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THE EFFECT OF STATIC PHYSICAL WORK ON THE WORK SAFETY

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Abstract: Physical activity is an inseparable sphere of human life, and is not rarely associated with work. Evolution has adapted man to perform various activities that meet their life needs. Man is created for walking, sitting, lying and standing. All these activities should take place in turns. Physical work should be varied in terms of dynamics and not limit people to stay in one position while performing work. The position changes, among others, to increase blood pressure, in addition, stimulates the heart and respiratory system, as well as improves the efficiency of both physical and mental work. In turn, taking only one position for a long time, which often occurs in static physical work, causes many health problems. For musculoskeletal disorders related to a non-ergonomic work position and a forced position at work, every fourth employee in Europe complains. In Poland, musculoskeletal disorders are one of the most common causes of absence at work. In Polish enterprises, the assumption that profit is the most important is still dominant. Man is rarely seen as the most important capital of an enterprise that needs to be taken care of. For many employers, all additional measures related to shaping safe working conditions are only costs, not investment and potential profit. This paper presents the effects of static physical work in relation to work safety in the light of publicly available reports and information. The review has been enriched with the results of research carried out in one of the production enterprises of the SMEs sector. The research results presented in the paper are pilot and constitute an introduction to a large research work.
Keywords: work safety, static physical work, musculoskeletal disorders

1. WORK AND PHYSICAL EFFORT - INTRODUCTION

Work is a deliberate human activity that takes place in conjunction with external environment factors. This action leads to the satisfaction of human needs and the production of specific tangible and intangible goods (Krause and Profaska, 2012). The literature on the subject defines work as successively in time and space the interaction of people, means of work and objects of work for the implementation of specific goals and tasks. These tasks may relate to individual, team, mental, monotype, dynamic and static

physical work. Physical work is not in itself something that threatens man by definition. However, too much workload can be such a threat. Especially when the employee is dealing with static physical work, which dominates the tasks they perform. Static physical work is work that is performed by the force of muscles held in a stable position with the participation of isometric contractions, which does not cause a change in muscle length but a gradual increase in muscle strain (Górski, 2006; Jackson et al., 1997; Markowska-Dyner, 2019). Physical work according to the effects on humans can be (Meerding et al., 2005; Wykowska, 2009):

- harmful factor - physical work which may cause occupational diseases of the musculoskeletal system caused by the way the work is performed;
- dangerous factor - physical work, which may be the cause of accidents at work, e.g. excessive physical exertion;
- troublesome factor - physical work, which may cause e.g. discomfort, fatigue, decrease in psychophysical ability.

When considering the physical load, the type of application should be taken into account - static, dynamic, monotype, etc. It should also take into account the organization of work and the frequency of repetition of operations. In the activity subject to physical stress, the characteristics of natural persons such as physical abilities, fitness, age, sex and health are also very important. The level of harmful substances for health, position at work and energy expenditure should also be added to this group of products (Koradecka, 2009; Luger et al., 2019; Makowiec-Dąbrowska et al., 2007; Teymourian et al., 2017).

The load of physical work (especially static) causes the risk of developing musculoskeletal discomfort (Hellig et al., 2018). According to the European Agency for Safety and Health at Work, one in four people working in Europe complains of musculoskeletal and back pain (EU-OSHA 2019).

In turn, data from the European Review of Working Conditions indicate that as many as 46% of working Europeans take uncomfortable or painful body positions for at least a quarter of their working time, 62% of them are exposed to repetitive movements of hands and arms, and 35% to carry heavy loads (EUROFOUND 2010). In Poland, on the other hand, musculoskeletal and connective tissue diseases are the third most common cause of total inability to work - 15%, right after cardiovascular diseases - 21% and mental diseases - 16% (ZUS 2010). The literature on the subject presents numerous examples of methods for assessing the risk of musculoskeletal disorders, dividing them into (Brand et al., 2017, Górska, 2012):

- static load testing methods - REBA method, RULA method,
- static load and monotype testing methods - OWAS method and "risk mapping" method,
- methods for testing monotypicity - the OCRA method and the JSI method,
- methods for testing manual heavy loads transfer - the LMM method and the NIOSH method.

Load static physical work (including monotype) is dangerous for the human body. In addition to the aforementioned musculoskeletal disorders, back pain in various sections, employees also complain of headaches, lack of concentration, numbness of the hands, carpal tunnel etc. They negatively affect broadly understood work safety (Enez and Nalbantoglu, 2019; Malińska, 2014).

