Topic 4

“Safety Health and Welfare in Building”

Oral Presentation

Risk factors in the wine industry

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Abstract
According to available statistics, the wine production process has risks of limited importance and sporadic case in terms of the safety of employees. However, some stages of processing (possible development of abnormal fermentations with methanol, the presence of pesticides, excess of sulfur dioxide, etc..) may represent a potential danger for both the consumer and the workers. Similarly, but with greater frequency and dangerousness, building materials, structures and above all the machines and equipment used in the cellar, are important critical points in terms of safety of workers employed. This paper analyzes the potential risks for health of workers in wineries and possible impairments of product's safety and proposes targeted interventions that, preserving the efficiency of the production cycle, worth to eliminate or reduce the potential dangers associated with building structures and machines.

Keywords: safety, health, buildings, machinery

INTRODUCTION

The winery, compared to other food industries, appears more "quiet" from the standpoint of safety and wholesomeness of the product for the absence, except for certain critical phases, of macroscopic elements of danger. Indeed, although numerous studies have highlighted the influence of plant and buildings on hazards to the health of workers, these continue to be undervalued. The Consolidated Security D.Lgs.81/2008 and D.Lgs 155/97 regarding safety of products, represented a turning point in the approach to the issues of prevention and self-monitoring of food hygiene.

METHODS

The study examines industry "cellar" in its various aspects (technology, plant engineering, construction) to identify potential hazards and then indicate the actions to eliminate or reduce the risks. To better achieve the objective of the work and for clarity, the workers' risks will be examined for first and will be classified according to the essential elements of the transformation cycle, and then the dangers associated arising from the application of HACCP standards on the wine .

IDENTIFICATION OF SOURCES OF RISK

The risk factors for injury in the cellar, limited to the processing plant, may be:

A) of a plant (presence of electrical equipment, use of machinery and equipment, risk of injury due to moving parts or bad anchoring the containers, exposure to noise, handling of heavy loads, plants producing steam, cryogenic plants, etc.)

B) of building and constructions in general (electrical system; wells grids, ladders, catwalks; slippery floors and surfaces; escape and emergency routes; warning signs.)

C) related to the processing cycle (the presence of CO_2 produced by fermentation, use of hazardous chemicals such as SO_2, aggressive detergents).

The various possible risk factors will be considered below, according to the classification above.

- ❖ Presence of Electrical Equipment

The risks associated with use of electrical equipment are particularly perceived by the operators, because they are aware of the danger of electric shock, burns and fire for possible overloads in an environment characterized by the presence of liquids, accidentally poured on the floor or water used for cleaning.

- ❖ The use of machines and plants.

In a cellar there are a great number of machines needed for the performance cycle. The main equipment which might cause problems related to workers' safety are the collection tank, the crusher and destemmer, bottle washers, the bottler, labeling and packing machines.

- ❖ Risk of injury

The grapes conferred is poured into a tank hopper, on the bottom of which there is an auger which transports the grapes to the crusher-destemmer. To avoid possible accidents, the tank must be provided with a protection grid. However, sometimes, for the drainage of the product accidentally locked by its own mass, this is irresponsibly removed to push it down manually. This operation is very dangerous and it would therefore be advisable to put a stop switch connected to the grid, so that if it is removed this would cause the immediate stop of the cochlea.
In the cycle of red winemaking, there are vertical tanks made of stainless steel or FRP, even taller than 5 m. placed directly on the floor, on a metal base or on suitable supporting legs. Regarding safety, given the considerable height reached, to avoid possible overturning these must be suitably anchored to the ground, fixing them possibly on the walls or with other tanks.
In order to reach the top of the tank, on which there will be a solid catwalk in steel grating equipped with side shields, starting from 2.50 meters high, they must be provided with a fixed scale with a circular protection.
The normal winery operations such as filtering, decanting, additions of correctives etc.. do not involve any particular problem, since the operator s work is done by connecting pipes between the containers and equipment used in the subsequent cycle. The bottle washing plant and the bottler employs hot water under pressure, thus constituting a major burn hazard to workers. However, on these machines the operator's intervention is limited to the loading of the bottles on the feeding belt. Labellers and packaging machines are fully automatic and can cause risks only if you don't follow the directions of the constructor. Emphasis should be put in place, however, during maintenance of machines: while verifying efficiency of the organs and movement mechanisms, special protections must be put in place.The best measures for such situations are represented, as well as a precise and timely information to those employees, by simple and clear signs pointing to the operator's attention on potential risks.

❖ Damage caused by noise

The winery is a work environment with a low noise level even though in some areas, the presence of several machines operating simultaneously (compressors, pumps, automatic systems), can generate higher levels of noise: high noise levels can cause serious hearing damage. Interventions to mitigate the hazards affecting the machines, providing acoustical isolation of the loud parts, and building structures through actions reflected on the propagation of noise through the adoption of sound-absorbing structures or coating the surfaces of the environment with sound-absorbing and sound insulating materials. Information to employees about the risks of noise combined with the allocation of the necessary individual protective equipment (headphones), will help to contain any damage.

❖ Handling of heavy loads

The handling of the grapes, of the pressed grapes and wine are made with the use of augers and wine pumps. Therefore, this risk can be considered negligible. However, the situation appears different in the bottling and marketing, where the movement of empty containers and especially of full ones, usually performed with the use of forklifts, represents a rather high source of risk,. These must be provided with a driving seat protected by a frame against the accidental fall of material from the top, a buzzer, a yellow and intermittent light and must be provided with locking devices of the load in case of failure during lifting, and / or during the descent phase of the load. Transport must be carried out with forks kept low and raising or lowering operations should be implemented at a standstill. In any manual handling of heavy loads, workers must put in practice all feasible precautions to avoid back injuries, most often dictated more by common sense than from a specific training.

❖ Installations for the production of steam, central refrigerating, etc..

In this group are included the technical equipments necessary to produce steam (for example necessary to sterilize the bottles) or the central refrigerating (to cool steel containers in some types of wine-making). These plants may be a potential danger for workers, in addition to the risks associated with the use of electric current, following the accidental release of steam or cryogenic liquids. Installations properly designed and constructed, and a correct utilization, would otherwise limit a lot of such dangers.

❖ Electric system

As in any industrial building, in cellars there are electrical systems to provide the energy needed to power the various machines and equipment and to illuminate the workplace. The risks are those already indicated above and concern the possible electric shock and burns of the employees and the risk of fire due to overloading. The main plants must comply with regulations on safety equipment and must provide for a proper design with the adoption of efficient earthing system, with sectioning of lines and with the use of conductors with a suitable section and differential thermal switches. The cellar for stored liquids and with presence of water is certainly a wet and damp workplace and therefore the electrical system must be achieved by adopting protected control panels and sockets.

❖ Presence of grills, pits, stairs, walkways

The need to remove from flooring the wash water or other liquids that may fall on them, requires the construction of a network of disposal wells and canals grills that may create the risk to stumble over protective structures and grids incorrectly reported. In the cellars the presence of areas of different level imposes the need to create connecting stairs and bridges provided with a rough surface and lateral and foothigh protection railings. It's still necessary that all of these structural elements are marked clearly with specific and coloured signaling.

- Floor surfaces and transit in general

To these structural elements are connected all the risks of tumbling of workers, also because liquids and slippery substances can accidentally accumulate on them. The use of floors with a rough surface represents the simplest solution as it decreases considerably the risk of dangerous falls. Even in this case the information is a key element to reduce the risk as well as the obligation to provide the workers with safety footwear with non-slip soles. The floors should be realized with slopes between 1,5 and 2% required for rapid drainage of excess.

- Escape routes and emergency exits

They are considered a source of danger if not properly located and sized. Must be kept clear, well marked and easily accessible with clear signal lights that will automatically light up in case of power failure. In detail the emergency exits must have a minimum height of 2 meters with doors equipped with panic bar, opening outward. Sliding doors and roller shutters are not allowed when there are no other doors that open outward.

- Warning and indication signs

To complete the picture on the prevention of possible accidents, a key role is played by warning and indication signs. Signposting is an instant communication tool to identify likely sources of danger and provide useful information relevant to their prevention. They must then be placed in a prominent position and given due consideration.

- Possible presence of CO2.

Carbon dioxide is an odourless gas, heavier than air, which occurs after alcoholic fermentation of must and, if not properly evacuated, may easily saturate the environment causing fatal injuries. To eliminate this risk the cellar must be provided with a good ventilation system that promotes air exchange in areas near the floor, checking often, both manually or automatically through the use of sensors, the presence of the gas. With regard to the workers engaged in inspection of tanks, they must be properly informed of the danger, and need to take some preventive measures such as the assistance of another worker during the inspection, using a harness and a respirator.

- Use of hazardous chemicals

Sulphur dioxide is currently the only antiseptic allowed by law in the wine industry for fermentation control. It's a gas contained in sealed cylinders and therefore quite safe, characterized by a pungent odor and irritating to the respiratory tract. For this reason, an accidental escape of this gas in large quantities, for example for accidental breaking of the hat of the cylinder, can be a matter of serious accidents. Only an incorrect use can lead to asphyxiation and, in severe cases, to explosion. A further element of risk comes from the soda used during washing of pipelines and equipment, as well as the chemical preparations used in the laboratory.

