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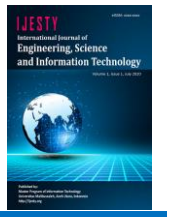

Work Posture Analysis in The Chips Frying Section Using Workplace Ergonomic Risk Assessment Method

Tania, Cut Ita Erliana*, Muhammad Zakaria

Department of Industrial Engineering, Faculty of Engineering, Universitas Malikussaleh, Indonesia

**Corresponding author Email: cutitha@unimal.ac.id*

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Abstract

U.D. Keripik Mustika is a small and medium enterprise (SME) that processes yam raw materials into special snacks in great demand for consumption and souvenirs. According to observations, the worker experienced pain complaints during frying in the shoulder area, arms, back, waist, hands, and feet. The complaint experienced by this worker was due to the worker's posture that had to stand and bend slightly with the position of the hands continuously mixing for 7 hours a day and done manually repeatedly over long periods. This is if left, then the worker will suffer musculoskeletal disorders (MSDs). The research was conducted using the WERA method (Workplace Ergonomic Risk Assessment), which explains the development of ergonomic risk assessment at the workplace to detect physical risk factors associated with musculoskeletal disorders (MSDs). The spread of the Nordic Body Map questionnaire on frying workers showed pain complaints from an unergonomic working posture. The study results were obtained from Employee 1, with a physical indicator score of 39 (Medium), and Employee 2, with a physical indicator score of 37 (Medium). Therefore, there is a need for improvement of the work facilities or the worker's posture. Based on the assessment results, the researchers suggested additional facilities for workers to design standing aids that reduce pain in the leg muscles and complaints of Musculoskeletal Disorders (MSDs).

Keywords: *Ergonomics, MSDS, Work Posture, Nordic Body Map, WERA.*

1. Introduction

UD Keripik Mustika is a small and medium enterprise (SME) that presents sweet potato chips as a product with a selling value that consumers favor. From 2004 until now, this enterprise has sustained its existence by offering quality comparable to other enterprises and increasing demand from the U.D. Keripik Mustika provides a variety of flavor variants ranging from sweet to spicy. The process of producing these chips has several stages, namely the process of peeling, washing, dissolving, frying, and packaging. The focus of this research is on the frying process. After a preliminary observation of the freezers, the researchers began by asking the workers and looking at the production section in the U.D. Keripik Mustika. Chips are roasted for eight hours daily, from 8 am to 5 pm. Workers only work four days a week, frying 600 kg of sweet potatoes daily. We have two workers for the frying part. According to observations, the worker experienced pain complaints during frying in the shoulder area, arms, back, waist, hands, and feet. The complaints experienced by this worker are due to the posture of the worker, who has to stand and bend slightly with the position of the hands continuously mixing for 7 hours a day, which is done manually repeatedly over a long period. This is if left, then the worker will suffer musculoskeletal disorders (MSDs). It's if left, then the worker will suffer musculoskeletal disorders (MSDs). As for the causes of work fatigue, the physical environment that also affects team member performance is room temperature; in the process of frying, the temperature of the room increases so that the worker feels the heat of the body so that a lot of excessive sweat, Also, noise and lighting affect the performance of employees [1][2][3].

On the other hand, the relevance of workers' ergonomics continues to evolve in line with the changing world of work, technology, and socio-economic challenges [4][5][6][7]. The current situation shows the importance of an improved understanding of ergonomics, not only from the physical side but also from the mental and socio-economic aspects that influence workers' well-being [8][9][10][11]. The research conducted by Yovi explains that financial constraints, insufficient knowledge to identify various sources of potential danger, as well as an inadequate understanding of the concept of the cost of accidents at work are obstacles to the implementation of effective occupational health and safety policies, Reaffirms the urgency of integrating comprehensive ergonomic approaches into industrial

practices. The ergonomic situation of the research objects, frying workers in the pottery industry, requires special attention given the high prevalence of musculoskeletal injury and exhaustion due to long hours of work as well as monotonous repetition of tasks [12][13][14]. Workers in industries who are active repeatedly and for long periods in the same job positions tend to experience back pain and musculoskeletal disorders; this is also likely to occur in freezing station workers [15][16][17]. It affirms the importance of ergonomic interventions, such as the development of working aids that are in line with ergonomics principles to help minimize occupational health risks [18][19][20][21].

