

Conference Paper

Assessment of Musculoskeletal Disorders and Fatigue of Workers in Creative Industry of Carving Wood in PK Novi Cilegon, Banten

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Abstract

Every company tries to improve its profit continuously. Improving profit does not guarantee that health of workers will also improve. Moreover, in the activities of some industries are only profit oriented, and the health condition of workers are not considered in every work activity. It happened similarly to creative industry of carving wood, where until now 'tatal' has become a serious problem in finishing the activity of carving wood. Some efforts are needed to minimize the inhalation of tatal dust by workers directly. The direct impact to workers are excess of muscle movements and unnatural body movement resulting musculoskeletal disorders and work fatigue. The objectives of this research are to assess musculoskeletal disorder and general worker complaints that are complemented by three assessment of aspects, that is, weakening of activity, decrease of motivation, and physical exhaustion in order to give recommendation to improvement of worker productivity and company profit. The design of this research is cross-sectional. It is a research method to study the correlation dynamics of risk factors and effects through observation approach or data collection at one time (point time approach). It means that each subject is observed only once, and the measurement is made on the subject variable status at the time of examination. Result showed that average score of musculoskeletal disorder is 58.75 ± 6.75 , general fatigue is 79.5 ± 1.3 , where weakening activity is 28.75 ± 4.25 , decrease of motivation is 24.75 ± 4.75 , and physical exhaustion is 26.00 ± 4.00 . Recommendation: need of working condition improvement such as design of dust collector so that worker is healthy and performance more optimal. This improvement would impact to decrease musculoskeletal disorders and worker fatigue, and decrease the insurance cost.

Keywords: musculoskeletal disorders, fatigues, motivation, physical exhaustion

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1. Introduction

In addition to increasing profits, companies also need to consider the health of their workers. The increased profit has not guaranteed the employees' health will increase as well. However, some small industries are oriented to profit only, thus the health conditions of the workers have not become the center of consideration.

The problem faced by the wood carving industry up to now is the wood dust of '*tatal*' (woodchip). It is still being a problem in wood carving completion activities, therefore an effort to reduce the occurrence of woodchip dust inhalation by the workers is needed. Dust in the form of *fly ash* is often found in manufacturing industry [1]. The improvement of work environment has not reached the effort to increase a new added value to maximize the resources within the company [2]; Work improvement has an impact on enhancing the workplace performance and workers' physiological conditions [3]. In developing their business and products, companies should pay attention to the environment so that environmental conditions remain healthy for the worker [4]. When the workers inhale the dirty air, they could not optimally complete their work, so that they are not able to meet the targets as planned, in other words their productivity decreases. The occurrence of work discomfort in the form of declined occupational health makes the workers often absent due to respiratory illness, company profits become not maximal, and the cost of workers' illness treatment is high in each period.

Besides losing productive hours, the companies are also experiencing decreased product target, however the product demands keep increasing. The companies need an effort to reduce the woodchip impact not to be directly inhaled by the workers. This work improvement is expected to provide benefits that the concentration of workers will be higher, occupational health will be increased, and company profit growth will be healthier.

The direct impact received by the worker is a problem of excessive muscle movement, unnatural movement of the body, resulting in musculoskeletal disorders of work stress conditions and increased workloads as stated in [4], work stress conditions may affect upper musculoskeletal disorders, while an increased workload causes musculoskeletal disorders [5]. As a result of prolonged fatigue, it will simultaneously decrease the body's immunity [6], resulting in reduced worker concentration as evidenced by the onset of work errors or decreased work performance.

This uncomfortable work movement has a continuing impact of decreasing job performance characterized by in-effective movement and slow work activity. It triggers high potential of occupational accidents due to uncomfortable working conditions,

resulting in the insurance costs incurred by the company to be over budget. Companies do not only lose the productive hours of workers but also experience decreased product targets.

One solution that needs to be done is by employing ergonomic participatory approach, in which it explores ideas to obtain solutions to the productivity gains and profitability of the company based on musculoskeletal disorders rate and work fatigue assessment viewed from decreased activity, decreased motivation, and increased physical fatigue aspects. Participatory ergonomics is often known as empowerment of all parties/interdisciplinary so that the results obtained have optimal usability and new problems do not arise anymore. Holistic and interdisciplinary researches are for endurance in the coming period [7].