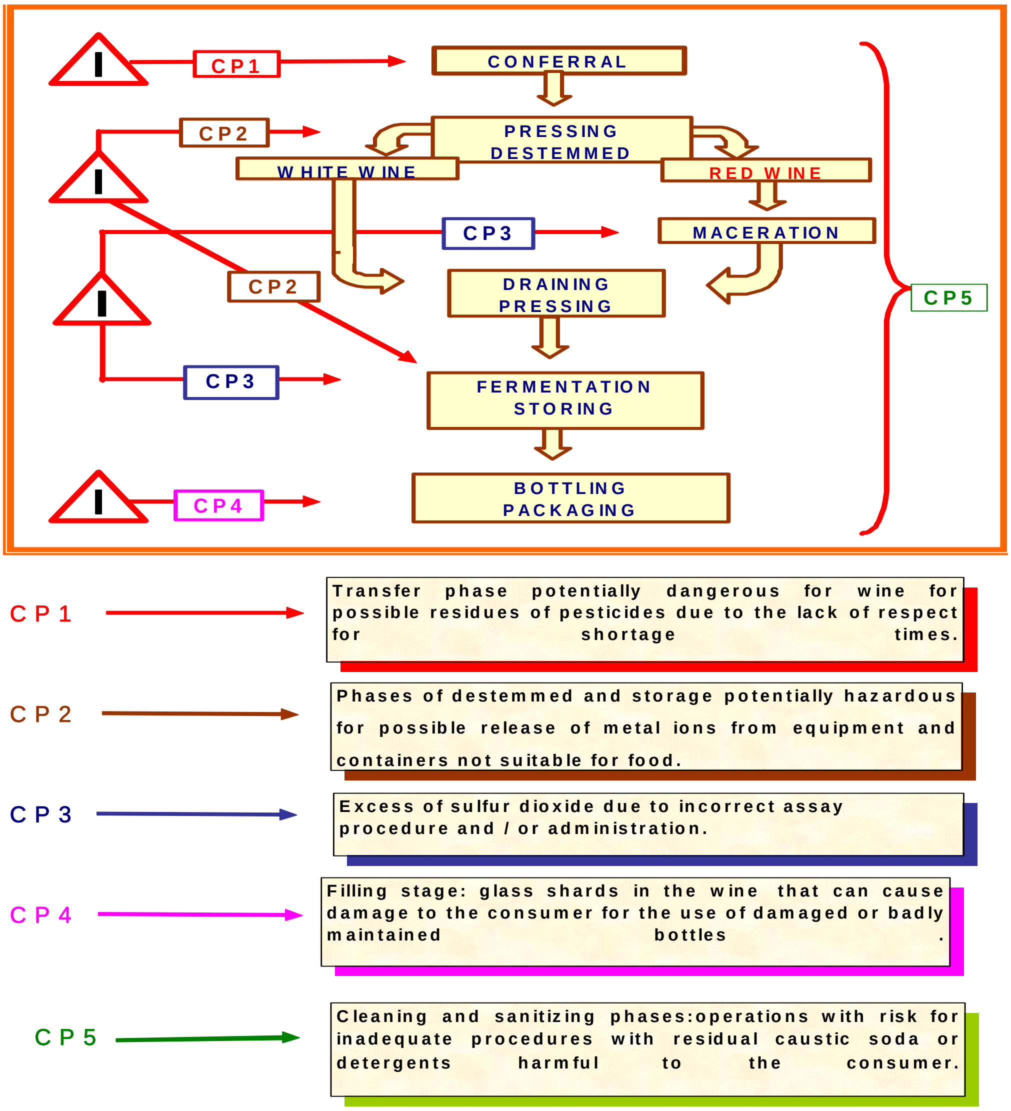

Figure 2 - Critical points of the process in a processing cycle of a cellar.

CONCLUSIONS

The cellar is perceived as a quiet and safe place. In fact, the precise application of the rules contained in the Legislative Decree 81/2008 showed that, while maintaining reduced levels of hazardous, building structures and equipment necessary for processing, may, if not properly corrected or mitigated, generate serious dangers related to bad or improper use of machines or making inappropriate choices of building materials. It is also demonstrated that the measures imposed by the application of safe working practices improve the organization of the production cycle. Even in terms of healthiness of the product, the production process, in the articulation of its main stages of processing such as crushing, bottling and storage until the sale, does not present risks of particular note because wine is not a suitable substrate for the development of pathogenic microorganisms, hazardous both for workers and consumers. There still can be chemical contaminations, arising from the failure of the qualifying period of pesticides used for the defense of the vineyard, and microbial cross-contamination with outdoor areas, as well as sporadic risks due to the presence of fragments of glass in the bottle.

Bibliography

1. Pisanu, M., Denti M. (2000): Influence of the regulations relating to safety and self-control of quality in the design of agro-industrial buildings. Proceedings National Conference on "The Construction for agricultural production and rural land." Bologna, 19-20 October 2000.

2. Pisanu, M., Denti M.: Integrated design: a method to ensure quality and food safety in buildings. Proceedings of the International agree on "Food production and quality of life." Sassari 3-8 / 09/2000.

3. Pisanu, M., Denti M. (2000): The design of oil production facilities according to HACCP and safety. Proceedings National Conference on "The Construction for agricultural production and rural land." Bologna, 19-20 October 2000.

4. ARSIA Tuscany (1998) - Guidelines for the implementation of the Decree. 155/97 farms in Tuscany. Wine sector - Florence in October 1998.

Estimation of the frequency, severity, and primary causative factors associated with injuries and fatalities involving confined spaces in agriculture

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Keywords: confined spaces, agriculture, suffocation, entrapment

Objectives:
The objectives of this study were to estimate the frequency, severity, and primary causative factors associated with injuries and fatalities documented in agricultural confined spaces. The data utilized in the study is contained in Purdue University Agricultural Confined Spaces Database (PACSD).

Methods:
A total of 1,282 cases involving confined spaces in agriculture were mined from the database of farm-related fatalities and injuries maintained by Purdue University. These incidents were documented during the period 1964 and 2011. Data was gathered from a variety of sources, including death certificates, police reports, newspaper clipping services, litigation documents, and online searches using keywords such as: "death confined space agriculture", "death grain bin", and "manure pit". Documented cases were, when possible, cross referenced and verified with other agricultural safety specialists who publish annual summaries of farm-related fatalities and injuries. All data was coded using a standardized process and utilized a panel of experts, when needed, to help in data interpretation. The database is not considered comprehensive but represents the best view of the problem in the U.S. that is currently available. It is believed that non-fatal incidents are significantly under reported due to the lack of a uniform required incident reporting system.

Results:
The average number of documented incidents over the 48-year period was approximately 28 with the average increasing to over 51 incidents per year during the past decade. The highest number of cases was reported in 2009 and 2010 which also had the highest number of entrapments in free flowing grain. Males accounted for over 96% of the total, and youth under the age of 16 comprised nearly one out of five cases where age could be determined. Over 65% of the cases resulted in multiple fatalities including two that resulted in five fatalities each or a total of ten deaths. Nearly 75% of the incidents involving youth were fatal. Four types of facilities accounted for the overwhelming majority of cases; grain storage and handling; livestock manure storage and handling; agricultural transport vehicles; and forage storage structures. These facilities represented over 96% of all cases. The single most significant contributing cause was out-of-condition grain that prevented normal unloading from storage units and resulted in workers entering the structures to aid in grain removal. Key recommendations included the need for enhanced engineering standards that focus on the safety of agricultural workers exposed to confined spaces and greater emphasis on increasing the level of awareness of the hazards of confined spaces, especially targeting youth working on farms.

Topic 4

“Safety Health and Welfare in Building”

Poster Presentation

Productive aspects and acoustic levels in a modern sorting and calibration plant for kiwi post-harvest processing.

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Abstract

The rising social and economic interest developed over the time for kiwi led to the creation of sorting and calibration lines constantly more sophisticated able to reach high levels of automation for the execution of the diverse post-harvest processing phases. But while technological progress allowed to increase sensitively work productivity and to execute a greater product quality control, it has also provoked the increasing of hazards incidence and health problems for machines operators.

Acoustic pollution particularly results as one of the most important factors of hazard for exposed individuals, since the noise is able to determine irreversible hearing loss and often the complete deafness too.

The present work aims, on one hand, to examine the productive aspects of sorting and calibration plant through the analysis of work cycle that is achieved therein, on the other hand, it intends to assess the dangerousness of noise phenomenon through the survey on exposition levels faced by operators.

Keywords: work productivity, quality control, acoustic pollution

Introduction

The kiwi (*Actinidia chinensis var.deliciosa*) is an egg-shaped brown berry with a downy skin. Currently, the most cultivated cultivar is Hayward, judged by consumers to be superior than the others, for both, fruit aspect and flavor, but it has also demonstrated a longer shelf-life in a refrigerated environment, allowing easier transport, even to more distant markets. Given the suitable climatic conditions of some areas of our country, its cultivation spread rapidly, making Italy now a days the largest producer in the world.

The Italian production of kiwi during 2009/2010 campaign, was in fact, of 436.300 tons equal to 32% of the worldwide production that was of 1.357.855 tons in the same period. The national cultivated area in the decade 2000-2009 had a steady increase going from 17.731 to 23.800 hectares, showing a significant increase [FAOSTAT data 2011], never the less, the increasing prevalence of "canker" that still seriously threat all or chards of the main growing areas.

Kiwifruit harvesting in Italy is carried out in the period between October and November. The most involved regions are Lazio (36 %) and Piemonte (19%). Calabrian production represents 4% of the national one. Kiwifruit destined for fresh consumption markets should be of minimum quality and size (greater than 50 grams) standards, below which the fruit is destined for processing.

Post-harvest operations of kiwi destined for the fresh market are therefore of great importance; and the growing interest for this fruit led to the creation of sorting and calibration lines constantly more sophisticated able to reach high levels of automation for the execution of the diverse post-harvest processing phases [Cocchiara *et al.*, 2005]. In fact, these operations aim at the elimination of foreign materials, fruit sorting according to common

quality standards, and the improvement of the presentation of marketed batch. On the other hand, technological progress, although allowed to significantly increase labor productivity and to take greater control of product quality, it has provoked an increase in mechanical damage to fruit and a higher incidence on health risks of machines handlers. In particular, one of the main risk for these subjects is the exposition to noise, that could cause irreversible hearing loss and, in severe cases, even complete deafness.
This paper aims, firstly, to examine the system of sorting and calibration through the analysis of work cycle that takes place there and, secondly, to assess the dangers of the phenomenon by measuring noise levels to which are exposed.
The study was conducted by the Mechanical Section of the Department Sta*f*a Mediterranean University of Reggio Calabria, Calabria Region as part of the FPA - Laboratory *QUASIORA* (Quality Source of Food Security), which aims at characterizing the development of criteria, methodologies and techniques designed to evaluate and improve quality and safety of food produced in Calabria.

Materials e Methods

The studied processing plant belongs to the O.P. Interpiana. A Cooperative Society, which operates in the province of Reggio Calabria, founded by more than 25 specialized cooperatives in citrus and kiwi cultivation, and that includes more than 2.600 farmers whose total production (on about 5.000 hectares of cultivated area) corresponds to 130.000 tons of Citrus and 1.500-2.000 tons of kiwi. The packing plant, located in Taurianova, extends on an area of 10.000 square meters; 1.000 of them are covered, and destined to all processing phases. The plant has an operating capacity of about 100 tons of kiwi/day and includes 15 operators. Processing period of the proper product usually takes 20 days, after which other external orders are accomplished.