The research is aimed at producing innovative worked designs. Working aids designed according to specific ergonomic principles addressing the gap by providing solutions to workers who need physical support in carrying out their standing activities sustainably through anthropometric data collection, fitness testing, and posture assessment, the work aid developed not only meets the physical needs but it also improves the comfort and safety of workers, potentially reduce fatigue and musculoskeletal injury, As well as enhancing the working posture, it can contribute to improving team member well-being and productivity [22][23][24][25].

Based on the phenomena that have been presented than can be drawn an urgent red thread in this research emphasizes planning to reduce the risk of fatigue and musculoskeletal injury in workers. Understand the importance of the ergonomics of the brick industry and identify the gaps in current work practices. This research contribution is expected to bring ergonomic improvements to the work in the Mustika chips enterprise and provide a reference for similar industries to implement ergonomic solutions to improve facilities and working conditions.

2. Method

This research was carried out on March 31, 2024. The study was conducted in the U.D. Keripik Mustika is located in Langsa City, Langsa Baro district, Paya Bujuk Tunong Village. Starting with the preparatory phase of drafting the research proposal. The WERA method became the method chosen in the study with the help of the Nordic Body Map questionnaire, which illustrates in detail the parts of the body that are most likely to be affected by the worker, From the neck to the leg, which consists of 28 skeletal muscles on the right and left sides of the body. After completing the questionnaire given to both employees, It was found that there was a placement of musculoskeletal complaints of workers in the frying section in the U.D. Keripik Mustika.

The WERA (Workplace Ergonomic Risk Assessment) approach is defined as establishing workplace ergonomic risk assessment to identify workers' physical risk factors. The WERA (Workplace Ergonomic Risk Assessment) assessment system guides the evaluation of the amount of risk and the requirement to undertake a more thorough assessment of work postures. The five primary body parts included in Part A, also known as Physical Risk Assessment No. 1–5, are the shoulders, wrists, back, neck, and legs. Two physical risk factors for any portion of the body, including posture and retardation, are covered in this section. Section B lists four physical risk factors: work time, vibration, strength, and contact stresses. The amount of action is displayed in the final score for each category. Final score with a total risk range of 18–27, or still acceptable. From 28 to 44 for moderate or unacceptable risk. The final score ranges from 45 to 54, a high-risk category requiring urgent repair. This helps the operator evaluate the risk associated with the work performed and make necessary modifications. As for the flow chart method, WERA can be seen in Figure 1 below as follows:

