

# Control of the Risk of Musculoskeletal Disorders in the Food Industry: Systematic Review

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## Abstract

Manual load handling in the food industry is unavoidable, and it is associated with musculoskeletal disorders (MSDs). The severity caused by MSDs can significantly reduce the work productivity of employees. The purpose of this study was to determine the control of MSDs in industries engaged in food processing. Articles traced from 2015 - 2020 on Science Direct, PubMed, and Taylor & Francis following the PRISMA Flow Diagram guidelines. There are inclusion criteria in the selection, namely; publications in English, available abstracts, peer-reviewed, not case studies/case reports, not acute trauma or fractures, quantitative or semi-quantitative descriptions of hazard exposure measures, industries or businesses that produce food or food processing and work productivity associated with musculoskeletal disorders. The risk factors associated with the occurrence of MSDs in food industry workers are age, work stress, gender, manual load handling process, extreme temperature excess weight (work environment), smoking habits, and workers who consume alcohol. Control of MSDs in the food industry ergonomics training, workplace adjustment, work management, improved occupational health services (including periodic checks), and manual handling load adjustments. This review provides information on controlling MSDs in the food industry or food processing to decrease work productivity.

## Keywords

Musculoskeletal Disorders, Risk Factor, Food Industry, Food Processing, Productivity.

## Introduction

Food processing is one of the critical sectors in the industrial sector. It is recorded that in Indonesia, 1,005,612 employees work in the food processing industry (BPS - Statistics Indonesia, 2018). In the food processing industry, it is unavoidable that there are still manual load handlers or high-frequency manual handling (Botti, Mora, & Regattieri, 2015). To obtain maximum work productivity in the industrial sector requires intense manual labor and psychological pressure (Guimarães, Ribeiro, Renner, & De Oliveira, 2014). The factors associated with interpersonal relationships and working conditions influence the occurrence of musculoskeletal disorders (MSDs) (Da Costa & Vieira, 2010; Nimbarte, Al Hassan, Guffey, & Myers, 2012).

Musculoskeletal disorders are a common problem that significantly impacts workers' health and the global economy (Seidel, Ditchen, Hoehne-Hückstädt, Rieger, & Steinhilber, 2019). Musculoskeletal disorder is the second most common cause of disability worldwide, measured by years of life with a disability (YLD), with low back pain being the most common condition (Storheim & Zwart, 2014). Some of the factors that cause musculoskeletal disorders in workers include age, gender, work shift, hand domination, perceived fatigue, and work experience (Jain, Meena, Dangayach, & Bhardwaj, 2018; R. R, Vinodkumar, & Neethu, 2017).

Health is often at stake in the workforce to meet productivity demands in the workplace. Health impacts are often related to the existence of a working system imposed by management, which results in health problems (Knutsson, 2003). According to the latest estimates released by the International Labor Organization (ILO), 2.78 million workers die each year due to occupational accidents and occupational diseases (International Labour Organization, 2018). About 2.4 million (86.3 percent) of these deaths were due to occupational diseases, while more than 380,000 (13.7 percent) were due to occupational accidents. Research on the 2017 Global Estimates of occupational accidents and occupational diseases states that there has been an increase of more

than 400,000 incidents(Hämäläinen, Takala, & Boon Kiat, 2017).Meanwhile, national data shows that the number of claims for compensation for work-related accidents and diseases is 106,914(Badan Penyelenggara Jaminan Sosial Ketenagakerjaan, 2017),including health disorders due to musculoskeletal disorders.

Lack of attention to the impact of musculoskeletal disorders on companies has resulted in the high value of compensation that has to be paid.It is noted that the total cost of these cases of musculoskeletal disorders relative to labor productivity is the US \$ 171.7 million(Piedrahita, 2006). Musculoskeletal disorders of skeletal muscle disorders are a type of occupational disease caused by several factors, including primary, secondary, and combination causesDecisions related to musculoskeletal disorders as occupational diseases are mentioned in Presidential Decree No.7 of 2019 Annex II / c(Pemerintah Republik Indonesia, 2019).