Post-Harvest Plant Cycle

Fruits delivered to the packing unit are weighted and then sampled, to identify the farmer and determine product quality. After this, product processing starts through a series of operations, carried out by machines placed in succession and suitably connected by transporters. The processing line is structured as follows:
- **Feeding**, is performed through a dumper of bins (12 bins in a continuous cycle), on which, from time to time, a forklift locates sets consisting of four bins. Inside the structure of the machine, a jaw device frees the lower tray of the sets, which is turned over by a device with double chain. In this way we obtain gradual emptying of the bin which continues upward to be stacked.
- **Conveying** the product by the dumping bins: fruit is dumped by a series of rotating roller covered with protective material. The fruit forward by turning on their side, while 4 operators, located laterally to the machine, on special platforms, can remove and separate the misshapen ones. Between the dumper bins and the dynamometer, a feed lung is installed to regulate product flow in the line. The misshapen or small fruit can be destined for processing or to small local markets.
- **Brushing**, at the end of the roller sorting bank, the product is subject to "brushing" through a system consisting of a series of rotating cylindrical brushes that with a gentle rubbing perform epicarp cleaning. The down is removed by vacuum cleaners located superiorly.
- **Calibration** by the dynamometer: the product is transferred to the calibrating weight, where the fruit separation in relation to the shape and weight is achieved, ensuring the uniformity of the commercial packaging. The optical selection is made by InVision Compac Sorma 5.000. With the camera, the sizer detects the length and diameter, checking fruit density too.

The sorter consists of 6 parallel lines, mounted in a row. The fruit fall and settle on the cups, they are then weighted by 2 load cells below, one on the right and the other one in the left of the conveyor. After that, they are sorted according to the following 13 outputs (Tab. 1). The weight of each fruit was recorded about 250 times.

Outputs	Caliber	Weight (gr.)
1	**20**	**> 135**
2	**46-49**	**60-70**
3	**42**	**70-75**
4	**39**	**75-85**
5	**36**	**85-90**
6	**33**	**90-95**
7	**30**	**90-105**
8	**27**	**105-115**
9	**25**	**115-125**
10	**23**	**125-135**
11	**Large plate**	**100-170**
12	**Small plate**	**70-100**
13	**Waste**	**< 55**

Table.1 Calibration weights and classes of kiwifruit

The software that manages the system allows to combine a class of goods to each exit and to monitor in real time the evolution of the work in progress (consistency of a class % of the total number of fruits / class). Eight outputs automatically down loading the product in containers using fillers bins. The latter are constituted by a tape vertical, reliefs wheel, which receives the product from the outputs, and from a hard PVC, divided into radial sectors, on which converge the fruit transported by the ribbon. During the rotation, the disc places the kiwifruit in a container below. Below the disk is mounted a probe which, in contact with the product present in the full bins, controls the elevation of the same. The full bins are removed and replaced with empty ones by means of electric pallet trucks.

- Anti-botrytis treatment, the filled bins are stacked and subsequently drawn, three each time, for anti-botrytis treatment which takes place by immersion. The residence time in the tank of the containers is from 5 to a maximum of 30 seconds, after which they are extracted and left to drain and dry before being placed in refrigerators for storage, where they remain for about 30 days.

Instrumentation and test parameters

The researches have been carried out with the use of a precision integrator phonometer Delta Ohm HD 2010. This instrument is calibrated every year at the laboratory S.I.T.; before and after each daily series of measurements by a calibrator Delta Ohm HD 9101. The collected data have been transferred through a serial cable to a laptop to be processed successively using Noise Studio 7.0 software. The modalities of measurement and the methodology of research include the arrangement of the instrument, through a special tripod and a bracket with a feeler, at the height of the operator's ear, and at a distance from his head, so as to reduce, as much as possible, the effects of diffraction and the distance of the measured value [Proto *et al*., 2011]. The tests have been carried out during full activity and normal operating conditions of the industries and, after evaluating the workers' residence time in their work stations, the level of daily personal exposure has been calculated ($L_{EX,8h}$) [Zimbalatti *et al.*, 2008; Zimbalatti *et al.*, 2010; Proto *et al.*, 2011]. Figure 1 shows the layout of the facility in which locations of employees covered by sound measurements were revealed. The exposure limit values and action values are indicated in the law, in terms of daily exposure level L_{EX} and L_{peak}(C). The employer must consider the uncertain ties in risk assessment. Uncertain ties must be calculated by appropriate methods, with the measures of equivalent sound level sand peak. Once these uncertainties are calculated, the noise will be evaluated to determine the possibility of exceeding limit values and action values, which is related to the adoption of safeguards and security laid down in chapter II [ISPESL 2008].

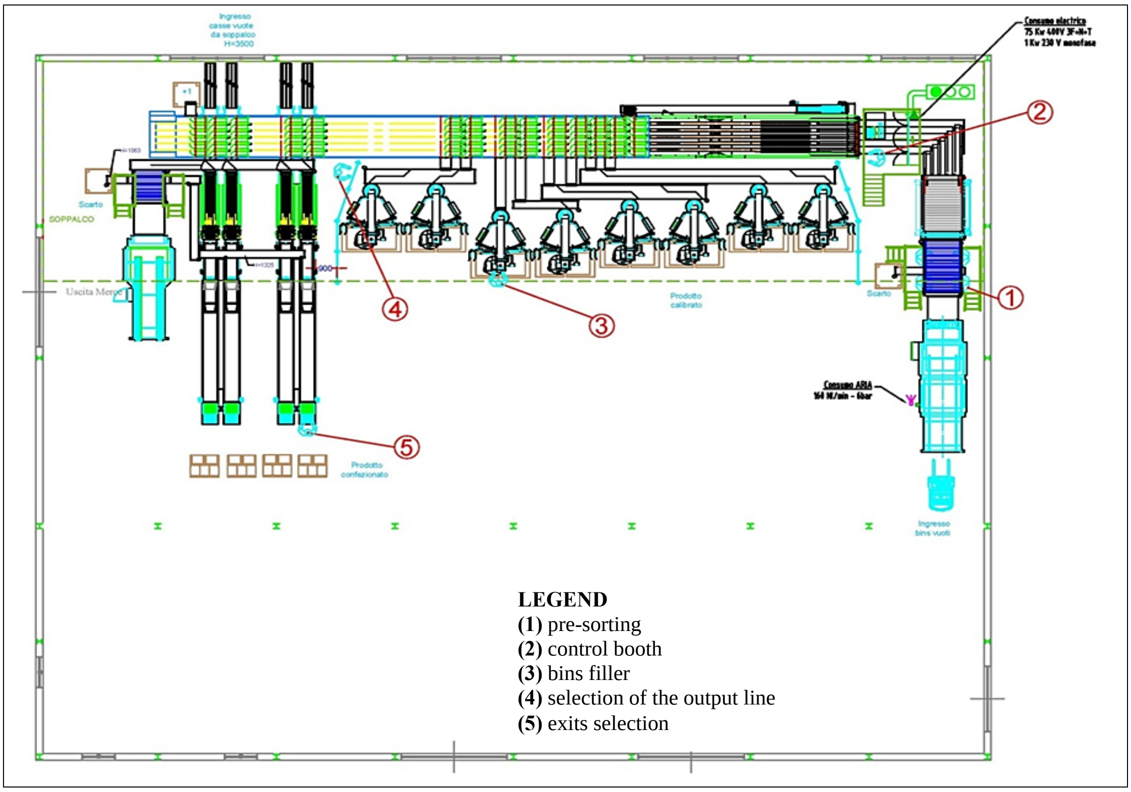

Figura1. Plant scheme and station operator.

The Legislative Decree 81/08 imposes minimum requirements for the protection of workers against risks to health and safety arising from exposure to noise at work, particularly for hearing; and takes into account these three factors to determine the categories of risk. The decree also establishes the technical and organizational action sand procedural training, information and protection to be adopted according to the level of exposure. It refers to a level (in decibels) for the presence of a possible damage that maybe: daily exposure to noise or weekly exposure to noise.
These levels consider the various sources of noise to which workers may be exposed and their exposure times that are reported to the eight-hour workday.
The assessment must also consider the peak sound pressure (maximum instantaneous sound pressure frequency-weighted "C").
The determination is performed as daily average values of the working weekdays that must not exceed the exposure limit value of 80dB(A) and appropriate measures were taken to minimize the risks associated to these activities. First of all, the limit of daily exposition to noise decreases from 90 to 87 dB(A); this limit considers also the noise reduction produced

by the personal protective equipment (PPE) worn by workers [Zimbalatti *et al.*, 2010].The maximum value of exposure to noise beyond whom it is obligatory to signal and/or to define the borders of the area, decreases from 90 to 85 dB(A); finally, the evaluation of noise considers also the possible interactions with vibrations or hearing toxic substances [Casini S., 2006]. In particular, if the lower value is exceeded, the activities such "information, training and supply PPE" must be carried out, if the highest value is exceeded, these actions: "information, training and provision of PPE with mandatory use" become necessary. The new legislation imposes to the employer, in case of exposure beyond the maximum value of 87 dB(A), to check the efficiency of the devices of hearing individual protection. So, during the tests in the different unit, the indications given by the D.M. 02/05/01 which fixe the standards for the identification and the use of hearing protection devices through the reception of the rule UNI-EN 458, have been applied [Proto *et al*, 2011].
The daily exposure level indicates a specific level of exposure that should not be exceeded.

Level of daily personal exposure $L_{EX,8h} = L_{Aeq,Te} + 10\ log\left(\frac{T_e}{T_0}\right)$ [dB(A)]

where: $L_{Aeq,Te} = 10log\left\{\frac{1}{Te}\int_0^{Te}\left[\frac{P_A(t)}{P_0}\right]^2\right\}$

$T_e =$ daily period of a worker's personal exposure to noise;
$T_0 =$ 8 hours;
$P_A =$ instantaneous acoustic pressure (weighting scale A), in Pa;
$P_0 =$ 20 µPa

Results

Noise levels were obtained by placing the measuring instrument according to fixed or variable positions of the sorting plant employees, considering only the most significant locations:1) pre-sorting; 2) control booth; 3) bins filler; 4) selection of the output line; 5) exits selection.
In general, the extent of exposure has been carried out during the simultaneous operation of all machines. The collected data in kiwi manufacturing plant show that very different noise levels, indeed $L_{eq,i}$ takes values between 71.7 and 83.5dB (A).