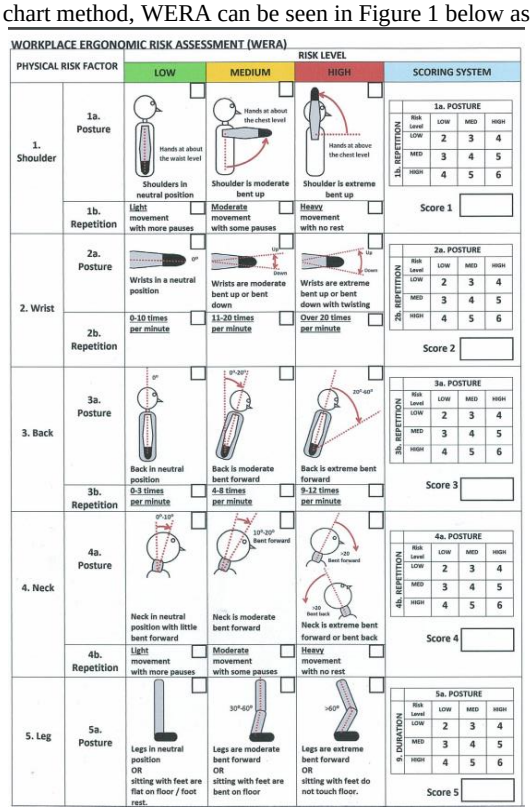

Fig 1. Workplace Ergonomic Risk Assessment

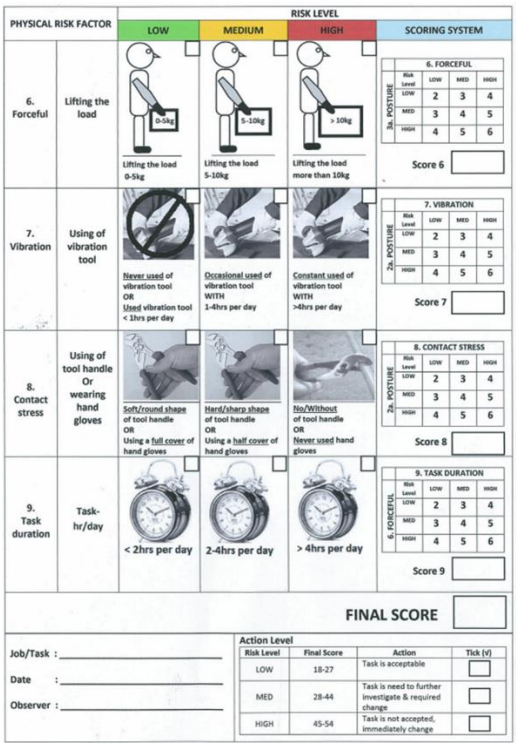

Fig 1. Workplace Ergonomic Risk Assessment (Advanced)

3. Result and Discussion

U.D. Keripik Mustika has 16 employees; in this frying section, there are two employees. The operators were given a Nordic body map questionnaire to learn about any issues with the activities. The summarized results showed that the workers reported having pain in their arms, legs, shoulders, backs, and waist.

3.1. Work Posture Assessment Using the WERA Method

The WERA method for assessing operator posture at work. At this point, when the team member is frying chips, their posture score will be determined. The two employees in the frying division were chosen for this study. Table 1 displays the worker identification or profile data as follows:

Table 1. Profile of Workers 1 and 2 in the Frying Section

No	Name	Age	Height	Length of Service
1	F	53 Years	158 cm	12 Years
2	P	37 Years	160 cm	5 Years

As for the picture of the posture of the worker's body when doing the chips frying activity in the U.D. Mustika can be seen in the figure 2 below as follows:

Fig 2. Posture of Worker 1

Evaluation of the posture of the worker The first assessment, the vibration assessment, receives a score of 6 in the high category; the wrist assessment gets a score of 5, which is in the medium category; the back assessment gets a score of 4 in the medium category, the neck assessment receives a score of 3 in the medium category, the foot assessment gets a score of 4 in the medium category, the workload assessment receives a score of 4 in the medium category, and lastly, the task duration assessment gets a score of 5 in the high category.

3.2. Work Posture Assessment Using the WERA Method

Working posture assessment with the WERA method is done by analyzing body posture movements and the employees' work in frying the chips. The initial step of analyzing the team member's posture can be seen in Figure 3 below as follows:

Fig 3. Posture of Worker 2

Based on the results of the data processing above in the frying section using the WERA method, it can be seen in Table 2 as follows:

Table 2. Recapitulation of Worker Assessments

Workers	Physical Indicators										Risk Level
	1	2	3	4	5	6	7	8	9	Score	
1	4	5	4	3	4	4	6	4	5	39	*Medium*
2	3	5	3	3	4	3	6	5	5	37	*Medium*

