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Original Research Article

ERGONOMIC RISK ASSESSMENT OF GADUNG PEELERS USING *NORDIC BODY MAP* (NBM) AND *OVAKO WORK POSTURE ANALYSIS* (OWAS) METHODS

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Abstract

Background: The activity of peeling gadung as a raw material for making gadung chips is done manually and repeatedly with an unnatural working posture and can cause musculoskeletal disorders (MSDs). Preventive measures need to be taken by carrying out ergonomic risk assessments.
Objectives: The research aimed to analyze the level of ergonomic risk in MSDs using the Nordic Body Map (NBM) and Ovako Work Posture Analysis (OWAS) methods.
Methods: The research method used was an analytical method with a cross-sectional research design. This research was conducted in the home industry gadung chips, Kediri in August 2024. The sampling technique was purposive sampling with a total sample of 10 gadung peeler workers. The variables in this study were the severity of muscle complaints and work posture (back, arm, leg, and load movements) as the risk level for MSDs. The type of data collection technique used was a field study by filling out the NBM questionnaire to determine the severity of MSDs. Working posture (back, arm, leg, and load movements) was also observed using the OWAS method by filling in a form. The results of the analysis will provide results as a reference for taking appropriate action to overcome ergonomic risks.
Results: Based on data analysis using the NBM showed the percentage of MSDs, that are right shoulder, right wrist, and right hand had the highest proportion of scores for complaints of pain that always occurred (100%). The left wrist and shoulder area (96%), stiffness in the lower neck (92%), pain in the back (91%), pain in the waist (90%), and also pain in the right and left knee areas for lower limbs. The results of the ergonomic risk level analysis using the OWAS method showed that the working posture is included in the moderate risk category (score 2).
Conclusion: Corrective action is needed to prevent musculoskeletal disorders such as improving work posture, doing stretching exercises before and after work and designing ergonomic work chairs.

Keywords: *Ergonomic Risk Assessment, Gadung Peeler Worker, NBM, OWAS*

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INTRODUCTION

The implementation of occupational health and safety in the informal sector is still very minimal, and many potential hazards can cause work accidents and work-related diseases (Akbar et.al, 2022). The most common things that occur are workers' health complaints such as back pain and fatigue caused by work processes which on average are still carried out manually, repetitively with work movements that tend to be monotonous and long working hours. Complaints felt by workers are often called musculoskeletal disorders. Prevention of musculoskeletal disorders is carried out through ergonomics programs (Rahman et.al, 2022).

Ergonomics programs to prevent MSDs can be carried out by assessing ergonomic risks using OWAS and NBM methods. The Ovako Work Posture Analysis System (OWAS) analyzes the ergonomic risk of musculoskeletal disorders, such as work posture which defines the movement of the back, arms, legs, and the weight of the load (Ramadani, 2019). Meanwhile, NBM can identify the parts of the muscle that are experiencing complaints. The level of complaints ranges from discomfort to very painful.

Research by Firdaus et.al, 2022 on workshop workers, the results of the NBM questionnaire showed that the most common complaints were in the right wrist and left upper arm. Meanwhile, the measurement from the OWAS method showed that there were 5 workers, 3 of whom had the potential to develop musculoskeletal disorders (MSDs).

The observations on gadung peeler workers in the home industry gadung chips often work on an overtime basis due to the cover of orders. The work is carried out manually and shows a static work posture, such as sitting in a small and unergonomic chair with a bent back. Workers have also experienced complaints such as back pain due to monotonous, repetitive work and sitting for too long. Awkward posture loads are the main factor causing musculoskeletal disorders due to work.

Objective(s): to carry out an analysis regarding the level of ergonomic risk, in this case using the Ovako Work Posture Analysis (OWAS) and Nordic Body Map (NBM) methods as an effort to determine control measures so that the workers can work optimally.

METHODS

Study Design

The research method used was an analytical method. Based on the type of research, it was observational. Based on the research design, it was a cross-sectional study because the variables studied were observed at one time (Nursalam, 2003).

Setting

This research was conducted on gadung peeler workers, home industry gadung chips, Kediri in August 2024.

Research Subject

This research population was all gadung chips workers in the home industry gadung chips, Kediri at the time this research was carried out. The sampling technique was used purposive sampling. The inclusion criteria set by the researcher were gadung peeler workers who were still productive with a minimum working period of 2 years and willing to be researched. Based on the research criteria set by the researchers, there were 10 gadung peeler workers according to these criteria, so 10 gadung peeler workers were used as respondents in this study.