2. Methods

2.1. Research design

This research employed quantitative research methods where the research required the use of numbers, ranging from data collection, interpretation of the data, to the presentation of research results. Quantitative research methods are used to examine a particular population or sample. Sampling technique is generally done randomly, the data gathering employs research instruments, and the data analysis is quantitative/statistical with the aim to test the predefined hypothesis [8]. This research used cross sectional method. It is a research method to study the correlation dynamics of risk factors and effects through observation approach or data collection at one time (point time approach). It means that each subject is observed only once and the measurement is made on the subject variable status at the time of examination. The purpose of this research was to observe the relationship of risk factors and the consequences in form of a particular disease or health condition simultaneously [9].

The steps of cross-sectional research are a) Identifying research variables and identifying risk factors and effect factors, b) Determining research subjects, c) Conducting the observation or measurement of variables that are risk factors and effect factors simultaneously based on variable status at the time of data collection, d) Conducting correlation analysis by comparing the proportion among groups of observations [8].

3. Results

3.1. Musculoskeletal disorders

The ergonomic study begins with the identification of tasks, followed by observations on work organization and work environment as assertions [10] in which from the task up to some work performance degradation need to be of concern, including environmental condition which highly affects the workers' health especially on the aspect of breathing [11]. The result showed that the average score of musculoskeletal disorder on workers is 58.75 ± 6.75 .

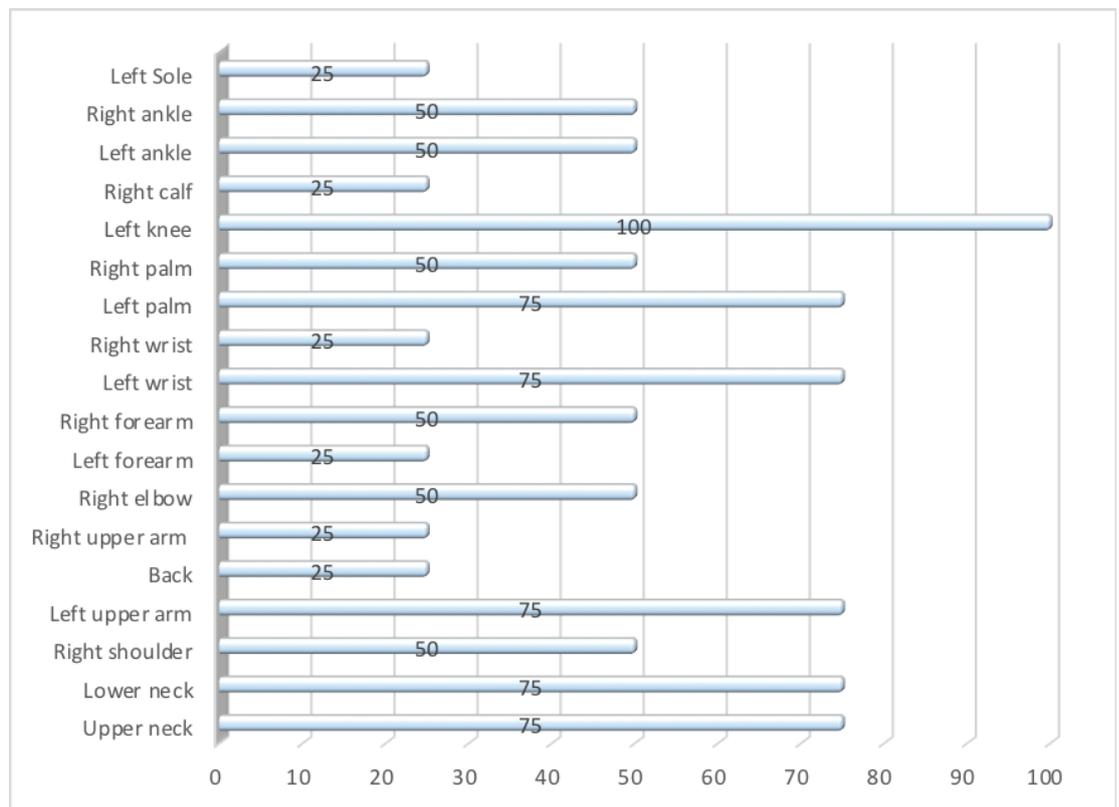


Figure 1: Musculoskeletal disorders in the worker's body (n = 75).

3.2. Employee fatigue

The result of work fatigue level showed that the average general fatigue score was 79.5 ± 13 . The average of fatigue rate on 3 aspects of fatigue including weakening activity was 28.75 ± 4.25 , decreased motivation was 24.75 ± 4.75 and physical fatigue was 26 ± 40 . It means there is a potential of decreased working performance especially in the employee fatigue level. This factor occurred because the job completion process

was in dusty environment conditions. The location of employee’s fatigue, the feeling of pain in certain parts of the body, is varied.