Work station	$L_{eq,i}$ (ε)	L_{peak} (dB)	Operator			
			a	b	c- d_1	d_2-e
			Residence time *ti* (hours)			
1) Pre-sorting	81,6 (±1,8)	110,0	8,00			
2) Control booth	71,7 (±1,8)	104,4				4,00
3) Filler bins	82,7 (±1,8)	135,1			4,00	4,00
4) Line output selection	81,0 (±1,8)	114,5		8,00		
5) Outputs selection	83,5 (±1,8)	138,6			4,00	
$L_{EX,8h}$[dB(A)]			81,6	81,0	83,1	80,0
ε $L_{EX,8h}$ [dB(A)]			±1,8	±1,8	±1,3	±1,7

Table 2. Acoustic levels in kiwi line selection

Table 2 shows the results of measurements in five different workstations, the most significant. Within this factory, two workers change their job every four hours, this means that the employer must provide a complete rotation of the labor; this situation also affects the levels of personal exposure to noise.

In the stations 3 and 5, the values of $L_{eq,i}$(A) received by the operators are above the threshold for the simultaneous presence of noise that generate interference of the sound.

In particular, all workers are subject to acoustic levels equal or higher than 85 dB(A), which, not only forces workers to wear PPE, but also imposes the employer to create and apply a specific program of technical and organizing measures to reduce this exposure [Proto *et al.*,2011].

The existing law provides that, for values above 135 dB(C) L_{peak} it is necessary to bear the PPE.

The value L_{peak}(C) is greater than or equal to 135 dB (C) in the stations 3 and 5 (135.1 dB (C); 138.6 dB (C)), as appears to be out of the norm, $L_{EX,8h}$ in same stations as well as in 1, 3 and 5 (81,6 dB(A), 83,1 dB(A)).

Fig.2 is a graphical representation of the sound level in dB (decibels) as a function of frequency in Hz.

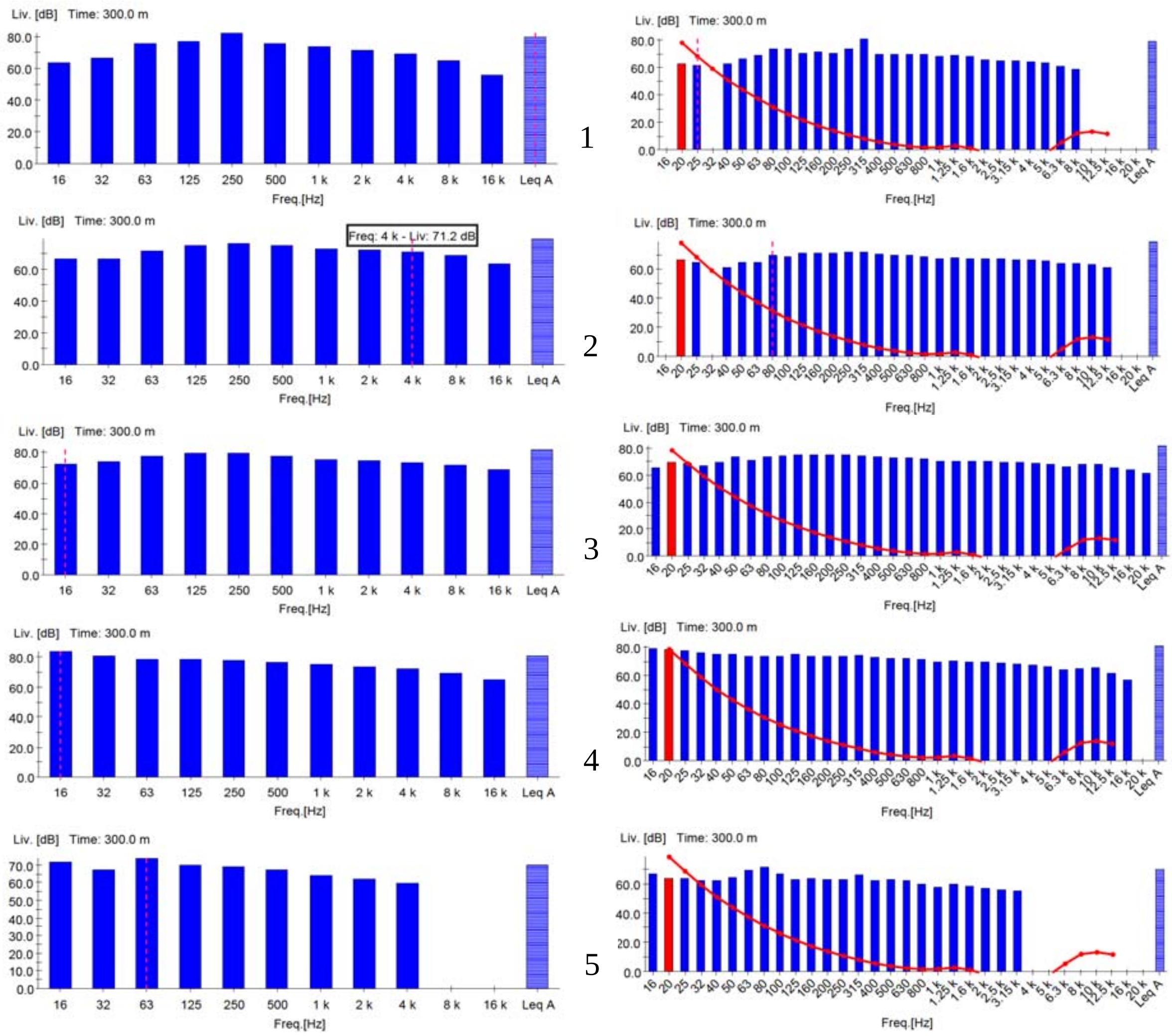

Figure 2. Equivalent levels for each position analyzed

Conclusions

The results highlighted the excellent operational performance of the studied post-harvest unit, and sorting line analysis allowed to draw appropriate solutions in order to improve such plants and to increase both commercial value and shelf life of kiwi fruit, furthermore, the assessment of the acoustic properties of the company. In fact, among the encountered problems, it has been noted, firstly, that the product has about 5% of fruit with defects that do not correspond to the commercial categories (double fruit or butterfly 20%, waste 2%, etc.). This denotes the absence of a first selection of waste fruits in the field by producers, which would reduce the amount of product to be moved, reducing transport costs, and would provide advantages to pres-sorting in the processing unit increasing thus, the speed of all operations. In addition, occasionally, some damages on the fruit have been found during processing, due to the impacts among themselves and with the parts of the machines with which they are in contact; if added to those already provoked during harvesting and transport, these can engender hurts that could affect the shelf life required for commercialization. It is therefore clear that processing lines analysis in order to identify the probable causes of damage to the treated fruit is of a great interest. This, could be achieved with suitable, electronic devices, called "instrumented spheres" or "artificial fruits", which together with the products placed in the lines to be processed, record over time the impacts caused to the fruits making them available for a complete analysis. These balls permit to identify any critical items in order to prepare the remedies. In general, the obtained results from the phonometric level of daily exposure to noise, are slightly higher than the threshold, as well as peak levels. Therefore, although the known difficulties to which the employer is confronted due to workers' indifference to these issues, we recommend the introduction of both personal protective equipment (PPE) and collective protection devices (CPD) accompanied by the rotation of work shift. The analyzed company is certainly in vanguard with respect to the technological progress, it is equipped with a highly automated plant, able to realize a product of a high quality, nevertheless, it requires some remediation (CPD) in the areas of pre-sorting, outputs selections and filler bins, possibly by designing special soundproof plexiglas shields so it could limit the noise and avoid the leakage or rooms recruits to reduce the sound source. The PPE (headphones or ear plugs) should be worn in areas where the noise level exceeds the dB(A) established by legislative decree in vigor. In addition, starting rotation shifts reduces worker exposure to noise.

The authors participated equally in all the phases of the present work

References

Cocchiara C., Giametta F., Mauro S., Morabito S.,2005. Aspetti produttivi e livelli acustici in un moderno impianto per la torrefazione del caffè. Rivista di Ingegneria Agraria, vol. 3, 37-44.

Decreto Legislativo del 10 aprile 2006, n. 195 Attuazione della direttiva 2003/10/CE relativa all'esposizione dei lavoratori ai rischi derivanti dagli agenti fisici (rumore).

Febo P., Orlando S., 2001. Interventi per ridurre la rumorosità all'orecchio degli operatori di una cantina con due linee di imbottigliamento. Rivista di Ingegneria Agraria, n°4, 244±252.

Giametta F., Proto A.R., Zimbalatti G., 2007. Analisi dell'esposizione al rumore nelle industrie di prima trasformazione del legno in Calabria, Sherwood – Foreste ed Alberi Oggi n°129.

Gorini F., 1992. Qualità, conservazione e trasformazione dei frutti di actinidia. L'Informatore Agrario, 26,71-74.

infortuni sul lavoro, n°12. Cassano F., Bavaro P., Aloise I., Dal Sasso P., Ruggiero G., 2005.

Problematiche connesse all'inquinamento da polveri e da rumore in un opificio per la lavorazione delle mandorle. Atti del Convegno AIIA "L'ingegneria agraria per lo sviluppo sostenibile dell'area mediterranea", Catania 27-30 giugno.

Proto A. R., Abenavoli L.M.M., Bernardi B., Zimbalatti G., Benalia S., Smorto D., 2011.Olive oil mills acoustic levels during a continuous processing. Efficient and safe production processes in sustainable agriculture and forestry XXXIV CIOSTA CIGR V Conference, Wien, Austria.

Zimbalatti G., 1992. Aspetti meccanici ed energetici della coltura dell'actinidia. Rivista di frutticoltura, 9, 33- 38.

Zimbalatti G., Bonfà D., Giametta F., 1999. Post raccolta del kiwi. L'Informatore Agrario, 49, 69-72.