Instruments

The research instruments used were the NBM questionnaire and the OWAS form from Tarwaka (2010) which have been tested for validity and reliability and widely used. The research instrument used to assess the level of respondents' complaints was filling out the Nordic Body Map (NBM) questionnaire based

on the part of the body that was experiencing musculoskeletal disorders (MSDs) complaints with a Likert scale starting from the degree of complaint of 1: no pain, 2: rather pain, 3: pain and 4: very pain. MSDs complaints consist of complaints of pain, tingling, cramps, heat, swelling, numbness, and other consequences if any part of the body complained ≥ 1 during the 12 months and last 7 days before the study was conducted.

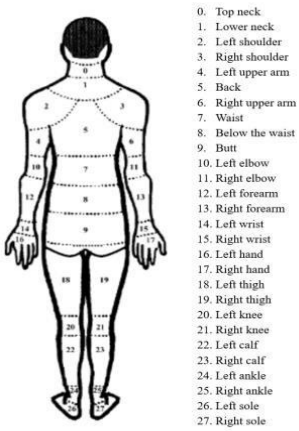

Figure 1. Nordic Body Mapping

Meanwhile, the Ovako Work Posture Analysis System (OWAS) method was used to analyze ergonomic risks, by observing the respondent's working posture while working, such as the classification of back, arm, leg, and load movement. Each posture was identified and coded based on the following classification:

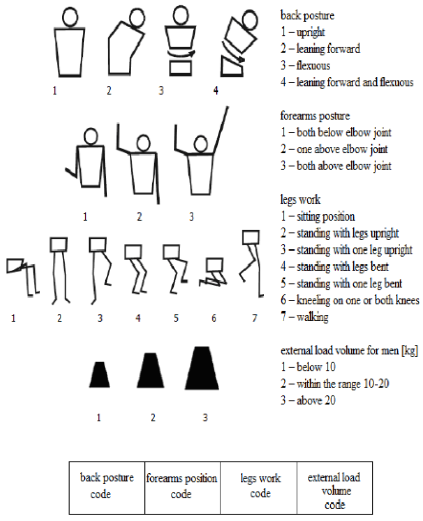

Figure 2. Body Posture Code with OWAS Method

Data Analysis

Based on the results of the pain level scoring on the NBM questionnaire, it was then classified into percentage intensity of MSDs complaints, namely: 0-10 few complaints, 11-30 moderate complaints, 31-50 frequent complaints, 51-70 very frequent complaints, 71-80 almost always complaints occurs, >80 complaints always occur. Meanwhile, based on the results of observing work postures using the OWAS method, the risk level for MSDs was classified into: 1 low-risk category without MSDs effects, 2 medium risks causing damage to the musculoskeletal system, 3 high-risks dangerous to the musculoskeletal system, 4 very dangerous to the musculoskeletal system.

Ethical Consideration

In this research, an ethical feasibility test was carried out.

RESULTS

Characteristic of Respondent

Based on Table 1 showed that respondent is carried out with a productive age range, most of them which are above 30 years with the most of a working period of 2 years, and most respondents never doing exercise.

Table 1. Characteristics of Respondents in the Home Industry Gadung Chips, 2024

Respondent's Characteristic	F	(%)
Age		
≥ 30 years old	7	70
< 30 years old	3	30
Working Period		
≥ 2 years	9	90
< 2 years	1	10
Exercise Habits		
No	8	80
Yes	2	20

Source: Primary Data of Questionnaire, 2024

Musculoskeletal Disorders Complaint Level Based on Nordic Body Map (NBM)

Table 2. Data Grouping of Pain Complaint Levels based on NBM of Gadung Peeler Workers, 2024