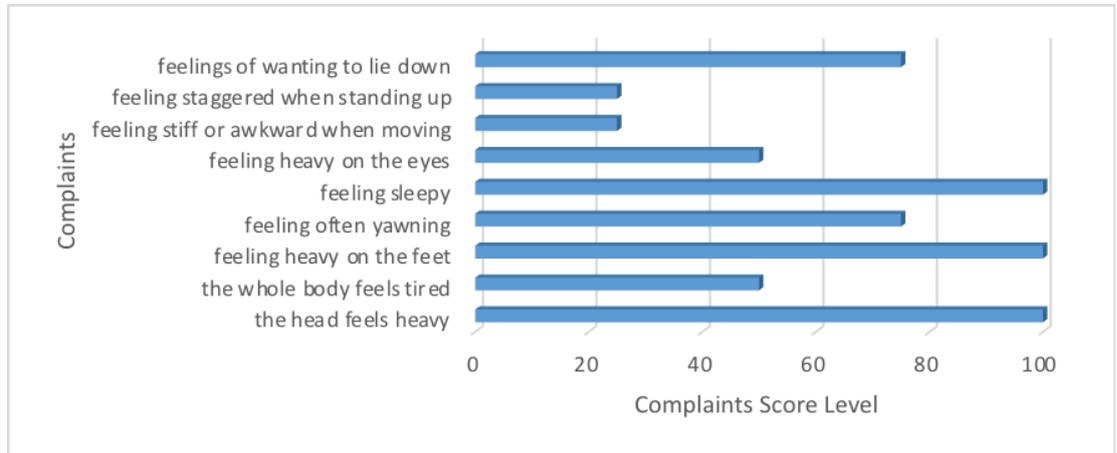


Figure 2: Weakening activity (n = 75).



Figure 3: Decreased motivation (n = 75).

4. Discussion

A variety of machinery activities in the wood carving creative industry produces side effects of woodchips dust which is harmful for the development of workers’ health conditions. The dust size of 0.3–0.6µ will be inhaled by the nose and passes the initial nose screen to enter the pulmonary alveoli, whereas the dust size greater than 0.6µ

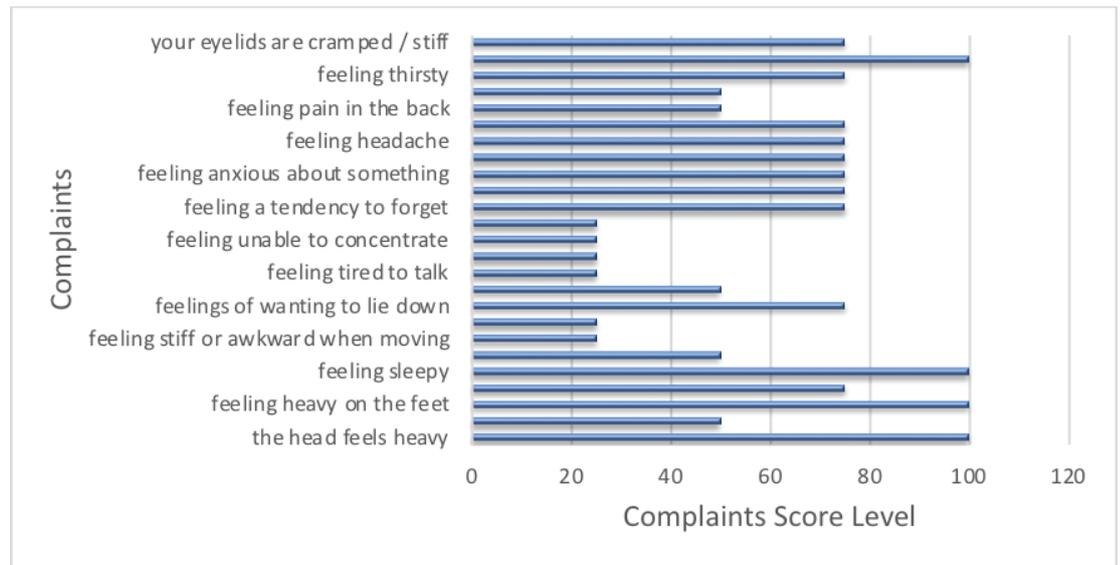


Figure 4: Physical fatigue (n = 75).

is retained in the respiratory tract and causes respiratory tract obstruction [12]. This condition causes the respiratory process to be disrupted [13, 14].