Zimbalatti G., Proto A.R., Morabito S., 2008. Acoustic levels in the manufacture of wood chairs. International Conference Innovation Technology to Empower Safety, Health and Welfare in Agriculture and Agro-food Systems, Ragusa.

Zimbalatti G., Proto A.R., Negri M., 2010. Acoustic levels in the wood processing industry in northeast Italy. International Conference Innovation Technology to Empower Safety, Health and Welfare in Agriculture and Agro-food Systems, Ragusa.

Zimbalatti G., Zema D., 1999.Research into environmental noise in continuous cycle oil mills. Proceedings of XXVIII CIOSTA-CIGR V Congress, Horsens, Denmark, 14-17 giugno, 244±249.

Reduction of the risks related to falling from heights in processes of greenhouses roof maintenance

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Keywords: safety, falls, agriculture

Objectives

The present communication tries to show the important safety deficiencies of greenhouses roof maintenance operations, because these operations had to carry out by workers at 4-5 meters height. In this context, the objective of this work will be the design of a new mobile equipment adapted to the roof greenhouse shape in order to increase workers safety during maintenance operations as roof shadowing, cleaning and plastic cover change.

Methods

This investigation began with the study of the state-of-the-art of the maintenance operations in greenhouses roof, including scientific publications and patents, and simultaneously, an evaluation of the film cover renovation works in two multispan greenhouses was carried out. Collected data in these two greenhouses was used to make an evaluation of labor risks following the methodology proposed by the National Institute of Labor Safety and Health in Spain (INSHT), classifying the risk levels for each one of the identified dangers. Finally, a technical solution was designed to guarantee the safety in these operations.

Expected Results

The literature reviewed revealed at the moment that advances in this area of greenhouses construction are few, with no methods or designs that facilitate the accomplishment of these operations in a safe way. Nevertheless, the means and procedures used in the maintenance operations show great safety deficiencies, verifying that, in the majority of cases, the legal measures proposed to avoid or to reduce these risks are not applied.
In this communication, design and operation of a new safety element has been described. This element has been tested and demonstrates that improves the working conditions avoiding risks of fall from height to which the worker are exposed.

Acknowledgements

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Safety equipments in an equestrian facility

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Abstract
In recent years an increased attention has been paid to the risks that can emerge within the equestrian environment. In fact, the activities that are carried out every day, whether of working or sport nature, can cause serious traumatic events. The main problems are related to the following risks: biological, physical contact, chemical, electrical, mechanical and can be contained through proper training and information of workers. The likelihood of accidents can be reduced also applying appropriate behavioural requirements and certain quality and construction parameters used in structures. Inside the equestrian facilities all the main safety systems should be well indicated, also through appropriate signs.

Keywords: horse, risks, prevention, safety

INTRODUCTION
This paper aims aims to highlight the main problems and risks that operators and users within the equestrian facilities and sites holding horses. As a first approach to this theme it was decided to analyze the different types of risk faced by all those who work in various ways, in such facilities. These risks may be due mainly to the following categories:
- Physical contact with the animal,
- Biological,
- Chemical,
- Other physical risks,
- Electrical and mechanical
- Climate.

Regarding the first aspect mentioned it is known that equestrian activities, both of sporting that employment, can cause severe traumatic events. The most frequent causes of trauma may be due to falls, bites, scratches, kicks and crushing of horses. As mentioned, may be subject to such risks, both horse facility users, and athletes, both those who are concerned with the routine maintenance of the stables. Another risk may be due to causes of a biological type and chemical. These factors can cause allergic diseases, respiratory diseases such as rhinitis or asthma, or lung diseases such as chronic bronchitis or pneumoconiosis. Grooms, trainers, veterinarians, farriers, riders, etc., that is, the operators that are in daily contact with animals, may be subject to the attack of pathogens transmitted by the horses. The horses, in fact, may be a source or reservoir of microbial agents potentially transmissible and pathogenic to humans, such as Salmonella, leptospires, Borrelia, Bacillus anthracis, Clostridium tetani, and tinea corporis. As regards the main factors of chemical risk, other hand, the main problems arise from the fermentation of beddings or vapors from cleaning and disinfecting products for the horse, its tack or the local horse stables. There are also risks of a physical nature, due to the manual handling of loads that can cause osteoarticular pathologies (the displacement of bales of hay and sacks of feed, the operations for care, the loading and unloading of horses

and the maintenance of structures) or related to the effects of noise and vibrations that are produced by the use of machinery.
Another problem is related to the use or to the contact with devices of electric type, both specific for the horse such as walkers, treadmill, electric clippers, etc., than generic for cleaning operations and / or maintenance. The malfunctioning or improper maintenance of the these may be the cause of a fire due to an electrical short.
At last we can say that the nature of the work, done primarily outdoors, exposes equestrian workers to severe humidity and temperature conditions.
The risks listed above can be limited or at least monitored by introducing various precautions, related to information and training of staff and users, for what concerns disease prevention and the use of specific machines, but also through a proper planning of the areas of housing of horses and of those areas designed for the core activities.
The work has therefore continued analyzing the parameters necessary for the correct planning of an equestrian facility. Creating a suitable environment to host horses is not only a necessary requirement to comply with the major animal welfare standards, but it also represents the possibility to combine these conditions to the safety of workers, creating suitable environments for an excellent performance of equestrian activities.
The analysis of planning requirements has continued with the study and definition of quality parameters, and then have been introduced measures relating to minimum enlightenment, footing, flooring, materials usable and other elements in the stable. Do not forget, however, that a correct planning of structures must be attached to the maintenance of certain standards of behavior, only the combination of these two requirements can create conditions of safety. This paper will conclude with the presentation of a check-list to be applied within the equestrian facilities for safety audit of the entire structure.

METHODS

Although equestrian activities are not newly created, but rather it could be argued that the relationship between man and horse has always been there, no one has ever established specific rules for the design of animal housing areas and service facilities for the same meaning. Recently, the Ministry of Health has published a "Code for the protection and management of equines" that by introducing some essential requirements for the design of stabling facilities, laid the first foundations for the regulation of the sector. The development of this work was initiated by a careful analysis of existing literature, paying particular attention to the results obtained from countries which, unlike Italy, have specific legislations for the equestrian sector, already into force and applied. An important aspect to consider is that often stables and equestrian facilities are made of prefabricated structures that have standard dimensions defined by producers. Care was taken to analyze this aspect into consideration whether, as present on the market, these structures can effectively respond to welfare and security requirements. A next step, especially with regard to service facilities attached to stables (such as silos, barns, warehouse, workshop etc.,), was accomplished by assessing what has already been done for the housing of large animals, adapted to the equestrian sector. The comparison with the opinions of equestrian experts has allowed us to obtain the results of this work.

RESULTS

Regarding the constructive parameters for a correct planning of horse stables you can refer to the following formulas:

Internal areas

Minimum area: Twice the square of the height at the withers (2hg) 2
Minimum width: One and a half times the height (1,5 x hg)
Minimum height: Once the height (1.0 x hg)

External areas:
Paddock constantly accessible to the stalls
The minimum area = twice the inside area 2 x (2hg) 2

Was also prepared a checklist to be used either in the planning phase, for structures not yet been realized, than for owners and operators of existing facilities, to see if required safety conditions are met.

CHECK-LIST for equestrian facilities				
n°	QUESTIONS	ANSWERS NA: not pertinent		
	Access to the stable	**Yes**	**No**	**NP**
1	Is the access area (as recommended) of a width of at least 5 m?			
2	Is the visibility in both directions (in / out) good enough?			
3	If the visibility is poor, is it at least facilitated by signage and mirrors?			
	Internal traffic			
4	Do the transit surfaces allow an easy removal of rainwater?			
5	Are depressions, holes, etc. absent?			
6	Load pits,tanks, wells, ... are they equipped with adequate railings or solid roof?			
7	Is the courtyard big enough to make U-turns with the tractor and towing?			
8	Are the thoroughfares at least 5 meters wide?			
9	In any event, can these routes ensure safe transit for riders?			
10	Are the overhead cables placed at a height that does not interfere with the vehicles in transit?			
	Doors, gates and stepways			
11	Is the height of the exit routes at least 3 meters?			
12	Are the exits occupied by improper material?			
13	Are doors and gates of a correct size to allow the handy passage of vehicles?			
14	Do doors and gates allow the handy passage of horse and rider?			
	Fixed ladders			
15	Are the steps embedded in both posts, are they solid and at the same distance (min. 24 cm - max. 28 cm)?			
16	Are the ladders longer than 5 meters equipped with a protective cage from 2.5 meters?			
17	Is the distance between the steps and the wall to which is fixed the scale less than 15 centimeters ?			
	Ladders			
18	Do they have non-slip supports?			

19	Are they provided with hooks?			
20	Is the distance between the steps of 24-28 cm?			
	Elevated platforms – lofts			
21	Is there a railing on open sides, with a height from 100 to 130 centimeters?			
22	Are they equipped with toe-end, on open sides, of a height of at least 15 centimeters?			
23	Are there protective rails at the height of knee and chest?			
24	For workplaces used only occasionally, are there safety uprights of 1.5 meters and a 5 centimeters toe board?			
	Ligthening			
25	Is artificial lighting sufficient and in good working conditions?			
	Haystacks and barns			
26	In case of hay or straw packed in large round bales (200-400 kg), do the walls of the building support the horizontal thrust, or otherwise is there a containment structure?			
27	Are the stacks of bales more than 5 meters high?			
	Workshop			
28	Are the equipments fixed so that they may not fall by accident?			
29	Are personal protective equipment (PPE) to specific processing (eg, gloves, goggles, welding masks, etc..) available for all workers ?			
30	The lighting can be considered satisfactory?			
31	Is there a first aid package?			
32	Is there sufficient space around the equipment?			
	Deposits of hazardous substances			
33	Is the location in an area that is not passing through?			
34	Is the unauthorized access prevented by lock and key?			
	Roofs			
35	Are there asbestos-cement roofing in a state of deterioration (parts chipped, points that are damaged, can they release fibers in the air)?			
	Tanks and cisterns			
36	Are the underground and outdoor tanks protected by fencing having a height of 180 cm and a 20 cm curb perimeter?			
37	Are the withdrawal points protected with barriers against fall and / or gates closing and / or railings and curbs?			
38	Are there exit ladders?			
39	Are the manholes completely closed?			
40	The tanks have closed withdrawal hatches and inspection manholes properly protected of at least 0.3 x0, 3 meters?			
	Horizontal silos			
41	Do the horizontal silos have walls sufficient strength to horizontal loads and not too tall (2.80 meters max)?			