3.3. Prosed Work Facility Design

Based on the findings of the calculation of the posture of workers in the frying section using the WERA method, the results show that there is a need for improvement or the addition of work facilities to improve posture and prevent musculoskeletal complaints in workers at the frying station caused by prolonged standing, it is necessary to add work facilities in the frying section, namely work aids, work aids developed by worker anthropometry and ergonomic principles to successfully reduce the duration of upright standing work postures and increase worker comfort with easy-to-use designs so that workers can quickly adapt and use them without difficulty. Regarding suggestions for adding work facilities, the authors suggest that to minimize future musculoskeletal complaints and improve posture, business owners can provide work aids for reasonable changes in the future. Regarding suggestions for adding work facilities, the authors suggest that to minimize the occurrence of musculoskeletal complaints in the future and improve posture, business owners can provide work aids for reasonable changes.

3.3.1. Anthropometric Calculation

The following calculations are explained in the table 3 below:

Table 3. Anthropometric Data of Frying Section Workers

	Measurement		
Workers	Hip Height (T.P.)	Hip Width (L.P.)	Popliteal Length (P.P.)
1	77	35	46
2	80	37	49
Average	78,5	36	47,5

3.3.2. Percentile Value

Percentile values are important in statistics because they help identify the relative position in a data distribution and can b. They also do various analyses such as anthropogenic research, market analysis, etc. Some commonly used percentiles are the 5% percentile for small sizes, the 50% percentile for average sizes, and the 95% percentile for the largest sizes. The formula for finding percentiles can be seen as follows:

P5 = $\bar{X}$ − 1,645 SD
P50 = $\bar{X}$
P95 = $\bar{X}$ + 1,645 SD
The calculation of the percentile value of each dimension measured can be seen in Table 4 below:

Table 4 Recapitulation of Results from the Data Sufficiency Test

No.	Body Dimensions	Percentiles		
		5%	50%	95%
1	Hip Height (T.P.)	75,01	78,5	81,99
2	Hip Width (L.P.)	38,1	41,5	44,99
3	Popliteal Length (P.P.)	35,69	41,5	47,31

Based on data processing results involving workers' body size and anthropometric calculations, the work aids will be designed using anthropometric data at the 95% percentile. The size used for the height of the stand is 81.99, for the width 44.99, and for the length of the seat 47.31. Thus, for the size of the work aids that have been obtained. The design of standing aids using dimensions that the anthropometry of workers has calculated can be seen in Figures 4, 5, and 6 below:

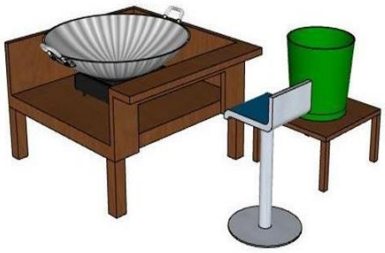

Fig 4. Work Facility Design

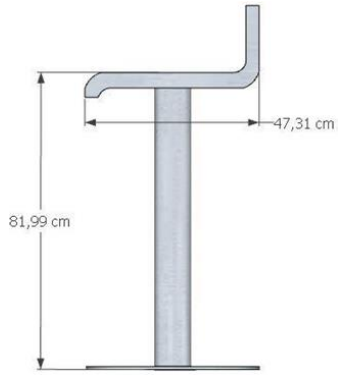

Fig 5. Design of Work Facility

Fig 5. Design of Work Aids

4. Conclusion

The assessment of work posture in the frying section at U.D. Keripik Mustika sings the WERA method for worker 1, who gets a total score of 39 in the *medium* category, meaning improvements are needed in the future. In contrast, worker 2 gets a total score of 37, which is also in the *medium* category, meaning improvements are required. Second, based on the results of the analysis of workers' posture and data processing that has been carried out, we get a proposal for improvement or addition of work facilities in the frying section at U.D. Mustika Chips reduce the duration of standing during frying activities, reduce musculoskeletal problems, and increase worker

productivity and comfort. The design of work aids uses *stainless* material to make them strong and more durable, and a foam mat is used to make the workers comfortable. The size used for the height of the stand is 81.99, for the width 44.99, and for the length of the stand 47.31.