For many years, employee well-being and ailments related to the work performed were treated with a grain of salt. For employers, managers but also employees of the OSH

service, the traditional OSH management model, limited to compliance with regulations, was sufficient. Unfortunately, despite this, the number of accidents still increased and the reason was on the side of the employees, especially their inappropriate behavior at work. Today, entrepreneurs are starting to pay more attention to the human factor, which for each enterprise should be the most important link in the work process and the largest capital of the enterprise. Unfortunately, there is still a lot to be done in front of many business entities in shaping the awareness of both employees and employers themselves. In large and medium-sized enterprises, OHS supervisors ensure safe working conditions, including static work. These issues are worst in small enterprises, where the lack of supervision or awareness of the fact that too much static physical work load has many negative consequences both for the employee and, as a consequence, for the entire enterprise (Hellig et al., 2018; Nevala et al., 2003; Ulewicz et al., 2015). Excessive physical workload, especially static work, along with many health ailments, may cause potentially accidents. Despite many technical and organizational safeguards, there are still accidents at work in enterprises. The causes of accidents at work are primarily seen in the human factor, especially in the inappropriate behavior of employees towards the tasks entrusted to them (Niciejewska and Klimecka-Tatar, 2017; Saja et al., 2020). Despite the fact that recent data show a decrease in the number of accidents at work in Polish enterprises, including accidents with fatal effects, there are still too many of them. Poland, compared to other European Union countries, is still in the top ten countries that report the highest number of accidents at work every year (EU-OSHA, 2019, GUS, 2019).

Increasingly, in large and medium-sized enterprises, OSH services are implementing programs that limit static physical work and minimize the negative effects of such work. In the smallest businesses that lack direct supervision or adequate awareness of employers and employees, the topic of too much static manual work is still a problem.

2. METHODOLOGY OF RESEARCH

The paper uses available information from publicly available reports on the subject matter. This information has been expanded to include the results of studies carried out using standardized direct interviews. The research has been carried out in one of the enterprises of the SMEs sector. Direct interview based on questions from the author's checklist. 18 production line employees participated in the study - the study was voluntary. A characteristic feature of respondent work is performing activities in a standing position, i.e. it has the character of static physical work with small elements of dynamic work in the field of upper limbs. In addition, the work performed can be classified as a monotype work. The questions asked during the study concerned the following issues:

- ailments related to the performance of professional work,
- causes of accident events in the opinion of respondents,
- ways of minimizing the effects of static physical work load.

The aim of the study was to determine whether the load of static physical work affects the health of the employee and thus the safety of their work.

3. RESULT AND DISCUSSION

The conducted research allowed to obtain the results utilized in the previously established three groups. They are presented in the following considerations: ailments related to the performance of professional work, causes of accident events in the opinion of respondents, ways of minimizing the effects of static physical work load.

3.1. Ailments related to the performance of professional work

In this part of the direct interview (ailments related to the performance of professional work), the respondents answered the questions asked. At the beginning, each employee was presented with separate rules for conducting the interview and the purpose of the study. The first question was whether the work done by the respondents caused them any discomfort at all? Almost all employees answered yes. Only two employees with the least seniority denied (up to 1 year of service). The results are presented graphically in Figure 1.

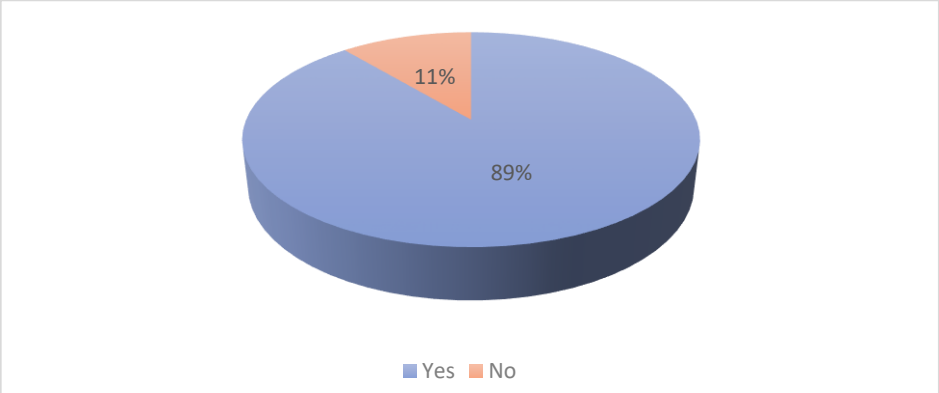

Fig. 1. Declaration of the occurrence of health complaints related to performing static work with elements of monotype, in the opinion of employees

Next, employees were asked what health problems related to work they identify. Employees could identify three different ailments that are dominant among all of them. Employees pointed out various ailments, however neck and back pain in the thoracic and lumbar spine most often appeared. Employees with the least seniority (up to 1 year of work and from 1 to 3 years of work) pointed only to occasional cervical pain. Other employees also considered lower limb and headache pain as health related to their work. Table 1 presents all the complaints reported by the respondents, together with an indication of the strength of these complaints, in the adopted 3-point pain scale.

Table 1.
Types of health complaints with the intensity of pain in the respondents' opinion

Types of health ailments	Scale of pain		
	Small - 1	Average – 2	Big - 3
Neck pain	2 employees		
Pain in the lumbar spine	4 employees	5 employees	7 employees
Pain in the thoracic spine	3 employees	9 employees	6 employees
Headache	5 employees	9 employees	4 employees
Numbness in the upper limbs	7 employees	8 employees	3 employees
Lower limb pain	5 employees	7 employees	6 employees

Source: Own study

Respondents for the most troublesome complaints (of the highest intensity) indicated "pain in the lumbar spine" as well as "pain in the thoracic spine" and "lower limb pain".

