ASPECTS REGARDING THE PREVENTION OF THE LABOUR ACCIDENTS WHEN TREE CUTTING

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RESEARCH ARTICLE

Abstract

Operational health and safety are essential for maintaining a high degree of physical, mental and social well-being of workers in all occupations. This involves identifying workplace risks and taking measures to prevent accidents. In this paper, the risk factors in the case of chainsaw workers from the experimental bases belonging to the National Institute for Research and Development in Forestry "Marin Drăcea" were highlighted. Following the application of the calculation method, a global risk factor of 2.89 was obtained, a value that places the occupation of mechanical shaper in the category of medium-risk jobs. At the same time, the factors that exceed this value were identified and analysed. Also, the risk factors on the components of the working system were analysed, respectively the risk factors specific to the executor, the work environment, the factors required to the means of production and those specific to the work load. From the analysis of the Evaluation form, it is found that 25 of the identified risk factors (62.50%) can have irreversible consequences on the performer (disability or death). Compliance with occupational health and safety regulations is the way to minimize accidents or even eliminate them.

Keywords: chainsaw workers, mechanical shapers, risk factors, forestry sector, safety and health at work
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INTRODUCTION

In forestry activities, which are quite diverse and involve the usage of machinery from the simplest to the most complex, wood harvesters are exposed during the performance of their work tasks to many and varied risk factors. The choice of machines for felling trees is made according to their dimensions, terrain relief, etc. Because of these causes, within wood harvesting activities, work accidents occur frequently, and are generally very serious because the working conditions are difficult, also. Thus, the European Agency for Health and Safety at Work (EU-OHSAS - European Agency for Safety and Health at Work) shows that the number of accidents and occupational diseases encountered in forestry workers far exceeds those in other sectors of activity (***, 2020; Iftime, 2020). The high rate of bodily injuries, occupational diseases and fatal accidents is produced by repeated exposure to an unfavourable environment (Tsioras et al, 2014; Laschi et al, 2016).

The operation of felling trees is considered the most dangerous from the point of view of worker safety, but also the one that produces the greatest damage, through the impact that the felled tree has on other trees when it falls (Timofte et al, 2017). When the tree felling operation is carried out, all its stages must be in a visible frame to ensure protection for the workers, but also to realize the direction of the tree fall in the desired direction in safe conditions (Timofte et al, 2017).

Mechanical shapers represent the category of forest workers involved in most of work accidents because the working conditions are difficult and the effort made by them is intense. Such conditions also determine a classification of the difficulty of work taking into account energy consumption, identifying categories of hard and very hard work (Grzywinski et al, 2016). The activity of mechanical shapers is accompanied by exposure to carbon monoxide, noise, vibrations, etc. The effect of these factors manifests itself differently from one worker to another and depends on the level and time of exposure, pre-existing conditions and whether they wear protective equipment or not (Ulutasdemir et al, 2015; Dabrowski, 2015; Iftime, 2020). Moreover, the environmental, physical and physiological factors in which the mechanical shapers work determine the appearance of conditions located at the level of the vascular, nervous, muco-skeletal and auditory systems (Fonseca et al, 2015; Iftime, 2020).

Exposure to carbon monoxide from power saws causes the health of the works to deteriorate over time. The high level of noise and vibration leads to the occurrence of Raynaud's syndrome and bilateral hearing loss which are occupational diseases (Malinowska-Borowska et al, 2012; Iftime, 2020). The vibrations to which mechanical shapers are exposed on a daily basis have the effect of numbness, tingling in the fingers, which shows vascular and neurological damage (Su et al, 2014).

Environmental factors in which mechanical shapers work such as terrain characteristics, weather conditions, etc. cause an additional physical effort with different intensity. The action of external factors on the mechanical shapers can influence his performance, his physical condition and his working time (Câmpu & Robb, 2022). These factors, especially those related to the terrain characteristics, lead to the usage of difficult body positions during work, often forced, depending on the terrain conditions. Over a long period (20-25 years), due to difficult working positions such as bending the body, twisting the trunk, etc. there is an additional risk to the health of the mechanical shaper leading to musculoskeletal disorders. Added to these is the weight of the mechanical saw used.