Various possible exposure to hazards in the work environment can be minimized to reduce musculoskeletal disorders in workers by implementing good working time management and other interventions in the production process.Based on article 77 of the Manpower Law No. 13 of 2003, the working hour regulation is 7 hours a day or the equivalent of 40 hours a week for six days of work in a week or 8 hours a day, the equivalent of 40 hours a week for five working days in a week(Pemerintah Republik Indonesia, 2003).Companies may also ask employees to do overtime if necessary, as long as the working time is following the policies stipulated in article 78 of the Manpower Law No. 13 of 2003, overtime can only be done a maximum of 3 hours a day, overtime can only be done a maximum of 14 hours a week. Overtime workers are entitled to overtime pay.

Based on the description above, it is necessary to have a comprehensive summary related to the control of musculoskeletal disorders in the food processing industry to be used as a reference for these companies to suppress or even prevent the occurrence of musculoskeletal disorders in their workers.

## **Methods**

### **Literature Search and Selection Process**

This study uses the Systematic Literature Review (SLR) method to present and evaluate literature related to research topics by utilizing a comprehensive and auditable methodology.(Kitchenham, 2004; Levy & Ellis, 2006). Search through three leading journal databases, namely Science Direct, PubMed, and Taylor & Francis. The literature search was carried out in October - December 2020. The study reviewed was a study in English, which was obtained using the following "Boolean operators" (control OR management) AND "risk factors" AND "musculoskeletal disorders" AND (industry OR factory). To select eligible publications, we follow the 4-step PRISMA Flowchart (1: Identification, 2: Screening, 3: Eligibility, and 4: Included Articles (Liberati et al., 2009; Moher et al., 2009), Figure 1).

### **Inclusion Criteria**

All inclusion criteria were defined a priori, that is; Studies that do not meet the scope, namely interventions using software or software to predict an event, studies not in industry or food processing businesses, and studies of human analgesics are sorted in advance. The criteria we mean in this paper are as follows:

- a) Publication in English, abstract available, peer-reviewed, not case study/case report.
- b) It is not a study of acute trauma or fractures.
- c) Studies with quantitative or semi-quantitative hazard exposure measures.
- d) Industries or businesses that produce food or food processing and work productivity are related to musculoskeletal disorders.

