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Work Posture Analysis using the RULA and OWAS Methods in the Cement Packing Section at the Packing Plant Indarung Unit of PT Semen Padang

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Abstract

PT Semen Padang is a cement manufacturer. According to preliminary observations, the cement packing process, which is done at the Packing Plant Indarung unit, is the last step of the cement production process. Due to the sideways and bowed body positions, cement bagging is performed manually with a less ergonomic working position. This is performed continuously, causing workers complaints of musculoskeletal disorders. The results of distributing the Nordic Body Map questionnaire to employees indicate that many operators experience pain due to their work positions. Based on these findings, the RULA method was used to analyze work posture, yielding a group A posture score of 7, a group B posture score of 4, and a final RULA assessment score of 7. The OWAS method assessment, meanwhile, earned a score code of 2141 and was categorized as a level 3 risk. The results of the risk assessment using the RULA method yield a score of 7, indicating that the operator's work attitude needs to change immediately, whereas the results of the assessment using the OWAS method yield a score of 3, indicating that work posture has a very significant impact on tension and needs to be corrected as soon as possible. On the basis of the results of these assessments, a recommendation was made to design a trolley work facility that can be utilized to reduce the risk of MSDs for cement packaging operators.

Keywords: *Musculoskeletal Disorders, Nordic Body Map, OWAS, RULA.*

1. Introduction

Cement packing occurs at the Packing Plant Indarung (PPI) unit as the concluding step in PT Semen Padang's cement production process [1]. According to the findings of a survey, the operator is required to stand while performing the cement bagging process because the body is in a sideways position when placing the cement bag into the machine [2]. The following poses a risk for workplace injuries as well as pain in the neck, shoulders, arms, back, and waist: These tasks are carried out by operators for seven hours a day. A bag that is next to the table is also picked up by the bagging operator and placed there without the use of a tool [3]. This is done continuously and repeatedly, increasing the risk of musculoskeletal disorders (MSDs), which are characterized by complaints of discomfort in the neck, back, abdomen, arms, and legs [4] [5].

This condition can reduce the productivity of cement bagging employees. Therefore, it is essential to conduct an analysis of work posture to reduce discomfort associated with performing activities in accordance with ergonomics-based good work posture. Based on these issues, work posture analysis is conducted using the RULA and OWAS methods. This study aimed to determine the outcomes of the operator's work posture risk assessment in the PPI cement bagging section using the RULA and OWAS methodologies, as well as the work facility design in the PPI cement bagging process [6] [7].

Ergonomics is a field of science that studies how to harmonize between humans and work and the work environment in order to create comfort, safety and prevention of injuries and health problems with the aim of increasing work productivity and a better quality of human life [8] [9] [10]. Posture and movement play an important role in ergonomics, with improper working posture and long working hours can cause workers to experience several musculoskeletal disorders and other disorders resulting in suboptimal production processes. In general, one of the leading causes of MSD symptoms in workers is an incorrect working posture, which initiates muscle disorders due to an increased workload [11][12][13].

RULA is a science developed in ergonomics research that studies and evaluates the working position of the upper body of workers. The main focus of the RULA assessment that is measured in detail is the posture of the shoulders or upper arms, elbows or forearms, wrists, neck and waist [14] [15]. The OWAS method is a work attitude analysis method that defines body movements of the back, arms, legs and the weight of the load being lifted. Each member of the body is classified into a working attitude. The purpose of using this method is to analyze the comfort level of work postures in workers and evaluate work postures [16] [17] [18].

2. Materials and Methods

The study was conducted at PT Semen Padang's Packing Plant Indarung (PPI) unit, which is located on Jl. Raya Indarung in Padang, West Sumatera, Indonesia, during the packing of cement. Observed was the work posture of the cement bagging operator, which included the process of placing the cement bag on the table and inserting it into the packer machine, to determine the risk of musculoskeletal disorders in employees. The research flow diagram can be seen in figure 1.