The specialized literature (Gallis, 2006; Grzywinski et al, 2016) mentions the fact that the symptoms of musculoskeletal conditions are manifested in mechanical shapers in the area of shoulders, neck, back and knees. If the mechanical shaper has a precarious level of professional training, such symptoms are also amplified by the stress at work. Correct and timely training of the worker can reduce the negative effects on health and prevent an accident.

The working posture when felling trees can cause an additional physiological load on the mechanical shaper. Thus, it was found that a working posture with a bent back and semi-flexed legs leads to the highest physiological load and that with semi-flexed knees to the lowest (Grzywiński et al, 2017). The results of national (Cheța et al, 2018) and international (Sawastian et al, 2015) research show that osteomusculo-articular disorders occur due to faulty wood harvesting workstations.

Occupational health and safety is a priority concern at the level of any specialized institution, being an activity with a very high socio-economic impact. Ensuring adequate protective measures and means has positive effects for the safe conduct of work processes by reducing exposures to risk factors, awareness of risky behaviours and prevention of premature wear of the body.

The objective of the research was the analysis of risk factors in the case of mechanical shapers within the experimental bases belonging to the National Institute for Research and Development in Forestry "Marin Drăcea" (INCDS). The paper takes into account the risks to which mechanical shapers are exposed, the calculation of the global risk level and the analysis of risk factors for each category in order to reduce them and prevent work accidents.

MATERIAL AND METHOD

The method used in the risk assessment was the INCDPM Bucharest method, which consists in identifying all the risk factors that appear at the workplace and analysing them based on combinations of the frequency of occurrence and the severity of the maximum consequences on the human body. The application of this method is completed with the Job evaluation form in which the global risk levels for each job are given. The job evaluation form is the basis of the program for the prevention of work accidents and occupational diseases for each individual job (Darabont et al, 2001). The method is used for starting a new activity or a job but also for exploiting the existing job.

The stages that this method involves are the following: (1) establishing the evaluation committee; (2) defining the analysed system; (3) identification of all risk factors at the workplace; (4) identification of occupational risks and illness of staff risks; (5) the ranking of risks and the establishment of priorities for their prevention; (6) proposing measures to prevent risks found following their identification.

The work tools used in the risk assessment of a job are (Darabont et. al, 2001): (1) the risk identification list; (2) the list of possible consequences of the action of the risk factors on the human body; (3) rating scale of severity and likelihood of consequences; (4) risk assessment grid; (5) the scale of ranking risk and security levels; (6) job description; (7) the sheet of proposed measures.

The global risk level (No) at the workplace is calculated as a weighted average of the risk levels established for the identified risk factors. In order for the obtained result to reflect reality as accurately as possible, the rank of the risk factor is used as a weighting element, which is equal to the risk level (Moraru et al, 2002), according to the relationship:

$$N_g = \frac{\sum_{p=1}^{n} r_p \cdot N_{sp}}{\sum_{p=1}^{n} r_p}$$

where: r_p – job rank "p" (equal in value to the risk level of the job);

n – the number of analysed jobs;

N_{sp} – the average level of job security for job "p".

In order to establish the necessary measures to improve the security level of the analysed work system, it is necessary to take into account the hierarchy of risks evaluated according to the Scale of classification of levels risks/security of work in the order:

- 7 – 1 if operating with risk levels;
- 1 – 7 if operating with security levels.

RESULTS AND DISCUSSIONS

The global risk level (No) calculated following the application of the INCDPM Bucharest method for the job of mechanical shaper is 2.89, a value that places it in the category of jobs with a medium risk level, not exceeding the acceptable value (3.5) (Figure 1). The result is supported by the "Evaluation form" from which it can be seen that out of the total of 39 identified risk factors, 3 exceed, as a partial risk level, the value 3, falling into the category of high risk factors (partial risk level 4). The 3 risk factors that are in the unacceptable area are:

F.1. Functional movements of work equipment (organs of machines in motion): hitting, crushing, gripping;

F.10. Flames (faults in electrical installations, ignition of wood storage);

F.14. Dangerous plants and animals (vipers, dogs, bears, wolves, wasps, ticks).