42	Are they filled up to a maximum of 20 cm from the top edge?			
43	Are the trench silos suitably protected (check for a curb perimeter or a stop socket for the tractor)?			
44	Are the overground silos suitably protected (check the existence of railways above the walls, or "guard rail", if the tractor is used for compacting the ground)?			
45	Is there an easy access of the means for the operations of loading and unloading?			
	Vertical silos			
46	Are cleaning operations carried out with due care (presence of 2 persons, availability of adequate harness systems, shaking the walls, etc ...)?			
47	Is the supporting structure of the hopper firmly fixed to the ground (eg, with plugs)?			
48	Are there, for the silos more than 9 meters high, walkways on the stairs every 5 meters?			
49	Are there devices that prevent manipulation by outsiders (eg safety switch under lock and key to enter the silo)?			
	Electrical Installations			
50	Is there an adequate number of high-sensitivity circuit breakers (GFCI)?			
51	Is there an earthing system of electrical equipment and metal structures?			
52	Is the earthing system connected to a equipotential bonding network (connection between large metal structures, electrical panels, outlets and other electrical appliances)?			
53	Is the efficiency of the earthing system periodically checked?			
54	Is the electrical system tested, verified and certified?			
55	Is the electric booth equipped with signals, locked, provided with the wiring diagram?			
56	Electrical outlets are pursuant?			
	Boiler / Generator	**Si**	**No**	**NP**
57	Is there at least one fire extinguisher for class "ABC" (at least extinguishant = 13A; also suitable for energized equipment) installed?			
58	Is there an easy access to control and safety devices ?			
59	Is there is an adeguated opening for ventilation?			
	Fuel storage			
60	Do the metal vessels have an earthing system?			
	Liquid fuel tanks above ground level			
61	Are the deposits of liquid fuel placed on supports rigidly anchored and provided with collecting basin?			
62	If close to transit routes, are they protected by beads of height at least equal to 20 cm?			
63	Are the fuel depots collocated away from the heat generator more than 5 meters?			
	fire Prevention			
64	Are the mobile distributors for stocking and distribution of a type approved by the Ministry with a capacity from 300 liters to 9000 liters max?			
65	Are there mobile (fire extinguishers) or fixed (hydrants) fire fighting equipment?			
	Noise			

66	Are workers subject to exposure values greater than 80 dBA?			
67	Are workers subject to exposure values greater than 90 dBA?			
	Biological contamination - Zoonoses / hygiene			
68	Are construction and qualitative parameters and behavioral requirements observed ?			
69	Are PPE regularly kept clean?			

CONCLUSIONS

Introducing construction parameters for the design of equestrian facilities would allow to meet the requirements for animal welfare and at the same time create optimal conditions for a safe use and handling. An increased wellbeing of the horse, in fact, generates greatest calmness and serenity that is transformed into a calm and relaxed behavior that hardly give place to manifestations of stress, making the environment safer for humans. The correct planning is just the first step, however, to define the safety of a given location, in fact, also other parameters concur to this, such as the quality of the structures, mainly related to floors, enlightenment and surfaces necessary to carry out activities. Also the behavior and the proper performance of the activities of users and operators is essential for safety purposes. The risks discussed in the first part of the job may be limited through an accurate training of the facility's users, as well as of the employees. In particular, training of staff is essential, not only for their safety, but for that of the whole equestrian center. Indeed not necessarily a staff that comes from a similar environment knows what happens inside the equestrian structure, and this can be a source of danger and bad management. It should also always be verified the presence of safety signage, as required by the law.

Bibliography

1. University of Pisa, "Safety Manual in equine practice."

2. Ministry of Health and Social Policies, "National Plan for the welfare of farm animals."

3. Ministry of Health, "Rules and regulations for the protection of the horse taken by the Ministry of Health"

4. Veterinary Bureau Federation, "Horses: how to look after"

The foodservice sector: assessment and operative instruments to improve the safety

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Abstracts

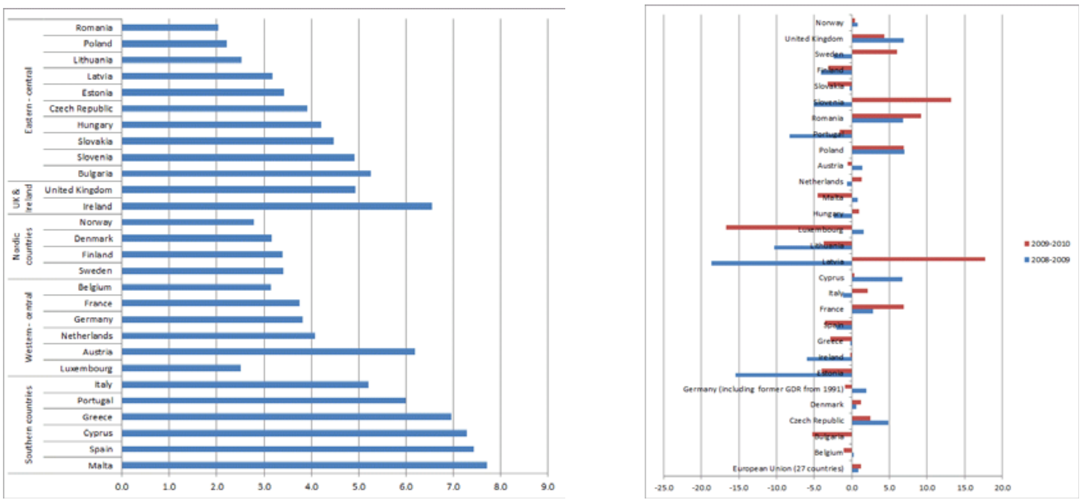
The foodservice centers, in these last years, increased their performance by increasing productivity and the technological level but, at the same time, still represent a context where worker safety is put at great risk because, especially in the expressed productive organization (the so-called fresh-hot link), the times are very concentrated in order to prepare all meals provided within the time required by the customers. The foodservice personnel is often young, with a very short experience and employed in a seasonal way.
The aim of this study was twofold: firstly to identify the major accidents reported in a catering company in three years, the other to present an equipment analysis methodology in such a way that we can provide, to those who must manage them, an approach based on "risk analysis model".
Data were collected starting from the analysis of all complaints for accidents recorded in the three years 2006/2008 occurred in a Catering Company. The details were then divided according to type of injury suffered by the worker, the place where the accident occurred, the days of prognosis and possibly the equipment that caused the damage. Through the objective analysis of these data were constructed graphs for equipment deemed most dangerous by relating the severity of the damage with the probability (risk analysis model): then actions to be taken in order to manage equipment safely were identified.

Keywords: risk analysis model, catering, accident

Introduction

The last ten years have been for the catering at a remarkable growth: "eating out" is now a growing habit for common food style. The foodservice centers, consequently, increased their performance by increasing productivity and the technological level but, at the same time, still represent a context where worker safety is put at great risk because, especially in the expressed productive organization (the so-called fresh-hot link), the times are very concentrated in order to prepare all meals provided within the time required by the customers. Think of a great cooking center, having to produce a few thousand meals, must concentrate all activities in the early hours of the morning in order to allow the logistics deploy on time (European Agency for Safety and Health at Work, 2008)
The personnel involved are mainly young (48% under 35 years old) and often in a seasonal period. Data on total employment in the industry HORECA (HOtel, REstaurant and CAtering) show that the levels are significant throughout all the European context (Fig. 1.a).
The dynamics of the sector have large variability (Fig. 1.b) with significant differences depending on the country considered.(Eurostat, 2011)
The working conditions in the sector are difficult and include irregular, often constraining work hours, atypical forms of employment, comparatively low pay and lack of job stability. And these conditions put workers' health and safety at risk. However, the incidence rate in the

HORECA sector (3041 accidents per 100 000 workers) for accidents with more than 3 days absence from work, is comparable to the rest of the economy (3176 accidents per 100 000 workers).(European Foundation for the improvement of living and working conditions, 2012).



(a) **(b)**

Figure 1 – (a) Percentage (a) and dynamics (b) of employment in HORECA in different European countries (Eurostat, 2011)

The aim of this study was twofold: firstly to identify the major accidents reported in a catering company in three years, the other to present an equipment analysis methodology in such a way that we can provide, to those who must manage them, an approach based on "risk analysis model".

Materials and methods

The analysis of major accidents was conducted in an operational context by partnering with a company of caterers (Serist S.p.A., Milano). It was analyzed the allegations of injury presented to three years (2006, 2007 and 2008). For each injury was defined:

1. *the environment*: the place where the accident occurred, specifying the exact location (kitchen, dressing room, washing area, hallway, elevator, stairs, cold room, administrative offices, storage). The injury was classified as ongoing, when it occurred while the employee was traveling to work or while driving home after work.
2. *the fact*: understood as the activity of the injured at the time of the occurrence of the accident, it is useful to understand how the accident and then classify the equipment.
3. *the equipment*: in case the damage was caused by an apparatus. Is has been classified as equipment including crockery, chopping, cleaning products, tables and knives, as well as the classic equipment used in restaurants as the slicer, the trolley, the kettle, a potato peeler, etc. ..
4. *the damage*: namely whether it is a burn, cut, bruise, trauma, injury, contact with chemicals, fracture, low back compression, distortion, etc. ..
5. *day of prognosis*: is the time that the worker had to abstain from work, so as to give an idea of how serious the injury was.

It was made graphs that have allowed to compare annual trends and the influences of individual parameters. Another analysis that was conducted is the correlation between the number of accidents and days devoted to training for the prevention of accidents in the professional kitchen. In the work on the analysis of equipment have been observed in cases where an injury has been caused by the use of an apparatus, have been taken into account in the days of the severity and prognosis for the number of injuries resulting from the use of that specific equipment, for the probability. And the type of damage caused to define the danger to which it refers. In doing so it defines the specific risk of any hazards observed, to give, when assessing the degree of specific risk of each hazard. First have been defined various dangers that may or may not be present in the use of a specific piece of equipment, these are:

• danger of cutting \ wound;
• Burn Hazard;
• danger of stumbling \ fall;
• electrical hazards;
• Hazards due to loss of stability of the equipment;
• danger of being crushed.