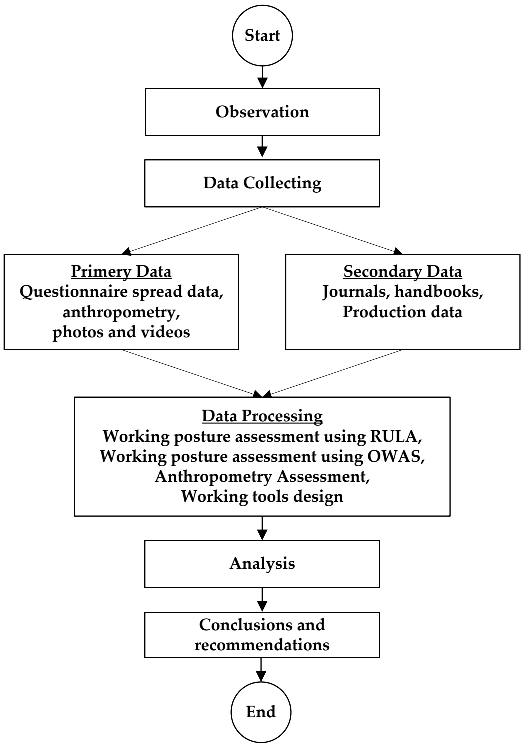

Fig 1. Research flow diagram.

3. Results and Discussion

There are fifteen workers in the cement packing section for ten packers and three operators for two packers. A Nordic Body Map questionnaire was distributed to operators in order to determine their complaints regarding the conduct of activities. According to the results of the recapitulation, more than fifty percent of employees complain of pain in the waist, the back, the shoulders, the legs, and the arms.

3.1. Work Posture Assessment Using the RULA Method

The RULA method for assessing operator posture at work involves determining the angles of the operator's posture while performing their tasks. Figure 2 below shows the operator's working position [19] [20].

Fig 2. Posture of the bag operator.

The assessment of the operator's work posture begins with an evaluation of group A's posture, which has a score of 7. This indicates that the operator's work posture poses significant risks and must be improved. In addition, an assessment of the body posture of group B, which yielded a score of 4, indicates that it poses a moderate risk and that improvements are required. Group A has an activity score of 1 and a load score of 0, so its total score is 8, while Group B has an activity score of 1 and a load score of 0, resulting in a total score of 5.

3.2. Work Posture Assessment Using the OWAS Method

Assessment of work posture with the OWAS method is carried out by analyzing the body posture movements carried out by operators in carrying out their activities. The first step is to analyze the operator's body posture as shown in Figure 3 below:

Fig 3. Bag transfer.

The stages of assessing work posture using the OWAS method can be seen in Table 1 assessment of attitude mode the following OWAS:

Table 1. Assessment of Work Attitudes of the OWAS Method

		Work Attitude																					
Back	Arms	1			2			3			4			5			6			7			Legs
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Load
1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	
	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	
	3	1	1	1	1	1	1	1	1	1	2	2	3	2	2	3	1	1	1	1	1	2	
2	1	2	2	3	2	2	3	2	2	3	3	3	3	3	3	3	2	2	2	2	3	3	
	2	2	2	3	2	2	3	2	3	3	3	4	4	3	4	4	3	3	4	2	3	4	
	3	3	3	4	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	2	3	4	
3	1	1	1	1	1	1	1	1	1	2	3	3	3	4	4	4	1	1	1	1	1	1	X
	2	2	2	3	1	1	1	1	1	2	4	4	4	4	4	4	3	3	3	1	1	1	
	3	2	2	3	1	1	1	2	3	3	4	4	4	4	4	4	4	4	4	1	1	1	
4	1	2	3	3	2	2	3	2	2	3	4	4	4	4	4	4	4	4	4	2	3	4	
	2	3	3	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4	
	3	4	4	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4	