No	Musculoskeletal Complaint	Number of Workers Based on Complaint Level			
		NP	RP	P	VP
0	Upper Neck	2	7	1	0
1	Lower Neck	2	3	3	2
2	Left Shoulder	1	4	3	2
3	Right Shoulder	0	6	4	0
4	Upper Left Arm	5	3	2	0
5	Back	2	4	4	0
6	Upper Right Arm	4	2	4	0
7	Waist	2	5	3	0
8	Hip	4	4	2	0
9	Bottom	6	2	2	0
10	Left Elbow	8	1	1	0
11	Right Elbow	6	1	3	0
12	Lower Left Arm	5	2	3	0
13	Lower Right Arm	5	2	3	0
14	Left Wrist	1	4	4	1
15	Right Wrist		7	3	0
16	Left Hand	5	3	2	0
17	Right Hand	0	6	4	0
18	Left Thight	6	3	1	0
19	Right Thight	5	2	2	1
20	Left Knee	3	4	2	1
21	Right Knee	3	4	3	0
22	Left Leg	5	3	2	0
23	Right Leg	7	2	1	0
24	Left Angkle	8	2	0	0
25	Right Angkle	7	2	1	0
26	Left Foot	5	5	0	0
27	Right Foot	4	4	1	1

Source: Primary Data of NBM Questionnaire, 2024

***) Note:**

NP: No Pain

RP: Rather Pain

P: Pain

VP: Very Pain

Table 2 showed the data on the level of pain complaints from the respondent. The data above was categorized into percentages between no pain and pain. The following is an example of calculations for one location of the body, the upper neck, in Table 2, for each degree of complaint the score on the Likert scale is multiplied by 1 category is no pain, 2 categories is rather painful, 3 categories is painful, and 4 categories is very painful. The calculation for the no pain category is 1x2 = 2, while the calculation for the pain category is ((2x7) + (3x1) + (4x0)) = 17. Then, the data is presented as a percentage as follows.

Table 3. NBM Categorization in Percentage

No	Musculoskeletal Complaint	Degree of Complaint			
		NP	(%)	P	(%)
0	Upper Neck	2	11	17	89
1	Lower Neck	2	8	23	92
2	Left Shoulder	1	4	25	96
3	Right Shoulder	0	0	24	100
4	Upper Left Arm	5	29	12	71
5	Back	2	9	20	91
6	Upper Right Arm	4	20	16	80
7	Waist	2	10	19	90
8	Hip	4	22	14	78
9	Bottom	6	38	10	63
10	Left Elbow	8	62	5	38
11	Right Elbow	6	35	11	65
12	Lower Left Arm	5	28	13	72
13	Lower Right Arm	5	28	13	72
14	Left Wrist	1	4	24	96
15	Right Wrist	0	0	23	100
16	Left Hand	5	29	12	71
17	Right Hand	0	0	24	100
18	Left Thight	6	40	9	60
19	Right Thight	5	26	14	74
20	Left Knee	3	14	18	86
21	Right Knee	3	15	17	85
22	Left Leg	5	29	12	71
23	Right Leg	7	50	7	50
24	Left Angkle	8	67	4	33
25	Right Angkle	7	50	7	50
26	Left Foot	5	33	10	67
27	Right Foot	4	21	15	79

Based on table 3, it showed the percentage of complaints that respondents experienced. Data obtained from respondents showed that the right shoulder, right wrist and right hand had the highest proportion of scores for complaints of pain that always occurred (100%). This was followed by complaints in the

left wrist and shoulder area (96%), stiffness in the lower neck (92%), pain in the back (91%), and pain in the waist (90%). Pain complaints of lower limb felt in the right and left knee area.

Musculoskeletal Disorders Analysis by OWAS Method

The work of peeling gadung is carried out in an unergonomic sitting position, with repetitive and monotonous movements. Analyzing ergonomic risks in this job can be done by observing and assessing work posture using the OWAS method. The application of the OWAS method is based on observations of various positions taken by workers while carrying out their work, as a result of a combination of back body posture (4 positions), arms (3 positions), legs (7 positions) and load weight (3 intervals) (Tarwaka, 2010). The following is a gadung peeling movement in a sitting position which can be seen in Figure 3.

Figure 3. Body Posture While Peeling Gadung

The OWAS assessment of the gadung peeling work can be seen in Table 4. Based on Table 4, the work posture with OWAS method includes the posture of the back, arms, legs and load in peeling gadung with a sitting position in which the back gets a score of 2 because the body is slightly bent, the arm gets a score of 1 because one or both arms are below shoulder height. Furthermore, the leg section gets a score of 1 because the worker's position is sitting, while the weight of the load is less than 10 kg gets a score of 1. These data are used to calculate the OWAS table. The following are the results of the OWAS calculation on the work of peeling gadung in a sitting position.

