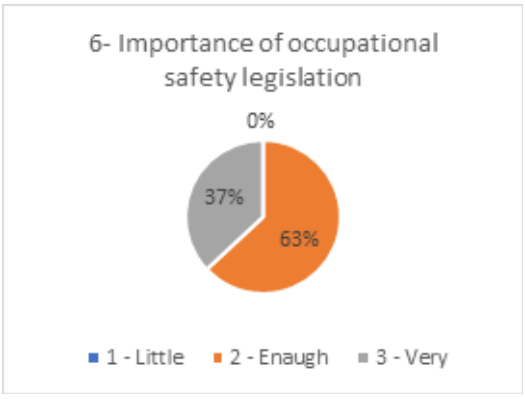
Graphic n.3

5. Most of the participants (56%) considered "quite important" the knowledge of the correct working procedures for their health and safety.



Graphic n.4

6. 6. The majority of participants considered "quite important" knowledge of legislation for the prevention of occupational accidents and diseases (63%), for their health and safety.

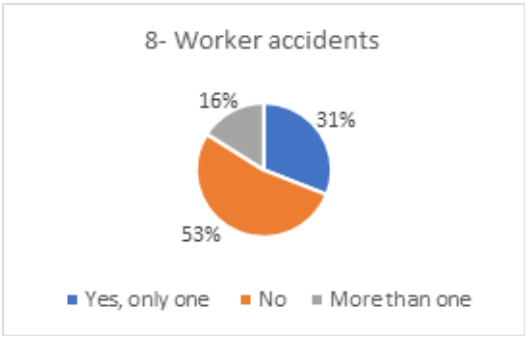


Graphic n.5

7. 7. Most of the workers (36%) said they had been trained in occupational health and safety for less than 1 year and none of the 53 participants said they had not been trained.

Graphic n.6

8. 53% of participants have never been injured, 31% have been injured only once, of which most are female, while 16% have been injured more than once, of which most are male.

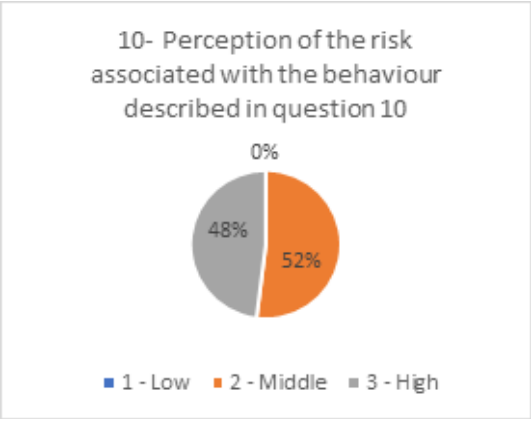


Graphic n.7

9. 97% of the participants think that "it is not normal" that a worker in the food industry has accidents at work.

Graphic n.8

10. 52% consider the behavior described in question 10 as "medium risk".



Graphic n.8

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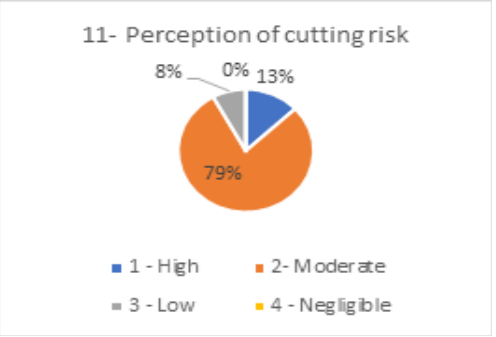
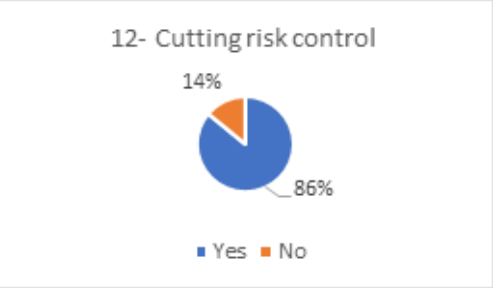
11. 79% of the participants consider the risk of cutting themselves while using knives, blades or other tools, as "moderate" and none of them considers this risk "negligible".



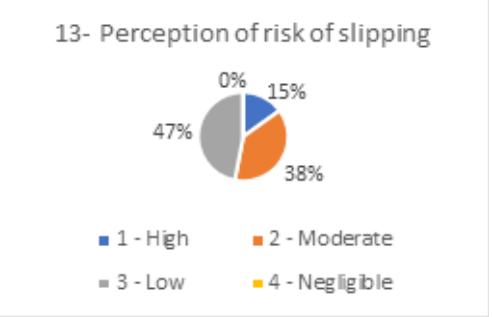
Graphic n.10

12. 86% of participants believe they can avoid the risks associated with the use of knives, blades and cutting tools.