Once it has defined what dangers may arise from the use of protective gear were assigned scores from 1 to 4 for the probability and severity of the damage, following the steps on Tables 1 and 2. Scores are given by observing the number of cases of injury occurred in the three years analyzed for the probability, and the same day prognosis for gravity.

Table 1 - Severity of the damage

SEVERITY OF THE DEMAGE (S)		
Value	**Level**	**Identification criteria**
1	Slightly	Injury or illness, less than 8 days.
2	Medium	Injury between 8 and 30 days. Occupational disease with reversible effects
3	Serious	Injury over 30 days. Occupational disease with irreversible effects
4	More serious	Fatal accident. Occupational disease with lethal or totally disabling.

Table 2 - Probability of damage

PROBABILITY' (P) OF DEMAGE		
Value	**Level**	**Identification criteria**
1	Possible	The observed situation is such as to cause damage only after the occurrence of unforeseen circumstances. You are not aware of similar events
2	Unlikely	Its occurrence would require uncommon circumstances. Similar events have already occurred.
3	Likely	There were similar facts. Its occurrence would not provoke surprise.
4	Very Likely	Its occurrence is almost taken for granted.

The graphs (fig.2) were constructed to have on the abscissa the probability of injury, on the ordinate the severity. Each danger is characterized by a point in the graph whose coordinates are the scores (from 1 to 4) by severity and the probability. The chart is divided into 3 parts as follows:

If the point, of a particular danger inherent to its equipment, is located below the limits of acceptability the risk will be said acceptable. In this case will not be necessary to intervene for the improvement of security.
If you find the point between the limit of acceptability and tolerability limit the risk that it will be tolerable. In this intermediate zone fall assess those risks for which interventions, not immediate, for the improvement of health and safety. Need to be kept under control.
Finally, if the point is above the limit of tolerance is a risk that will be improved, these situations require immediate action to improve safety. In the last part of the work have been highlighted those situations of risk that require immediate action, ie those that are located above the limit of tolerability. They were then dictated the possible corrective actions to be applied to the system or equipment to improve safety

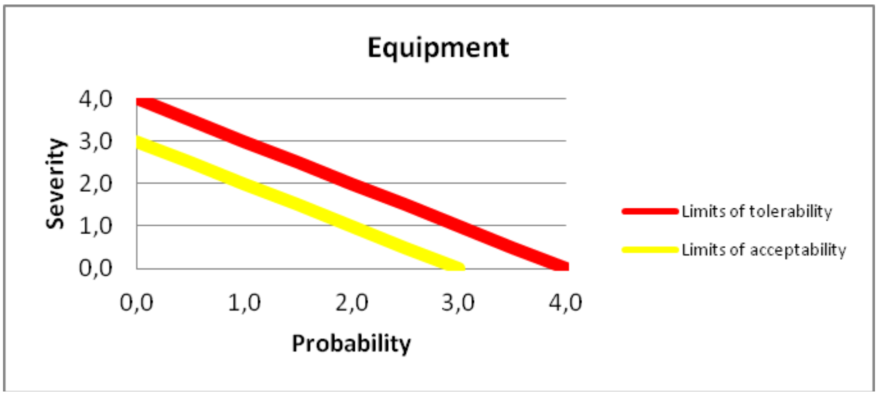


Figure 2 – Example of graph that characterizes the equipment in terms of likelihood and severity of risk

Results

The analysis of the types of accidents and their characterization are shown in the following graphs (Figures 3, 4 and 5) and it is possible to consider interested dynamics for the management of a safety system for the workplace in the catering.
In particular, Figure 3 refers to the analysis of the environment where accidents have occurred: in the kitchen was closed on average 70% of injuries (60% in 2008, where the largest percentage of accidents in other places related to food). Commuting accidents have a share stationary fluctuating between 11% and 13%.

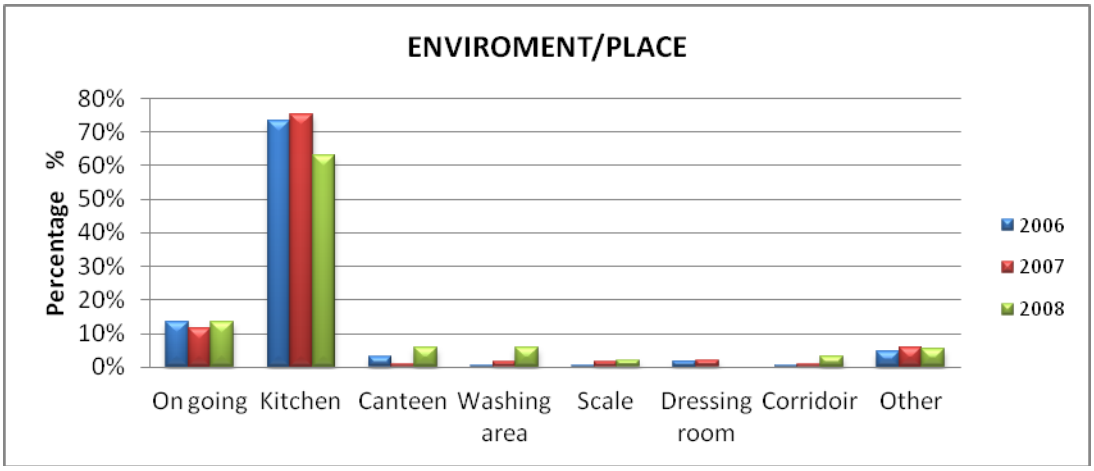


Figure 3 - The environments in which the accident occurred

The analysis of the type of damage (Fig. 4) showed that the cut appears to have a rate of 23%, with a peak of 25% in 2007. The damage caused by cutting may have many causes, one of all is the use of knives, the use of slicing, the breaking of dishes etc.. The cut has different severity, prognosis can be from 3 days as the prognosis for over 60 days, but most are minor. The fall had a peak with 21% more in 2007, has remained static for the rest of values between 13% and 15%, this damage can be caused by a slippery pavement, wet or uneven, the handling of trolleys; by the impact against equipment such as the table. Falling objects, dishes, pots and pans can cause bruises, their frequency is between 17% and 27% in three years. The burns have a relatively low frequency, whereas an environment like the kitchen, even gravity is usually low with poor outcome that rarely exceed 10 days.

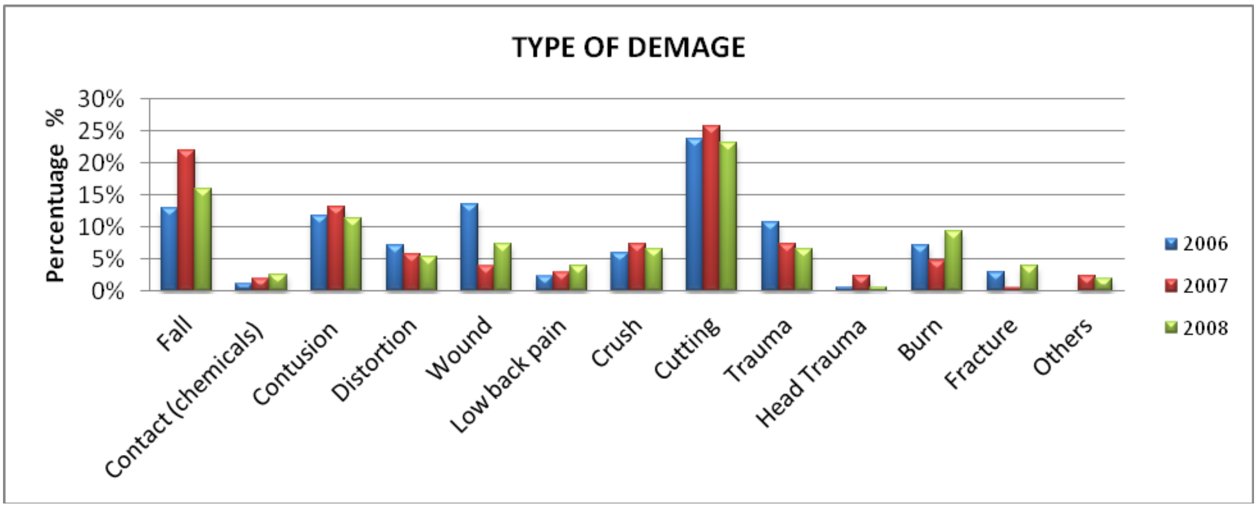


Figure 4 - Types of damage observed in the three years evaluated

Injuries caused by the equipment (Fig. 5) range from 42% in 2008 to 47% in 2006, with 45% in 2007. In all three years the equipment was found to be more dangerous than the knife, the percentages are still declining: from 15% in 2006 to 11% in 2008. The severity of the damage is very variable. The truck has the same trend of the knife, the percentage of accidents caused by this equipment has decreased by 1% each year, however, has values that do not exceed

9%. This equipment due mostly falling damage and by crushing, and, in rare cases, can cause burns in the case where the trolleys are heated. The damage caused by a dish rather an opposite trend compared to the other two facilities analyzed, there is an increase of 1% in three years. The dishes and causing minor damage due to cuts, bruises and burns. The percentage of injuries caused from slicer increased from a maximum of 9% in 2006 to a 5/6% in the other 2 years. This equipment does cause more damage to the cutter, in very rare cases has been found the occurrence of other damages, which are of medium severity. The cleaning products have caused injury mainly in 2008 with a 3%, these products can cause harm by inhalation or contact with eyes.