References

[1] Setyowati, R., Jazuli., and Setyaningrum, R., "Application of REBA and EFD Methods in Designing Ergonomic Workstations in the Tofu Product Printing Process (Case Study of Sendang Tofu SMEs)," *Applied Industrial Engineering Journal*, vol. 1, no. 1, pp. 65–75, 2017, [Online]. Available: http://publikasi.dinus.ac.id/index.php/aiej/indexv65

[2] Shobur, S., and Sari, Fenti Indah, "Risk Factors for Musculoskeletal Disorders (MSDs) in Weaving Ikat Workers in Tuan Kentang Village, Palembang City," 2019.

[3] Saputra, H. Rahma., and Dahda, S. Salim., "Analysis of the Risk Level of Musculoskeletal Disorders (MSDs) in Welding Workers at CV. XYZ Using REBA and OWAS Methods," vol. 20, no. 1, pp. 90–97, 2022.

[4] Fahmi, M. Fajar., and Widyaningrum, D., "Analysis of Manual Work Posture Assessment to Reduce the Risk of Musculoskeletal Disorders (MSDS) Using the OWAS Method at U.D. Anugrah Jaya."

[5] Tuhumena, R., Soenoko, R., and Wahyudi, S., "Designing Ergonomic Welding Process Work Facilities (Case Study at P.T. Aji Batara Perkasa Workshop)," *JEMIS*, vol. 2, no. 2, 2014, [Online]. Available: http://JEMIS.ub.ac.id/

[6] Siswanto., Pusporini, P., and Ismiyah, E., "Analysis of Work Posture of Sack Screen Printing Operator by Rula and Wera Method," vol. 1, no. 4, p. 591, 2020.

[7] Shofiyyullah, M., and Mahbubah, N. A., "Evaluation of Work Posture of Fire Brick Installation Operators Based on Rapid Upper Limb Assessment and Work Ergonomic Risk Assessment Methods at PT ABA," *Serambi Engineering*, vol. VI, no. 4, 2021.

[8] E. Y. Yovi, "Ergonomic Status of Forestry Sector Workers in Indonesia: Physical-Mental-Social Fatigue, Job Satisfaction, Hazard Source Concept, and Accident Cost Concept," Journal of Forestry Science, vol. 13,no. 2, p. 137, 2019, Doi: 10.22146/jik.52140.

[9] Erliana, C. Ita., and Razif, "Ergonomics and Work System Implementation of Car Ergonomics Design of Rice Milling Machine," 2017.

[10] Hasibuan, M. Faturahman., and Erliana, C. Ita., "Work Posture Analysis of Packaging Process Workers Using the Nerpa Method at P.T. Jampalan Baru," *Industrial Engineering Journal*, vol. 10, no. 1, 2021.

[11] Erliana, C. Ita and Zaphira, M., "Work Posture Analysis to Reduce Work Risk Levels Using the Rapid Office Strain Assessment (ROSA) Method," *Talenta Conference Series: Energy and Engineering (E.E.)*, vol. 2, no. 3, Dec. 2019, doi: 10.32734/ee.v2i3.774.

[12] Putriani, L. Vira Eka., Sari, R. Puspita., and Wibisono, A., "Analysis of Factors Associated with Musculoskeletal Disorders in PT. Kwz Indonesia Factory Employees", [Online]. Available: https://publikasi.medikasuherman.ac.id/inde

[13] Murphy, M. C., George, H. A., Naqi, M., Owen, P. J., Chivers, P., and Hart, N. H., "Musculoskeletal injury epidemiology in law enforcement and firefighter recruits during physical training: a systematic review," 2022, *BMJ Publishing Group*. Doi: 10.1136/bmjsem-2021-001289.