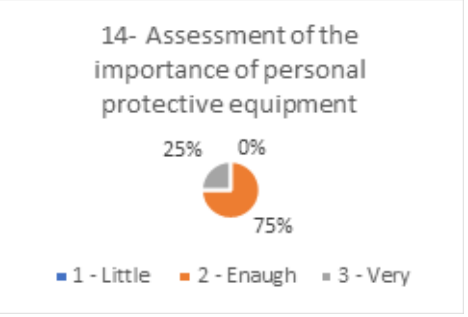
Graphic n.11

13. 47% consider the risk of stumbling or slipping while working as "low" and of these, most are male.



Graphic n.12

14. 75% of the participants consider the personal protective equipment provided for his job very important.



Graphic n.12

DISCUSSION

The accidents analysed are all cases where the adverse event was caused by human error, in fact starting from the last accident analysed, it can be considered that this event resulted from the fact that the worker did not use the appropriate glove for the operation he was about to carry out, has underestimated the risk associated with this operation and it is likely that the two previous accidents also resulted from a misperception of the risk associated with the misuse of the equipment mentioned above.

Taking then into consideration the risks related to accidents occurred in the company under study, and comparing the data emerged from the questionnaire, INAIL data and risk evaluated by the "experts", we observe, regarding the risk of falling/ slipping, that:

- the data provided by INAIL show that more than 30% of deaths at work in this sector were caused by falling from a height or stumbling/ slipping,
- the questionnaire showed that 47% of workers consider the risk of stumbling, falling, or slipping while working as "low",
- this disagrees with the assessment in the risk assessment document, where it is considered "moderate" for the possible fall of flour and jams during production.

It is therefore possible to assume that there is a problem of wrong perception of the risk that leads to underestimate the consequences that an incorrect behavior could have.

Regarding the risk of cutting, we note that:

- 79% consider the risk of cutting themselves while using knives, blades, or other tools as "moderate", according to the assessment in the Company's Risk Assessment Document,
- most of them believe they can avoid such risks,
- data provided by INAIL show that hand and arm injuries, from simple micro-cuts to much more severe injuries, are among the most common in the food industry.

Therefore, here again it can be inferred that the basis of the problem lies in the human factor. In this regard, it is also noted that workers perceive better the risks more "frequent" but with low impact as precisely the risk cut, that the risks less frequent but more impacting as the risk fall/ slip mentioned above.

Finally, considering:

- INAIL data
- the data collected with question 10 which was formulated on the basis of an accident that actually occurred and taken from the INFOR.MO sheets, which involves a worker assigned to the kneading machine, who noticed, during processing, the presence of a foreign body and with the machine running he tried to remove it, dismantling the grill present on the machine and using a shovel, which was taken in contrast at the point where the two working parts of the machine intersect and with the backlash he dragged his hand causing it to

be amputated.
We observe that:
- from the analysis of INAIL data it emerges that contact with workers is one of the primary ways in which accidents occur.
- from the questionnaire it emerged that many participants (52%) associated a "medium risk" with a behaviour that we can objectively consider very risky, that is removing a foreign body from the mixer by dismantling the fixed grid on the machine.

Therefore one can think that there is probably a problem of risk perception, since, following a situation of this type, if an accident had occurred, the cause would have been attributed to incorrect behavior of the worker, given that the machine it was equipped with the required safety requirement such as the fixed safety grille, the removal of which does not cause the machine to block.

CONCLUSION

This work has made it possible to obtain further confirmation of the importance of the human factor in the prevention of accidents at work, as often the harmful event is the possible consequence of dangerous behavior implemented following a incorrect perception of risk.
In particular, from the INAIL data it emerges that over the years there has been a significant but still insufficient reduction in accidents, which is certainly attributable to the regulatory system in force in Italy, in which the prevention discipline is one of the most advanced in the world and provides for continuous strengthening of the control activity, which has seen the figure of the Prevention Technician belonging to the Prevention Departments of the Local Health Authorities engaged for decades, and in light of the latest updates also the staff of the Territorial Labor Inspectorate. Furthermore, another aspect to consider in the reasons for this decrease is represented by technological evolution, which continues to make increasingly "high-performance" equipment available to employers in the field of accident prevention, which they have purchased over the years, also thanks to state incentives, in order to comply with the obligation of "maximum technologically feasible safety" enshrined in the art. 2087 of the Civil Code. In fact, this article provides that "The entrepreneur is required to adopt in carrying out the business the measures which, according to the particularity of the work, experience and technique, are necessary to protect the physical safety and personality of the providers of work".
Therefore in this context it must be considered that compliance with current legislation on safety at work and the use of new and safe work equipment, in compliance with the instructions in the use and maintenance manual and by trained personnel, will not allow never a further reduction in the number of accidents if we do not act on the human factor and on the perception of risks, as a starting point for achieving a true Culture of Safety. Therefore, the need emerges to delve deeper into the issue of risk perception by workers through further studies, also with a view to creating systems and procedures that can protect workers from their own incorrect behaviour, to try to make the risk truly close to zero. that work, from being a tool for achieving a free and dignified life, turns into an opportunity for death and suffering.

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