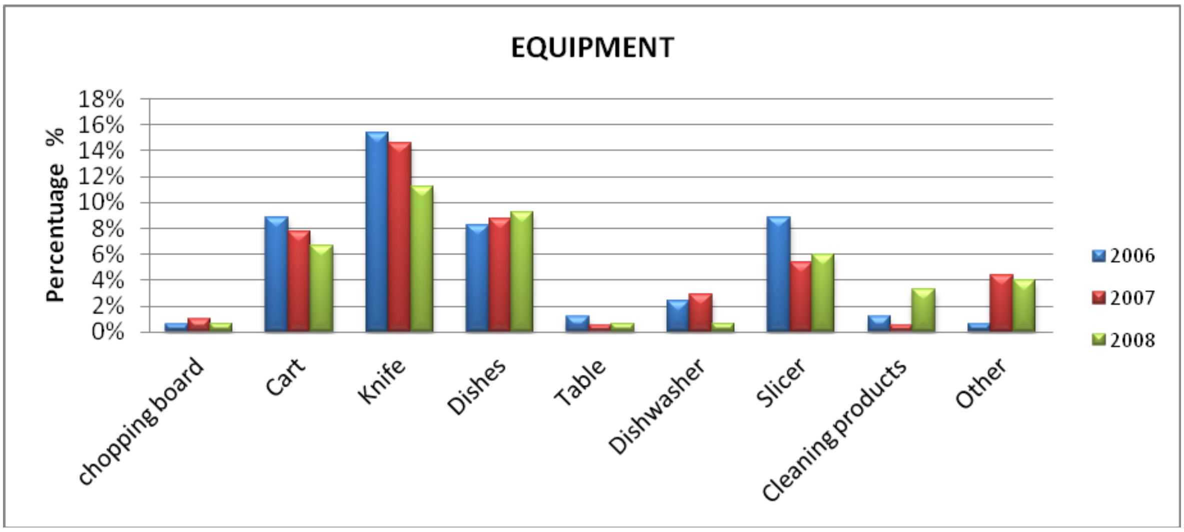


Figure 5 - Equipment involved in the accidents

The days of prognosis (Fig.6) have undergone a significant change, first of all accidents with prognosis than 15 days has decreased from 47% in 2006 to 37% in 2007 up to 11% in 2008. This is an important finding because the seriousness of the damage is increasingly lowered and, therefore, appear to be less dangerous accidents. As it is easily seen from the graph in 2008 has been an incredible change of direction with regard to this parameter. In 2008, in fact, the prognosis of less than 5 days and those between 5 and 10 days were significantly increased relative to the other two years, as well as those between 10 and 15 groups are significantly decreased. The death in 2008 refers to an event in progress.

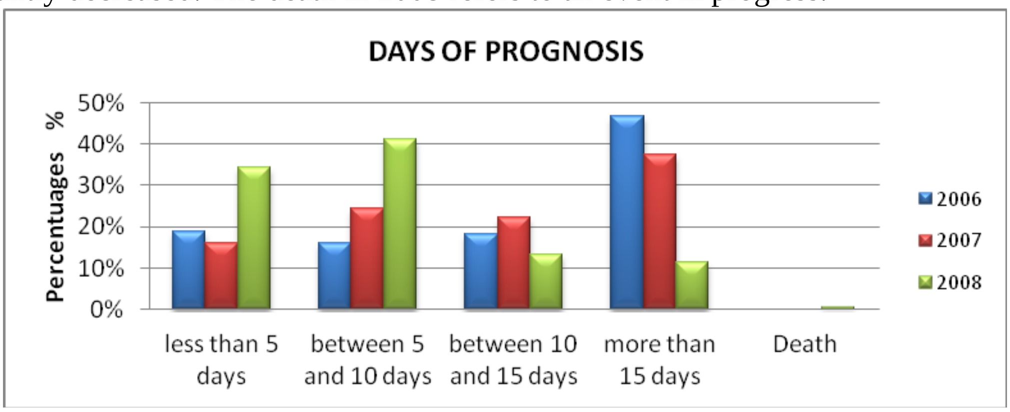


Figure 6 - Percentage of days of prognosis in the three years evaluated

The last analysis led to the crossroads with the number of accidents with persons trained on safety (Fig. 7)

Figure 7 - Total persons trained & number of accidents

As you can see the number of courses taken and the total number of accidents have a relatively proportional, this once again puts the emphasis on how important and how this tool is useful for improving safety in the workplace.
The analysis allowed to identify the equipment most important for assessments in terms of danger and harm: the cart, the knife and the slicer. The cart was involved in several accidents causing different types of hazards. Tripping/falling while cart are handled has a probability but a high average severity. This equipment is moved frequently this leads to dangers such as being crushed against the walls, doors and other equipment. This type of event is likely but its severity is mild. The cart does not appear to be quite stable, there have been several accidents resulting from loss of stability of this equipment, gravity is medium. Other hazards are attributable to the burn, in the case in which are used a heated cart, and the risk of cuts\wound. The risk assessment has led to the graph of Figure 8.

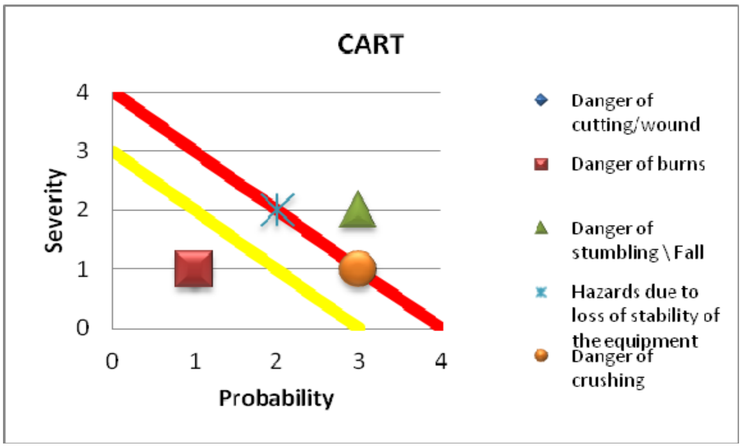


Figure 8 – Cart Risk Analysis

As it can easily see, the only danger above the tolerance threshold is the danger of tripping/fall, this danger must implement immediate actions for improvement. The danger of being crushed to loss of stability is at the limit of tolerability and needs of improvement actions in the short/medium term, to not risk the worsening this situation. The danger of scalding is rather limited, in this case it is sufficient to intervene only in the programming phase.
The only risk that one runs when using a knife is the danger of cutting/wound. This type of damage is very common in places like the kitchen and in rare cases the severity appears to be high. Considering the cases of injury resulting from use of this equipment, in the three years analyzed, it was concluded that the danger of cut/wound is above the tolerance threshold (Fig. 9).

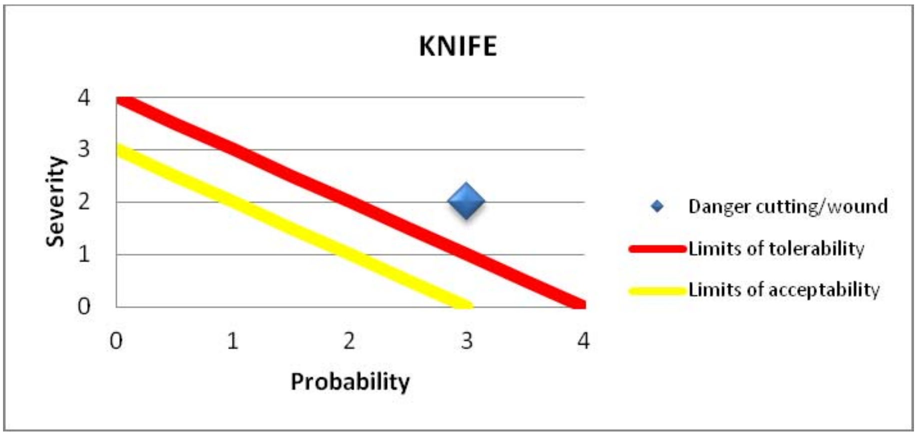


Figure 9 – Knife Risk Analisys

The slicer is a tool widely used for slicing meats, cold cuts, cheeses and available in a wide range of models to suit every user. Noteworthy too is the number of available accessories, such as slicercount or device off slices. In any case it is always made up of some characteristic elements: an electric motor, a regulator of thickness for the grammage, a blade and a carriage. There are essentially two types of dangers of using this type of equipment (Fig. 10): the danger of cut/wound and electrical hazards. The danger of cutting wound turns out to be an average frequent with a severity which, for most of the cases, is high.

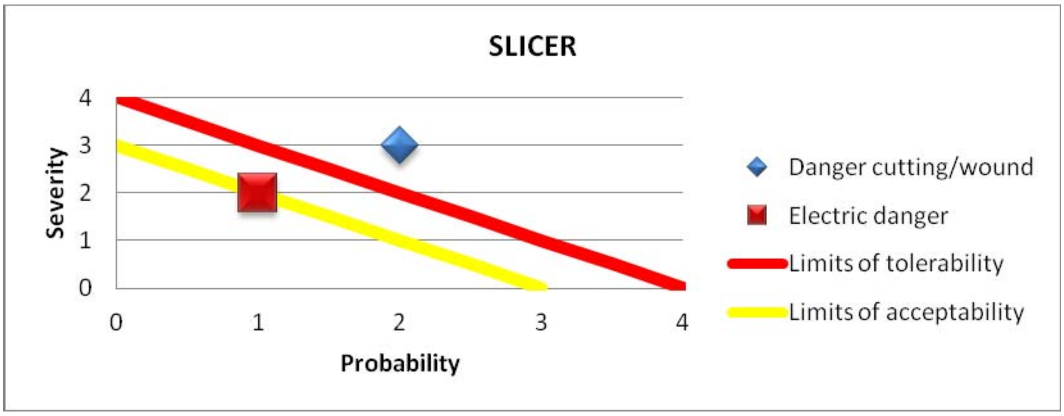


Figure 10 – Slicer Risk Analysis

Conclusions

The analytical approach and the technique of Hazard Analysis of catering equipment are two very interesting tools to increase the level of security in the context HORECA an advance logic. The analysis showed that:

1. the formations still constitutes the main tool that allows to reduce significantly the number of accidents;

2. approach based on risk analysis allows to identify the precise technical measures must be undertaken to secure equipment that, while respecting the safety rules, is still the cause of accidents; 3. graphs obtained allow to support preventive interventions with objective evidence coming to raise the security level of the sector.

References

European Foundation for the improvement of living and working conditions. 2012. *Employment and industrial relations in the hotels and restaurants sector*, www.eurofound.europa.eu

Eurostat. 2011. *Accommodation and food service activities (NACE Rev. 2)*, Statistics Explained
(2011/10/5)

European Agency for Safety and Health at Work. 2008. *Good practice: accident prevention in HORECA*, http://osha.europea.eu

European Agency for Safety and Health at Work. 2008. *Safety and health risks in HORECA*, http://osha.europea.eu