3.2. Causes of accident events in the opinion of respondents

Subsequently, employees were asked whether health complaints resulting from physical and static work could be the cause of potential accidents at work. All respondents agreed in the affirmative. The next question was, therefore, whether there were accidents at work in the last 5 years as a consequence of the physical static work load with monotype nature or already felt health problems related to the work performed. One employee pointed out a situation where sharp pain in the lumbar spine caused a fall at the press. As a result of the fall, the employee broke their right side of the forearm. It was a light accident at work. The employee who had an accident had the greatest seniority among all employees. In this group of questions used in the face-to-face interview there was also a question about the ailments that most significantly make the work performed less effective. Table 2 contains the respondents' answers.

Tabel 2.
Ailments related to the load of static physical work, which to the greatest extent cause a reduction in the effectiveness of work in the opinion of respondents

Types of health ailments	number of employees – respondents
Neck pain	2 employees
Pain in the lumbar spine	6 employees
Pain in the thoracic spine	3 employees
Headache	1 employees
Numbness in the upper limbs	6 employees

Source: Own study

It turns out that in the respondents' opinion, the complaints that can reduce the effectiveness of their work to the greatest extent are "pain in the lumbar spine" and "numbness in the upper limbs".

3.2. Ways of minimizing the effects of static physical work load

In the next group of questions, employees formed a list of ways to minimize the potential effects of their static physical work with elements of monotype. The questions that were asked of them, together with comments supplementing those questions, allowed to formulate the aforementioned list, which is presented in Table 3.

Table 3.
Ways to minimize the effects resulting from static work load with elements of monotype

No	Ways of minimizing the effects of static physical work load
1	during breaks, performing activities that require actions other than those that are routine activity
2	taking care of appropriate working conditions (e.g. temperature and air quality, noise, lighting of the workplace), which additionally intensify the potential negative effects of static work load with elements of monotype
3	compliance with break time
4	if possible, introduce rotation at work stations
5	more frequent breaks that cause rapid regeneration of strength and concentration
6	diversifying the "climate" in the work environment – e.g. playing quiet music that is conducive to work
7	social support, e.g. sports employee passes

Source: Own study

The obtained results gave the opportunity to create the above list of suggestions on how to minimize the effects of static work load with elements of monotype. The list is an excellent collection of information regarding both employees' awareness of the topic taken up and a collection of information for employers, which can be incorporated into the employee life of the company. Respondents' proposals are nothing more than expecting changes in the scope of the problem.

Static physical workload with elements of monotype is very dangerous for both health and life of employees. Muscle fatigue is a source of disturbance to the rhythm and precision of movements. A person who performs static physical work with elements of dynamic work of a monotype character, i.e. repetitive, is exposed to faster fatigue. This fatigue, in turn, causes less employee efficiency (Terman, 2014). It is also the cause of many accidents and bodily injuries excluding employees for a longer period of time. Static physical work is not dangerous until its percentage share in the whole work process does not exceed 30%. If, in addition, it is a job that engages a specific, one muscle part to perform tasks, and is a repetitive work, then there may be an additional psychological burden. Tiredness, boredom, repetition of activities, back pain - all this causes the employee to experience mental discomfort and frustration. Physical fatigue is manifested by biochemical muscle modification, loss of energy reserves, overheating of the body (dehydration). In turn, mental fatigue is primarily a decrease in the level of motivation, a decrease in the ability to think logically, the possibility of emotional disorders, or a decrease in concentration. All these elements can cause numerous human errors in the work process. The monotypic nature of working movements also causes fatigue - caused by the lack or uniformity of stimuli and actions, a decrease in vigilance and its response time increases.

Attention should also be paid to the characteristics of employees, which often have an impact on the adaptation of certain working conditions and dealing with threats, even those related to the performance of static physical work with elements of monotype. In this case, the age of the employees and gender should definitely be mentioned. There are types of jobs that are less adapted to the groups of employees than other employees. Both women (especially pregnant women and nursing mothers) and older workers are less able to minimize the effects of this type of work than other employees (Łastowiecka-Moras, 2019). Of course, this is a very extensive topic and certainly worth a separate scientific position. However, it should be remembered that features such as the age and gender of the employee do not rarely limit the possibility of minimizing the effects of work performed in the form of health ailments. There is a great need to make employees and employers aware of the topic.

4. CONCLUSION

In the light of the reports presented and the results of the tests carried out, recommendations can be made to prevent or minimize the effects of static physical work load with elements of monotype.

In addition to work rotation and compliance with break time. An appropriate action of employers would be training, on the subject of this work, dedicated to both themselves and employees. In addition to training, a very important activity that is observed especially in large enterprises are employee visits to specialists in both ergonomics and work physiology. Employers should provide the opportunity to consult specialists and ergonomists who discuss their work in an accessible way, the effects of poor performance of tasks, or non-compliance with the rules imposed by the nature of the employee tasks

performed. Reliable information based on examples and specific recommendations are the basis for shaping safe working conditions and minimizing the negative effects of its performance in the form of health ailments that can lead not only to a decrease in the effectiveness of work performed but also to accidents at work.

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