3.3. Proposed Work Facility Design

The design of work facilities is based on the results of anthropometric calculations, namely the height of the trolley is 107 cm, the hydraulic height is 96 cm, the height of the hydraulic pressure setting is 96 cm, the width of the trolley is 50 cm, the width of the material container 60 cm, the length of the trolley is 88 cm, and the length of the material container is 78 cm. The proposed design of the hydraulic trolley work facility used in the cement bagging process can be seen in Figure 4 below:

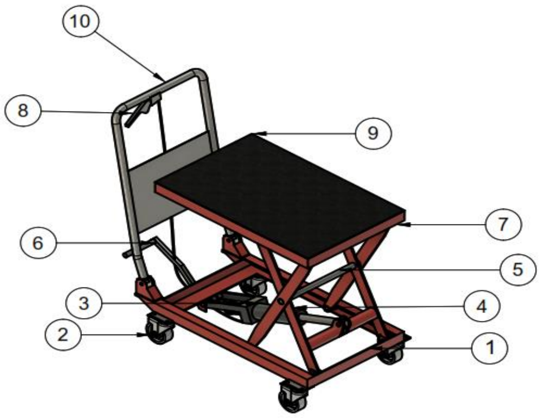

Fig 4. Hydraulic trolley.

Based on the proposed drawing, the following are the parts and functions of the designed hydraulic trolley:

1. The trolley frame is the main part of the trolley which is useful as a cross section of the elements on the hydraulic trolley.
2. The trolley wheels are useful for making it easier for users to move the trolley from one place to another place.
3. Hydraulic functions as a successor to the pressure on the load received by the trolley.
4. The retaining frame functions as a retainer for the material and a position for the material load.
5. The retaining shaft functions as a retainer for the position of the retaining frame and the connection of two retaining frames.
6. The hydraulic pedal functions as a hydraulic pump tool.
7. The material retaining frame functions as a barrier to the load received by the trolley and the position on the material.
8. Handrail trolley serves as a handle for the user when using the trolley.
9. The rubber base material functions as a position for the material so that the material does not shift easily or as an attachment to the material.
10. Hydraulic handle functions as a hydraulic rise and falls controller.

4. Conclusion

The conclusion that can be drawn based on the purpose of conducting the research is that the results of the assessment using the RULA method get a score of 7 where there needs to be a change now for work attitudes, while the results of the OWAS assessment get a score of 3, which means that work posture has a significant influence so that improvements are needed as soon as possible. Based on this analysis, one of the proposed ways of improvement is to design a work facility in the form of a hydraulic trolley to reduce complaints of musculoskeletal disorders in operators when carrying out cement bagging activities. It is hoped that this research can become a reference for companies in making decisions on improving operator work posture by providing work facilities to support the productivity and comfort of cement bagging workers.

References

[1] A. Setiawan, L. B. Suparma, and A. T. Mulyono, "Flood water resistance of asphalt concrete by using unconfined compressive strength test," in *Journal of Physics: Conference Series*, 2019, vol. 1175, no. 1, doi: 10.1088/1742-6596/1175/1/012022.

[2] M. Weiser, "Some computer science issues in ubiquitous computing," *Commun. ACM*, vol. 36, no. 7, pp. 74–85, 1993.

[3] J. Lahap, R. I. Azlan, K. A. Bahri, N. M. Said, D. Abdullah, and R. A. Zain, "The effect of perceived waiting time on customer's satisfaction: A focus on fast food restaurant," *Int. J. Supply Chain Manag.*, 2018.

[4] S. Kilbom, *Ergonomics Guidelines and Problem Solving*. 2000.

[5] S. Njaka, D. Mohd Yusoff, S. M. Anua, Y. C. Kueh, and C. O. Edeogu, "Musculoskeletal disorders (MSDs) and their associated factors among quarry workers in Nigeria: A cross-sectional study," *Heliyon*, vol. 7, no. 2, 2021, doi: 10.1016/j.heliyon.2021.e06130.

[6] M. Ijaz, S. R. Ahmad, M. Akram, W. U. Khan, N. A. Yasin, and F. A. Nadeem, "Quantitative and qualitative assessment of musculoskeletal disorders and socioeconomic issues of workers of brick industry in Pakistan," *Int. J. Ind. Ergon.*, vol. 76, 2020, doi: 10.1016/j.ergon.2020.102933.

