

Risk assessment of repetitive and strain movements of the upper limbs in a pig head processing company

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Background: the processing of pig heads is a processing high repetitive activity and at high risk of biomechanical overload of the upper limbs.

Objectives: to assess the prevalence of musculoskeletal disorders of the upper limbs and in particular carpal tunnel in a group of workers assigned to pig head processing.

Methods: a clinical investigation and assessment of occupational risk in a pig head processing company was carried out.

Results: the clinical investigation showed the presence of carpal tunnel syndrome in 14 percent of cases. The ergonomic analysis of work showed an high risk for disorders of the upper limbs.

Discussion: the results of ergonomic work analysis have shown the causal role played by risk factors including the repetitiveness, the use of force, the awkward postures and the absence of recovery time.

Conclusions: the adoption of preventive solutions as a rational distribution of recoveries, the alternation of tasks, the use of knives of ergonomic type, have proven effective in reducing the risk of biomechanical overload of the upper limbs.

KEY WORDS: UL-WMSDs, Repetitive activity, Work-related musculoskeletal disorders.

Introduction

In the territory of the USL 3 of the meat processing industry, in particular those of pigs, there is a wide variety of companies, from slaughter to processing with production of hams, sausages, cured meats. Among these, an important activity is the processing of pig heads, a type of processing involving high repeatability, with awkward

postures of the wrist and hand, high strength of the upper limbs and the use of tools involving compressions on the carpal tunnel. These occupational factors are associated with an increased risk of musculoskeletal disorders and muscle tendon-related work (WMSDs Work-related Musculo-Skeletal Disorders) (1-3). In order to verify what is described in literature, we conducted a survey in a firm processing pig heads including an ergonomic analysis of work directed to evaluate exposure, medical history and clinical study aimed to assessing the prevalence of musculoskeletal disorders of the upper limbs, particularly the carpal tunnel (4, 5).

The survey aimed to assessing the exposure to risk factors of biomechanical overload of the upper limbs and the prevalence of musculoskeletal disorders of the upper limbs, particularly the carpal tunnel in a group of 14 workers employed boning heads of pigs, typical processing in the territory of the Valdinievole (PT) and only in Tuscany.

Methods

Activities of the Company

The company carries out the studied on boning heads of pigs for the production of all the possible derivatives of meat intended for delicatessen. The process begins with the arrival of the pig heads on specific media (rides) which are moved by hand up to the counter for peeling, washing and flaming.

The following step is that of boning along a tape carrier (chain) where the various parts are removed until the preparation of cassettes of the finished product. The tasks in the chain appear to be very similar, while the movements to be made to cut the pig head are virtually identical and involve the assumption of similar postures. The head of the pig that comes in all positions on the conveyor belt is gripped with the left hand (with glove metal mesh) and worked with a knife held in the right hand. First, heads are chopped in half and each half is made from the boning meat and boning of various edible parts. At the end of the process, the products are stored in the cell. About 300 heads / hour for a total of 2400 heads / are processed per day. There are two breaks (in the morning and in the afternoon). In order to ensure the execution of cuts /boning with the use of less force, the company has taken steps to provide each worker with a rack containing 4 blades /knives for a worker and portable sharpeners so you always have adequate tools with wire and cut with less effort. The workers engaged in the processing line are 14, all male, 3 of which are Nigerians and one is

Moroccan, not affected by previous pathologies of the upper limbs, for which they could complain of painful symptoms regardless of the task being performed.

For every worker this is a repetitive task performed for the entire working day and there is no job rotation.

The clinical investigation covered all workers in the period 2012-2013, aged on average 33.3 years (minimum 22, maximum 56), and average length of 11.1 (minimum 2 years, maximum 31). Three workers visited were working members.

The method proposed by the research EPM for screening clinical with the administration of medical history questionnaire targeted and functional evaluation by physical examination in cases who reported symptoms (5-7) was used.

As a control group we used the 139 EPM supervisors urban studied (8). The cases were compared with controls using the Fisher exact test.

The evaluation of occupational risk was made under the analytical method of working with repetitive tasks proposed by the research EPM (9). We proceeded to inspections and filming the various stages of processing, the data on daily and hourly production, needed to calculate the velocity of the chain and the theoretical life cycles, have been provided by the company, as well as working hours and pauses officers. The task analysis was current out by examination of the footage, slowing it down, and we calculated the duration of the cycle, the average frequency of technical actions, the presence of micro-breaks of at least 10 seconds, the postural commitment both to the right left shoulder joint to joint, elbow and wrist, the type of grip and finger movements and complementary factors of risk.

Results

The processing is characterized by a low number of workers and a high turnover. In fact, both the average chronological age (33.3 years) and the average length (11.1 years) are quite low. Examining the working population of 37 workers employed between 1994 and 2007 years, we have found that the permanence in work in 15 cases was less than one year. 7 of the other 22 workers have quit their jobs to one three years af-

ter taking office, only 15 are still in force, and of these, three are members.

Risk assessment

Table 1 describes the main risk factors for the different tasks performed on the chain.