The perceived impact of additional workload workers is greater than the main workload. The worker feels that the workload is heavy resulting from inhaling the woodchip dust directly. Automatically the working process or cycle time of product completion will be hampered, and the worker productivity will decrease as a result of unhealthy environment condition. The final result does not match the target which means the company's productivity will decrease, the company's profit is not maximal. The woodchip dust that causes the workers to be disrupted in finishing the products also affects the companies, for example they need to spend a sum of money to heal the workers.

If these environmental conditions continue without any improvement within 3 to 5 years, it will affect the health condition of the workers and human including bronchitis, asthma. There is a decrease in health, especially in the respiratory part [15]. Therefore, it is necessary to measure regularly by taking samples of air pollution especially on the respiratory zone [16]. In addition to losing labors, this condition can also affect the production process not to be optimal. The application of a dust-catching device with human-focused design as a primary user is needed. The Dust Collector tool design with consideration of work comfort (ergonomics) uses the 6 TTG (Appropriate Technology) criterion principles [17].

Dust collectors for catching dust should consider humans as the primary users, since there are many tools on the market which are sold freely but only prioritizing the functionality without considering the user's comfort. Thus, when they are being operated the noise level exceeds the threshold, ignoring the work attitude.

The collected woodchips can be reprocessed into products that have high artistic and sale value, generally for making calligraphy or making handicrafts. The dust that can disturb the physiological condition of the worker can be managed so that it can improve the health and profit of the company. Along with the improvement of environmental performance, gradually the workers will experience the comfort of work that can be seen from the decreased musculoskeletal disorders [18], and the declined musculoskeletal problem [19].

The decrease in musculoskeletal disorders is also consistent with the decrease in work fatigue caused by adjustment of working conditions. Fatigue can be measured in subjective way through questionnaires and other forms [20]. Fatigue generally begins with peripheral muscle fatigue and is continued with massive muscular fatigue. This muscle fatigue can be recovered by reducing the impact of tension on the muscles that interact directly with the load [21].

Based on the analysis result of musculoskeletal disorders rate and worker fatigue, one of the recommendations given is the engine design should minimize the problem on worker health. The engine design takes into account the 6 principles of *TTG* (Appropriate Technology) criteria prioritizing the user convenience. The six *TTG* (Appropriate Technology) criteria are: (a) Technically, the designed tool is easy to be used, easy to maintain, reduces working environment hazards, (b) economically, the cost of the tool making and maintenance is affordable, (c) ergonomic, designed by considering human anthropometry (d) Socio Cultural, acceptable and can be operated continuously, (e) Energy-saving, (f) Environmentally friendly or not making noises above the environmental threshold because of using an electric motor.

The environmental aspect needs to be a consideration for the design [22] but the main concern in any product design with deeper vision is to prioritize human as the executor of the business organization wheel, for example the design of the engine that is designed with human priority as the main factor, the machine is functioned to minimize woodchip dust inhaled by the worker as a side effect of the process on the wood carving creative industry. This machine is a vacuum cleaner. The woodchip dust that causes the worker health problems can be reduced by means of suction with Dust Collector tool. The repair process involves all users (participatory ergonomics) starting on the assessment of the task or the type of main job. The productivity and

employee benefits increased in terms of changes in employee health levels along with the improved work attitude namely musculoskeletal disorders and work fatigue. The product and environmental designs that take into account the ability and limitation of human skill, affect the improvement of employee performance through improved occupational health.

It is necessary to enhance the working conditions through dust collectors design in order to improve the employees' health and work performance. This working conditions improvement can decrease musculoskeletal disorders and employee fatigue, optimize the employee benefits due to decreased health insurance costs, decrease the inhaled woodchip dust, and simultaneously increase the companies' profits. The level of musculoskeletal disorders and employee fatigue assessment in the wood carving creative industry can serve as a basis for recommendations for increased employee productivity and indirect company benefits.

5. Conclusions

Result showed that average score of musculoskeletal disorder is 58.75 ± 6.75 , general fatigue is 79.5 ± 1.3 where weakening activity is 28.75 ± 4.25 , decrease of motivation is 24.75 ± 4.75 and physical exhaustion is 26.00 ± 4.00 . Recommendation: need of working condition improvement such as design of dust collector so that worker healthy and performance more optimal. This improvement would impact to decrease of musculoskeletal disorders and worker fatigue, decrease of cost insurance

Conflict of Interest

The authors declare that they have no competing interest in this research.

Ethical Clearance

Sample involved in this research had already filled and approved *informed consent*.

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