Table 4. OWAS Assessment of Gadung Peeler Worker

Working Posture	Code	Description
Back	2	Back bent with inclination >20º
Forearms	1	Both arms are below shoulder height
Leg	1	Work is done in a sitting position
Load/Force	1	Less than 10 kg

Based on Figure 4, the results of the work posture assessment obtained were 2, which means that the code is 2-1-1-1 which the value of 2 is the worker's back posture is bent, the value of 1 is the posture of both arms below shoulder height, the work is done in a sitting position with a value of 1 and the value of 1 is the weight of the load <10 kg.

Pung-gung	Lengan	Kaki																				
		1			2			3			4			5			6			7		
		Beban			Beban			Beban			Beban			Beban			Beban			Beban		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
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	3	3	3
	2	2	2	3	2	2	3	2	3	3	3	4	4	4	4	4	4	4	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	2	3	3	3	4	4	4	1	1	1	1	1	1	1
	2	2	2	3	1	1	1	1	2	4	4	4	4	4	4	3	3	3	1	1	1	1
	3	2	2	3	1	1	1	2	2	3	4	4	4	4	4	4	4	4	1	1	1	1
4	1	2	3	3	2	3	3	2	3	3	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	2	3	4	
	3	4	4	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	2	3	4	

Figure 4. The Calculation with OWAS Table in Gadung Peeling Work

DISCUSSION

Musculoskeletal disorders are complaints of the skeletal muscles that can be felt from very mild complaints to pain. Skeletal muscles that are often complained about occur due to the provision of a very heavy workload for a long duration increasing muscle contractions (Maudy et.al, 2021).

According to Ardi et.al (2022), the emergence of complaints of pain and soreness in the muscles after work occurs due to the accumulation of lactic acid. The accumulation of lactic acid in the muscles is triggered by a small or decreased supply of oxygen to the muscles in muscles that contract continuously. Increased levels of lactic acid in the muscles can affect the acidity level so that muscle contractions become weaker and lead to muscle fatigue.

Table 1 showed that 90% of respondents have worked for more than 2 years. However, the length of the working period does not effect on the pain complaints felt by workers when seen from the results of the NBM questionnaire. This is in line with research by Trimala et.al (2023) which there is no relationship between work experience and fatigue. This may be caused by the frequency of work and rest or also the exercise habits of the worker.

The data obtained from respondents showed that the right shoulder, right wrist, and right hand had the highest proportion of scores for complaints of pain that always occurred (100%). Based on these results, the work posture used in the gadung peeling work is not ergonomic. Based on the results of interviews with workers, they consider this bad posture to be a comfortable body position for doing their work. However, the workers also complained of often experiencing problems with musculoskeletal disorders, such as muscle cramps, and tingling, in the wrist and right shoulder, back, neck, and knees. This is because the gadung peeling work is often done with repetitive movements using the right hand, sitting position with an unergonomic knee position with a small chair.

This is in line with the research of Bagas et.al (2023) that there are 7 locations of body parts that have frequent complaints, there are upper body and the right side because that are often used to do work. The results of Azmi et.al (2016), research on dimsum makers using the NBM method also indicate ergonomic risks to workers. The results of the NBM questionnaire in the research of Firdaus et.al (2022) found the most common complaint was in the right wrist.

The results of the ergonomic risk level analysis using the OWAS method showed that the working posture of gadung peeler workers is included in the moderate risk category which the corrective actions need to be taken to prevent musculoskeletal disorders. It is known that the results of the OWAS assessment showed the code 2-1-1-1 which means that the use of static back and arm limbs has the potential to cause MSDs disorders. This is in accordance with research by Firdaus et.al (2022) on lathe workshop employees, it was found that 3 out of 5 workers had the potential for musculoskeletal disorders (MSDs), especially for grinding and welding work which focused on the use of back and arm limbs.

CONCLUSION

Based on data analysis using the NBM showed the percentage of MSDs, that are right shoulder, right wrist, and right hand had the highest proportion of scores for complaints of pain that always occurred (100%). The left wrist and shoulder area (96%), stiffness in the lower neck (92%), pain in the back (91%), pain in the waist (90%), and also pain in the right and left knee areas for lower limbs. The results of the ergonomic risk level analysis using the OWAS method showed that the working posture is included in the moderate risk category (score 2), so corrective action needs to be taken to prevent musculoskeletal disorders.