The identified risk factors lower than the average value (2.89) are 12 in number, some of them being related to environmental conditions such as natural lighting, air currents, variable temperature, which can increase or decrease on the period of a working day etc. All these factors influence the performance of the activity but are not factors with a high level of risk.

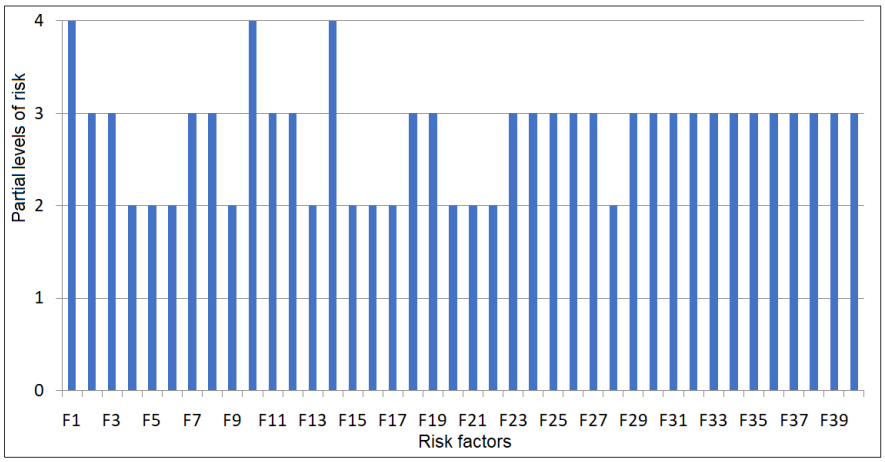

Figure 1. **Partial levels of risk presented by risk factors, for the chainsaw worker**

By comparing the factor obtained for the experimental bases taken into account with other results derived from research also carried out for chainsaw workers (Iftime, 2020), which obtained a factor of 3.31, it is found that some results have differences of approximately 8%. The difference between the two assessments is 0.42%, which means that some risks have decreased or have been eliminated.

The analysis of risk factors on components of the work system shows some similarity with those obtained from the specialized literature (Figure 2). The executor's own risk factors calculated for the analysed experimental bases are 30.00% slightly higher

than those calculated in other researches which are 27.59% (Iftime, 2020). This shows that the performers, respectively the chainsaw workers, may have a lower qualification, may have a harder time adapting to work with new machines and technologies, or it is possible that the implementation of safety and health at work is deficient. At the same time, the age of chainsaw workers can also contribute to the increase of this factor, which is quite high, on average around 52 years.

