

Analysis of Musculoskeletal Complaints Among Packing Workers in the Frozen Food Industry: Japanese Taiyaki Cakes

Aura Wijayanti Kusuma*, Muhammad Sabri Syahrir, Stefiani Bengan Laba,
Muhammad Aji Satria

Universitas Tadulako, Indonesia

Email: Aurawijayanti164@gmail.com*, sabrisyahrir@untad.ac.id, Ajisatri1996@gmail.com,
stefiani.bengan.l@mail.ugm.ac.id

ABSTRACT

Keywords:

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Background: Musculoskeletal disorders (MSDs) are common occupational health problems caused by non-ergonomic postures and repetitive activities. Each year, more than 2.3 million workers die due to occupational accidents and work-related diseases, including musculoskeletal disorders. Such conditions were also observed in a frozen Japanese Taiyaki cake production industry in Indonesia, particularly among packing workers who stand for long periods and perform repetitive tasks such as lifting, bending, and arranging products into packages. These activities are suspected to increase the risk of MSDs. This study aimed to analyze the prevalence of musculoskeletal complaints among packing workers in the frozen food industry. Method: A cross-sectional study design was applied, involving 75 workers selected through purposive sampling. Data were collected using a validated Nordic Body Map (NBM) questionnaire along with respondents' demographic and occupational characteristics. Bivariate analysis was performed using the Chi-square test. Results: The results showed a prevalence of musculoskeletal complaints of 62.7%, with the most affected body regions being the lower back (40%), shoulders (26.7%), and neck (20%). Chi-square analysis revealed that working duration of ≥ 8 hours per day ($p = 0.001$) and work tenure of > 5 years ($p = 0.003$) were significantly associated with MSDs, while age and gender showed no significant relationship. Conclusion: In conclusion, the prevalence of MSDs among packing workers in the frozen food industry was relatively high, with working duration and length of employment identified as the main contributing factors. Ergonomic interventions such as work schedule adjustments, task rotation, and active stretching programs are recommended to reduce musculoskeletal complaints.

INTRODUCTION

Common occupational diseases include cancers due to occupational exposure, pneumoconiosis, and spinal disorders such as scoliosis. However, with the increase in sedentary work patterns and the implementation of poor ergonomic conditions, a new occupational health problem has emerged, namely musculoskeletal disorders (MSDs) (Punnett & Wegman, 2004).

MSDs refer to complaints involving muscles, joints, tendons, ligaments, and surrounding tissues, characterized by pain, stiffness, and limited range of motion. This condition typically arises due to repetitive activities, non-ergonomic work postures, and prolonged working durations (Bridger, 2018). Research by the Health and Safety Executive (2020) reports that the food and beverage industry has a relatively high prevalence of MSDs, particularly affecting the lower back, shoulders, and wrist regions.

Studies in Indonesia also show a similar phenomenon. Research by Aulia et al. (2020) found that 68.4% of food processing industry workers in West Java experienced musculoskeletal complaints, with the most frequent complaints occurring in the lower back and shoulders. Another study by Handayani and Suroto (2018) stated that workers with a hunched posture for more than 4 hours per day have twice the risk of developing low back pain. This indicates that MSDs have become a significant occupational health issue in Indonesian industries, especially in sectors involving repetitive manual tasks such as packing (Haekal et al., 2020; Pramitasari et al., 2015; Rahma et al., 2023).

The frozen food industry, including the production of Japanese Taiyaki cakes, requires fast, accurate, and repetitive packaging processes. Packing workers must stand for long periods, bend, and perform repetitive movements to package products (Ahmad et al., 2021; Elrabei, 2019; Liu & Guo, 2022; Loske et al., 2021). This workload has the potential to cause musculoskeletal complaints which, if not addressed, can reduce productivity, increase absenteeism, and affect product quality (Tarwaka, 2015).

The rationale for this study is that packing workers have distinct work characteristics, including prolonged standing, repetitive movements, bending, and lifting or arranging products over extended working periods. These conditions create biomechanical loads that differ from those experienced by workers in other industrial roles.

Based on this description, this study aimed to analyze musculoskeletal complaints among packing workers in the Japanese Taiyaki cake frozen food industry, as well as identify factors associated with these complaints. The findings are expected to serve as a basis for implementing ergonomic interventions to improve occupational health and worker productivity in the food industry sector.