SUGGESTIONS

Based on the results of the above research, preventing musculoskeletal disorders could be done by improving work posture, providing regular counseling, and carrying out sports activities to maintain physical condition, including stretching exercises before and after work, as well as designing ergonomic work chairs.

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DECLARATION OF CONFLICTING INTEREST

There was no conflict of interest in the implementation of this research.

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AUTHOR CONTRIBUTION

Nima Eka Nur Rahmania: Collected literature, collected data, searched for the questionnaire, compiled manuscripts and conducted data analysis.

Achmat Kuncoro: Collected data and compiled menuscripts.

Riza Irianingtyas: Tabulated the data and coding.

Geovania Nage Nuwa: Collected data.

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REFERENCES

Akbar AK., Cahyani C., Firmansyah F., Ayu F. (2022). Analisis Keluhan Musculoskeletal Disorders dan Kelelahan Kerja Menggunakan Metode NBM dan IFRC Pada Industri Sandal UD Satria Sidoarjo. *Jurnal Pengabdian Kepada Masyarakat, 1*(4),50-2509. https://doi.org/10.55681/swarna.v1i4.202

Ardi, S. Z., Hidayah, Q., & Dahlan, U. A. (2022). Factors Related of Musculoskeletal Disorders (MSDS) Complain in Online Study at Public Health University X. *Jurnal Ergonomi Indonesia, 8*(2), 23–29. https://doi.org/10.24843/JEI.2022.v08.i02.p03

Azmi N., Sukania W., Samsudin J. (2016). Analisis Beban Kerja Pada Pekerja Proses Pembuatan Dimsum. *Jurnal Ilmiah Teknik Industri*, *4*(3), 184-191. https://doi.org/10.24912/jitiuntar.v4i3.1546

Bagas RP., Prastawa H. (2023). Analisis Tingkat Kelelahan Serta Keluhan Anggota Tubuh Menggunakan Metode Swedish Occupational Fatigue Inventory (SOFI) Dan Nordic Body Map (NBM) Studi Kasus Pekerja Divisi Produksi PT XYZ. *Industrial Engineering Online Journal*, *12* (4)

Danur, S. M. B., Wahyu, A., & Thamrin, Y. (2022). Hubungan Postur Kerja dan Masa Kerja terhadap Keluhan Muskuloskeletal pada Pengemudi Bus. *Hasanuddin Journal of Public Health, 3*(2)

Firdaus M., Ismiyah E,. Negoro YP. (2022). Analisa Postur Kerja Karyawan Bengkel Bubut Sinta Jaya Menggunakan Metode Ovako Work Posture Analysis System (OWAS). *Jurnal Sains, Teknologi dan Industri, 20*(1), 209-217. http://dx.doi.org/10.24014/sitekin.v20i1.19802

Maudy, C. K., Ruliati, L. P., & Doke, S. (2021). Keluhan Musculoskeletal Disorders dan Kelelahan Kerja pada Tenaga

Kerja Bongkar Muat di Pelabuhan Tenau. *Media Kesehatan Masyarakat, 3*(3), 312–321. https://doi.org/10.35508/mkm

Ramadhani RM. (2019). Analisis Penilaian Ergonomi Postur Kerja Ketika Memasang Roda Dengan Metode Ovako Work Posture Analysis System Dan Rapid Entire Body Assesment Untuk Mencegah Musculoskeleal Disorders Analisis. *J. Tek. Dan Keselam. Transp, 2*, 233-243. https://doi.org/10.46447/ktj.v6i1.44

Tarwaka. (2010). *Ergonomi Industri, Dasar-Dasar Pengetahuan Ergonomi Dan Aplikasi Di Tempat Kerja, Ed 1, Cet. 1*. Surakarta : Harapan Press

Trimala A., Damayanti R., Lutfiya I., Rahmania N. (2023). The Relationship Between Shift Work And Individual Factors With Work Fatigue In Workers In The Production Area Of The Manufacturing Industry. *Journal of Industrial Hygiene and Occupational Health*, *8*(1), 36-49. http://dx.doi.org/10.21111/jihoh.v8i1.9247

Wiranto, A., Ramdan, I. M., & Lusiana, D. (2019). Faktor Yang Mempengaruhi Keluhan Musculoskeletal Disorder Pada Pekerja Penggilingan Padi Kabupaten Penajam Paser Utara. Husada Mahakam: *Jurnal Kesehatan*, *4*(8), 439–452. https://doi.org/10.35963/hm:jk.v4i8.153

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