[7] M. Landekić, S. Katuša, D. Mijoč, and M. Šporčić, "Assessment and comparison of machine operators' working posture in forest thinning," *South-East Eur. For.*, 2019, doi: 10.15177/seefor.19-02.

[8] S. S. Parker, "What Is Ergonomics?," in *Ergonomics in the Dental Office*, Wiley, 2022, pp. 1–5.

[9] M. Iqbal, I. Hasanuddin, A. Bin Hassan, M. S. M. Soufi, and F. Erwan, "The study on ergonomic performances based on workstation design parameters using virtual manufacturing tool," *Int. J. Integr. Eng.*, vol. 12, no. 5, 2020, doi: 10.30880/ijie.2020.12.05.015.

[10] A. C. Beyan, B. Dilek, and Y. Demiral, "The effects of multifaceted ergonomic interventions on musculoskeletal complaints in

intensive care units," *Int. J. Environ. Res. Public Health*, vol. 17, no. 10, 2020, doi: 10.3390/ijerph17103719.
[11] R. S. Bridger, *Introduction to Ergonomics*. 1995.
[12] M. K. Sain and M. L. Meena, "Occupational Health and Ergonomic Intervention in Indian Small Scale Industries: a Review," *Int. J. Recent Adv. Mech. Eng.*, vol. 5, no. 1, 2016.
[13] R. Jain, K. Bihari Rana, M. Lal Meena, and S. Sidh, "Ergonomic assessment and hand tool redesign for the small scale furniture industry," in *Materials Today: Proceedings*, 2020, vol. 44, doi: 10.1016/j.matpr.2020.12.762.
[14] M. C. Lim *et al.*, "Prevalence of upper limb musculoskeletal disorders and its associated risk factors among janitorial workers: A cross-sectional study," *Ann. Med. Surg.*, vol. 73, 2022, doi: 10.1016/j.amsu.2021.103201.
[15] F. Fahreni, V. Mardina, I. Indriaty, and R. Ramaidani, "Examination of Gel Hand Sanitizer from Mangrove Leaves and Patchouli Oil Against Sthapylococcus Aureus," *Int. J. Eng. Sci. Inf. Technol.*, vol. 1, no. 4, 2021, doi: 10.52088/ijesty.v1i4.139.
[16] B. Das, "Improved work organization to increase the productivity in manual brick manufacturing unit of West Bengal, India," *Int. J. Ind. Ergon.*, vol. 81, 2021, doi: 10.1016/j.ergon.2020.103040.
[17] L. P. Tuti Ariani, "The Effect Of Repetition Sprint Training Method Combined With The Level Of Physical Fitness Toward The Speed Of 100 Meter Run," *Int. J. Eng. Sci. Inf. Technol.*, vol. 1, no. 3, 2021, doi: 10.52088/ijesty.v1i3.89.
[18] D. Abdullah, Tulus, S. Suwilo, S. Efendi, Hartono, and C. I. Erliana, "A slack-based measures for improving the efficiency performance of departments in Universitas Malikussaleh," *Int. J. Eng. Technol.*, vol. 7, no. 2, 2018, doi: 10.14419/ijet.v7i2.11253.
[19] I. M., A. S.R., A. M., K. W.U., Y. N.A., and N. F.A., "Quantitative and qualitative assessment of musculoskeletal disorders and socioeconomic issues of workers of brick industry in Pakistan," *Int. J. Ind. Ergon.*, vol. 76, 2020.
[20] M. Gómez-Galán, Á. J. Callejón-Ferre, J. Pérez-Alonso, M. Díaz-Pérez, and J. A. Carrillo-Castrillo, "Musculoskeletal risks: RULA bibliometric review," *International Journal of Environmental Research and Public Health*, vol. 17, no. 12. 2020, doi: 10.3390/ijerph17124354.