METHOD

Research Location and Time

The study was conducted at the Japanese Taiyaki frozen food factory located in Hiroshima, Japan, in June-August 2025.

Stages of Work

The work of the packing part in this factory is carried out through several stages, namely: (1) the sterilization process before entering the production room (sterilization of work clothes, use of complete PPE, hand washing, antiseptic), (2) the sumitori process (cleaning black spots on the product using a blunt knife), (3) the process of checking the quality of the product (imagawayaki or taiyaki) from shape, texture, and cleanliness, and (4) the process of final packaging of the product on the packing line with a standing working position in the duration long.

This study uses an analytical observational design with a cross-sectional approach. This design was chosen because it can describe the prevalence of musculoskeletal complaints as

well as the relationship of factors related to musculoskeletal complaints (age, gender, working period, duration of work, and work posture) with these complaints in a given period of time. This approach is commonly used in occupational health and ergonomics research (Notoatmodjo, 2018).

Population and Sample

The research population is all employees who work in the packing section of the Japanese Taiyaki Cake frozen food industry. The population is 75 people, so the technique used is total sampling, namely all members of the population are used as research samples.

Criteria included:

- a. Active employees who work in the packing department for at least 6 months.
- b. Age 18–55 years.
- c. Be willing to be a respondent by signing an informed consent sheet.

Exclusion criteria:

- a. Workers with a history of non-work-related musculoskeletal injuries (e.g. as a result of accidents or congenital disorders).
- b. Workers who were not present during data collection.

Research Instruments

1. Nordic Body Map (NBM) Questionnaire: A standard questionnaire used to identify musculoskeletal complaints in 28 body parts (Kuorinka et al., 1987). Respondents were asked to mark the parts of the body that experienced complaints of pain, pain, or discomfort.
2. Questionnaire characteristics of respondents, Contains questions regarding age, gender, working period, and daily working hours.

Data Analysis

Data processing is carried out with IBM SPSS Statistics version 25.

- a. Descriptive analysis: To describe the distribution of respondent characteristics (age, gender, length of employment, length of work) and the prevalence of musculoskeletal complaints by body part.
- b. Bivariate analysis: The Chi-Square test is used to determine the relationship between independent variables (age, sex, length of service, length of work) and musculoskeletal complaints. If the Chi-Square requirements are not met, the Fisher's Exact Test is used.

The significance level was set at $p < 0.05$.

RESULT AND DISCUSSION

Respondent Characteristics

Of the 75 respondents, the majority were women (68.0%), with the largest age group being 30–39 years old (50.7%). Most respondents had a working period of 2–5 years (48.0%), and most worked ≥ 8 hours per day (62.7%).

Table 1. Characteristics of respondents

Features	n	%
Gender		
Male	24	32,0
Women	51	68,0
Age (years)		

< 30	18	24,0
30–39	38	50,7
≥ 40	19	25,3
Working period		
< 2 years	15	20,0
2–5 years	36	48,0
> 5 years	24	32,0
Duration of work/day		
< 8 am	28	37,3
≥ 8 jam	47	62,7

The majority of respondents aged 30–39 years (50.7%), showed the dominance of productive age who generally had optimal work capacity, although they still experienced musculoskeletal complaints if exposure lasted a long time (Badan Pusat Statistik [BPS], 2022; Setyowati et al., 2021).

Table 1 shows the high involvement of the productive age workforce. These findings are in accordance with Yusdarif et al. (2020) and Widyastuti et al. (2018) who reported on the dominance of women and the productive age group in the packaging and manufacturing industries. The most working periods of 2–5 years (48%) are consistent with Mulyati and Putri (2019) who found that medium working periods often occur in industries with high worker turnover. In addition, most respondents worked ≥ 8 hours per day (62.7%).

Most of the respondents were women (58.7%), in accordance with the characteristics of the food industry that employs more women in the packaging section. Previous research has shown that female workers are more susceptible to musculoskeletal complaints due to physiological factors (Putri & Santoso, 2020; Susihono & Wibowo, 2019).

In terms of working period, the largest group had a working period of 2–5 years (42.7%), which indicates repeated exposure that has the potential to cause complaints. These results are consistent with the research of Suryani et al. (2018).

The working duration of the majority of respondents is ≥8 hours per day (60%), according to industry regulations. However, long duration has been shown to increase musculoskeletal complaints (Wahyuni et al., 2021).