[14] Syahputra, M. A. N., Zakaria, M., and Erliana, C. Ita., "Ergonomic Risk Analysis at UD. Mawar Sari", doi: 10.53912/iej.v10i2.1102.

[15] Kurniawan, I., Hunusalela, Z. F., and Murgani, R., "Proposed Work Facilities Using the WERA Method, NERPA, and Sketchup Software ARTICLE INFORMATION ABSTRACT," vol. 04, no. 02, pp. 67–73, 2022, doi: 10.30998/joti.v6i.13827.

[16] Sanjaya, K. T., Wahyudi, S., and Soenoko, R., "Improvement of Batik Work Facilities with an Ergonomic Approach to Reduce Musculoskeletal Disorders," *JEMIS*, vol. 1, no. 1, 2013, [Online]. Available: http://JEMIS.ub.ac.id/2013

[17] Afma, V. Methalina., and Widodo, B. W., "Design of Goat Skinning Aids Using the Reba (Rapid Entire Body Assessment) Method to Reduce MSDs," vol. 8, no. 1.

[18] Erliana, C. Ita., Syarifuddin, Wahyuri, R., and Abdullah, D., "Analysis of Work Posture of Ice Block Workers Cv. Mulieng Iceberg," Postur Kerja Pada Pekerja Es Balok Cv. Mulieng Iceberg," *Industrial Engineering Journal*, vol. 11, no. 2, 2022, Doi: 10.53912/iej.v11i2.944.

[19] Tanuwijaya, D., Widodo, L., and Andres "Work Posture Analysis Using the Wera Method and Design of Waistband and Chair Assistive Devices for Manual Car Washing Activities," *Jurnal Mitra Teknik Industri*, vol. 2, no. 1, pp. 26–35, 2023.

[20] Febrilian, Z., Ningtyas, D. R., and Isharyadi, Febrian., "Implementation SNI 9011:2021 For Ergonomic Evaluation of Plastic Injection Department Production Operators: A Case Study in the Implementation Manufacturing Industry of SNI 9011:2021 to Ergonomics Evaluation of Production Operator of The Plastic Injection Department: Case Study in The Manufacturing Industry."

[21] Safira, I. D., Ekawati., and Kurniawan, B., "Analysis of the Level of Ergonomic Risks to Msds Complaints in Batik Cap Craftsmen at the Domas Batik Industry," *Journal of Medicine and Health: Scientific publication of the Faculty of Medicine, Sriwijaya University*, vol. 9, no. 3, pp. 299–306, Sep. 2022, Doi: 10.32539/jkk.v9i3.18114.

[22] Campbell, P., Pope, R., Simas, V., Canetti, E., Schram, B., and Orr, R., "The Effects of Early Physiotherapy Treatment on Musculoskeletal Injury Outcomes in Military Personnel: A Narrative Review," October 01, 2022, *MDPI*. Doi: 10.3390/ijerph192013416.

[23] Paudel, P., Kwon, Y. J., Kim, D. H., and Choi, K. H., "Industrial Ergonomics Risk Analysis Based on 3D-Human Pose Estimation," *Electronics (Switzerland)*, vol. 11, no. 20, Oct. 2022, doi: 10.3390/electronics11203403.

[24] Saedpanah, K., Motamedzade, M., Salimi, K., Eskandari, T., and Samaei, S. E., "Physical Risk Factors among Construction Workers by Workplace Ergonomic Risk Assessment (WERA) Method. Archives of Occupational Health," 2018. [Online]. Available: https://www.researchgate.net/publication/322675341

[25] Saputra, W. S., and Absor, U., "Application of the Nordic Body Map and Work Place Ergonomic Risk Assessment Methods to Analyze Work Postures at Sumber Jaya Jepara in Furniture Making."