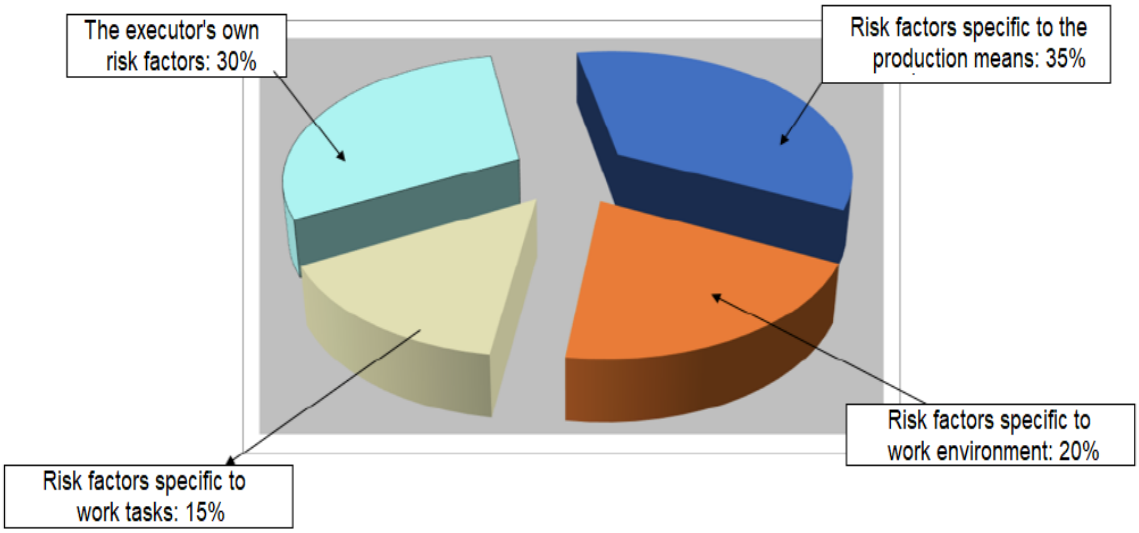

Figure 2. **The proportion of risk factors on the components of the work system**

The characteristic factors of the work environment resulting from the calculation for the experimental bases are represented in percentage of 20.00%. Compared to other studies (Iftime, 2020), where a factor of 27.59% was obtained, it can be concluded that within the experimental bases the works are carried out in better conditions for the exposed personnel, the work performed by the chainsaw workers and the working conditions are better and tree felling operations are in less dangerous areas and that do not require intense or great physical effort.

The factors due to the means of production obtained for the experimental bases are in percentage of 35.00%, quite high compared to other researches that obtained 27.59% (Iftime, 2022). This percentage may be due to the use of machines that do not have effective safety systems, are outdated or not properly used. Added to this, there is a weaker professional training of some chainsaw workers resulting in ignorance of the performance of the chainsaw. Related to the factors specific to the workload, they have a percentage of 15.00%, slightly lower than that presented in other studies (17.24%) (Iftime, 2020).

Based on the results obtained following the analysis, some measures can be adopted to reduce the identified risks that are high. To reduce or eliminate the 3 risk factors that are in the unacceptable range (F1, F10, F14), the measures presented in the Form with the proposed measures are necessary. From the analysis of the Evaluation form, it is found that 25 of the risk factors (62.50%) identified can have irreversible consequences on the performer (disability or death). At the same time, a reduction of the other risk factors is required so that no more work accidents occur.

CONCLUSIONS

In the forestry sector, the work tasks for workers involve a great effort over a long period of time. Also, direct actions on workers' health are produced by environmental factors, bad postures during work and musculoskeletal conditions. For chainsaw workers the most common risks are high noise level, vibration, carbon monoxide exposure and work microclimate.

In order to reduce the risks of injury of chainsaw workers, it is necessary that the medical supervision of their health status to include several types of analyses and additional investigations, especially for workers who already have health problems. It is also required to equip them with high-quality protective equipment to ensure effective protection of workers against occupational risks. Clothing

must be comfortable, lightweight, yet allow the worker to perform their work tasks and provide increased protection at higher cutting speeds of the chainsaw. In order to avoid loud noises, protective audio systems equipped with radio communication systems must be used. Footwear must be moisture resistant and provided with metal protection. Gloves must be worn to limit vibrations.

In addition to wearing protective equipment, communication of any event related to occupational safety and health can be the boundary between life and death (Lesch, 2005). If events are communicated in time, risks and dangers can be reduced or even eliminated, thus avoiding both economic damage and injury to personnel and their capacity.

In our country there is a legal framework that regulates the field of safety and health at work. Among these can be mentioned: (1) Law no. 319/2006 on occupational safety, with subsequent amendments and additions, (2) Government Decision no. 1425/2006, for the approval of the Methodological Norms for the application of the provisions of the Labour Security Law no. 319/2006, with subsequent amendments and additions, and (3) Order no. 3/2007 regarding the approval of the Form for registering work accidents.

The minimum conditions that any entity that carries out activities that involve the use of human labour must comply with are provided in the following documents: (1) Government Decision no. 1091/2006 on minimum safety and health requirements for the workplace; (2) Government Decision no. 1146/2006 regarding the minimum safety and health requirements for the use of work equipment by workers; (3) Government Decision no. 1048/2006 on the minimum safety and health requirements for the use by workers of individual protective equipments at the workplace; (4) Government Decision no. 971/2006 regarding the minimum requirements for safety and/or health signalling at the workplace.

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