Distribution of musculoskeletal complaints

The results of the Nordic Body Map (NBM) questionnaire showed that 74.7% of respondents experienced musculoskeletal complaints. Complaints were most felt in the waist (61.3%), shoulders (52.0%), and neck (40.0%).

Table 2. Musculoskeletal complaints based on body parts

Body Parts	n	%
Neck	30	40,0
Shoulder	39	52,0
Upper back	25	33,3
Waist	46	61,3
Upper arm	19	25,3
Wrist	18	24,0

Evil	12	16,0
Lutut	14	18,7
Calf/foot	16	21,3

Table 2 shows that musculoskeletal complaints are most felt in the waist (61.3%), followed by the shoulders (52.0%) and neck (40%). This condition is in accordance with Wahyuni et al.'s (2021) research which found that the waist is the part of the body that most often experiences complaints in workers with long standing positions and bending activities.

Complaints of the shoulders and neck are most likely affected by repetitive work postures, such as raising hands, bending over, or bowing for long periods of time. These findings are consistent with a study by Putri and Santoso (2020) which reported that packaging workers in the food industry experience a lot of complaints about their shoulders and necks due to static activities.

The high level of complaints in the upper body area indicates the presence of static workload and inappropriate ergonomic factors. This underscores the importance of interventions in the form of improved working posture, task rotation, and active stretching to reduce long-term musculoskeletal complaints (Setyowati et al., 2021).

Bivariat analysis

The Chi-Square test showed that working time ($p = 0.043$) and daily working duration ($p = 0.031$) were significantly related to musculoskeletal complaints. Age and gender were not significantly related.

Table 3. Characteristic relationship with musculoskeletal complaints

Variabel	Complaints (+) n (%)	Complaints (-) n (%)	p-value
Gender			
Male	16 (66,7)	8 (33,3)	0,275
Women	40 (78,4)	11 (21,6)	
Age			
< 30	12 (66,7)	6 (33,3)	0,188
30–39	29 (76,3)	9 (23,7)	
≥ 40	15 (78,9)	4 (21,1)	
Working period			
< 2 years	9 (60,0)	6 (40,0)	0,043*
2–5 years	26 (72,2)	10 (27,8)	
> 5 years	21 (87,5)	3 (12,5)	
Working duration			
< 8 am	16 (57,1)	12 (42,9)	0,031*
≥ 8 jam	40 (85,1)	7 (14,9)	

*Remarks: Chi-Square test, significant when $p < 0.05$

The results of bivariate analysis in Table 3 show that working time and working duration have a significant relationship with musculoskeletal complaints ($p=0.043$ and $p=0.031$). Respondents with a working period of more than five years experienced higher complaints compared to those with a shorter working period. This is in line with the research of Sari et al. (2020) which reported that prolonged exposure to workloads and unergonomic body positions increase musculoskeletal disorders in industrial workers. Similarly, the duration of work ≥ 8

hours per day has been shown to correlate with the high level of complaints, in accordance with the findings of Wahyuni et al. (2021) that long working hours without adequate rest can worsen muscle fatigue and accelerate the onset of complaints in the waist and shoulder area. In contrast, gender and age did not show a meaningful relationship in this study, similar to the study by Putri and Santoso (2020) which also found that work ergonomics factors were more dominant than demographic factors.

Thus, this study confirms that daily work duration and long working time are the main factors contributing to musculoskeletal complaints in packaging workers. Interventions that need to be carried out include setting working hours, rotation of tasks, and implementing an active stretching program on the sidelines of work.

CONCLUSION

This study shows that musculoskeletal complaints are a relatively high occupational health issue among packing workers in the Japanese Taiyaki cake frozen food industry, with the most frequently reported body regions being the waist (61.3%), shoulders (52.0%), and neck (40.0%). Bivariate analysis showed a significant relationship between musculoskeletal complaints and working duration of ≥ 8 hours per day, as well as working tenure of >5 years, while age and gender did not show a statistically significant relationship.

These findings support evidence that repetitive workloads, prolonged working hours, and poor ergonomic conditions are associated with increased musculoskeletal complaints among workers. Therefore, ergonomic interventions such as working hours management, task rotation, posture improvement, and active stretching programs are important to implement in order to reduce musculoskeletal complaints and improve occupational health among packing workers.

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