The work shift takes place over 8 hours with a break of 2 hours for the meal and two breaks of 10 minutes that are carried out after the 2nd hour after the 6th hour. Number of hours without recovery 4.

Additional risk factors are in addition to the metal glove, contact with cold surfaces and the use of knives which causes compressions of muscle tendons of the wrist. The pace of work is completely determined by the machine.

The ergonomic analysis of work showed an elevated risk for disorders of the upper limbs in the processing of pig heads due to the high frequency of action, combined with awkward postures, use of force, complement factors and the lack of the necessary time recovery. The causal role played by these factors is confirmed by the results of the clinical investigation which showed a high prevalence of some symptoms of some diseases and in the upper limbs, despite the limited sample.

Clinical investigation

The clinical investigation carried out on 14 workers all under the age of 35 including three members showed the presence of shoulder and wrist pain in 43% of cases, while in 4 cases (28.6%) were present continuous nocturnal paresthesias in the hand. The diagnosis of JTS were specialized in two cases (14.3%) and cysts of the wrist tendons in a case (7.1%). In one case it was bilateral carpal STC at an advanced stage (worker with 32 years seniority of 12 years) and was treated with surgical neurolysis (if recognized then as a professional INAIL), in the other case (subject 33 years of seniority and 12) of STC in the initial phase.

Comparing the cases found in the study group with the control population (8) a statistically significant difference

Table 1 - Analysis of risk factors: frequency (number of actions per minute), force and posture.

Task	Min.	Frequency		Intensity of effort (Borg)		Postural Risk Score							
		Right	Left	Right	Left	Shoulder		Elbow		Wrist		Hand	
						Right	Left	Right	Left	Right	Left	Right	Left
Singeing	300	15	37.5	2	2	0	4	0	0	1	16	7	12
Preparation	300	60	16.4	3	2	4	0	4	4	0	0	11	8
Hung on a hook	300	20	15	3	2	4	4	4	4	0	0	8	8
Boning 1	300	37	30	2	1	4	8	8	8	16	16	11	8
Boning 2	300	82.5	67.5	2	3.5	4	8	8	8	16	16	11	8
Boning 3	300	82.5	67.5	2	2	4	8	8	8	16	16	11	8
End-of-line	300	82.5	67.5	2	2	4	4	8	8	16	16	11	8

for the two cases of carpal tunnel syndrome ($p < 0.015$) for the 5 cases of nocturnal paresthesias ($p < 0.0000$) and for the 6 cases of nighttime pain ($p < 0.0000$) was observed.

Discussion

The clinical investigation, on people working in pig head processing showed a high prevalence of diseases and disorders of the upper limbs. In fact the two cases of carpal tunnel syndrome found are significant, one worker of 33 years and 12 years seniority, subject to the other in 32 years and 12 years seniority, especially when you consider that workers with seniority work of more than just the shareholders. The nocturnal paresthesias related to the hands, even in the absence of objectivity, as prodromal symptoms of carpal tunnel syndrome, observed in 4 cases (28.6%), two with seniority of 12 years and two with less seniority are equally significant. This result well correlates with risk analysis that showed an high frequency of actions and a commitment to high postural upper limb together with a failure recovery time. In workers with higher seniority no disorders were seen probably because of exclusively concerned shareholders workers who, while performing the same tasks, perform, unlike other workers, a rotation in tasks to replace absent workers and do more for recovery perform other tasks, including organizational and managerial.

The results obtained from the study show that there is a risk factors of biomechanical overload of the upper limbs significant in the processing examined.

Conclusions

Both assessment in the clinical investigation showed an elevated risk for upper limb disorders, especially those affecting the wrist. However, since we considered a very special processing, the study would need further confirmation given the limited nature of the sample.

In fact, the data should be verified in a larger working population.

This figure confirms that the adoption of preventive solutions such as a rational distribution of recoveries (preferably hourly) and the alternation of tasks with the rotation of workers on more tasks are able to greatly reduce the risk of biomechanical overload of the upper limbs (1, 4). Of course, for the prevention of musculoskeletal disorders of the upper limb in this sector particular attention should be paid to the use of knives to be ergonomic handle covered with material that promotes adhesion without compressions on the hand. In this regard, OSHA recommends the use of knives with curved handle that allow workers to keep their wrists straight while reducing the strain on the tendons of the wrist and ulnar deviation of the hand postures. It is also important to keep the blades sharp by sharpening the knives several times a day and in any case as soon

as you feel fatigue and heaviness on the wrist. Moreover, do not neglect the training, information and training of workers on the proper use of knives and education to practice sharpening knives at the first signs of fatigue of your wrist. The use of the sharpener, especially by less experienced workers may be a transaction involving a significant number of actions that aggravate the repetitiveness.

Even the use of steel mesh glove on the non-dominant hand, while essential to prevent injuries from cutting may be annoying to some workers and prove an additional element of risk.

The key issue is health surveillance for workers with the scheme proposed by OSHA that provides an initial examination pre-assumptive followed by a recheck after the training period and subsequent checks at least every 2-3 years or at the request of the employee from the first symptoms to formulate a diagnosis early and move towards specialized in-depth and to appropriate therapies.

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