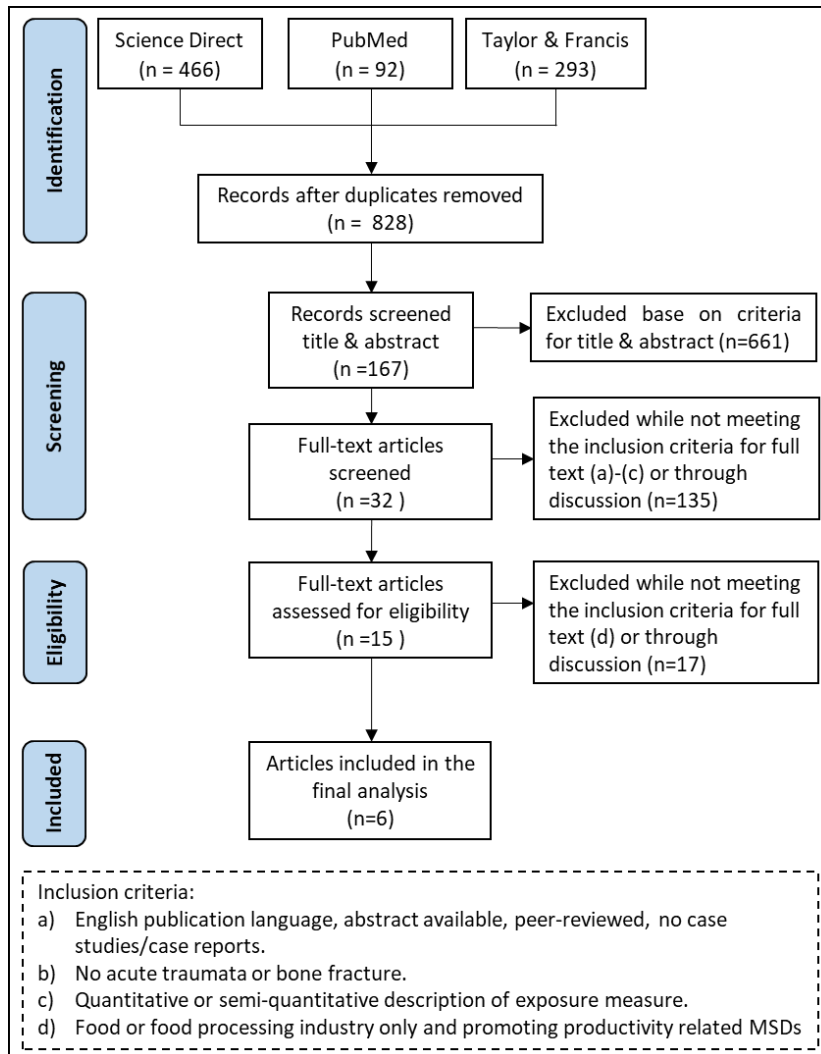


Figure 1. PRISMA Flow Diagram: This figure shows the study selection process of articles

### Result

Tabel 1. Summary of search results for literature studies

| No | Research Title   | Design and purpose   | Participants                             | Instrument  | outcome  |
|----|--|--|--|---|--|
| 1  | Factors affecting the musculoskeletal disorders of workers in the frozen food manufacturing factories in Thailand (Thetkathuek, Meepradit, & Jaidee, 2016) | Cross-sectional study<br>The purpose of this study was to study the factors that influence musculoskeletal disorders | 528 workers at two frozen food factories | Questioner, Risk assessment for work posture method (REBA & RULA) | Most of the symptoms were found in the dissecting department, higher than in the control group. The details of the symptoms are elbow pain. Regarding the risks of drinking alcohol, workers are exposed to higher risk when alcohol is consumed |
| 2  | Cold Exposure and Health Effects among Frozen Food   | Cross-sectional study<br>Aims to explore the health effects of   | 497 workers at two frozen food           | Interview & Working environment                                   | Workers' health should be monitored, especially back pain  |

|   |   |  |   |  |  |
|---|---|--|---|--|--|
|   | Processing Workers in The Eastern Thailand(Thetkathuek, Yingratanasuk, Jaidee, & Ekburanawat, 2015)   | working in cold environments and the factors affecting frozen food industry workers' abnormal symptoms to provide necessary information to monitor health risks due to exposure to cold. | factories   | data   | and muscles, respiratory symptoms, episodic symptoms of fingers, and cardiovascular symptoms. Health promotion must be done in the form of the prohibition of smoking and consuming alcohol for employees.   |
| 3 | Educational intervention for reducing work-related musculoskeletal disorders and promoting productivity (Abareshi, Yarahmadi, Solhi, & Farshad, 2015) | quasi-experimental design (control)aims to determine the role of implementing interventions based on protective motivation theory in reducing WMSD and increasing productivity           | 158 workers assessed the work productivity associated with MSDs | Questionnaire-based on protection motivation theory (PMT), Productivity questionnaire based on subjective productivity measurement (SPM), Quick exposure check (QEC) | The provision of intervention in the form of training for workers significantly increased the production cost and efficiency in the group studied. Ergonomic training based on protective motivation theory effectively reduces musculoskeletal risk factors. It increases subject knowledge can lead to increased productivity. |
| 4 | Health risk assessment on musculoskeletal disorders among potato-chip processing workers (Chaiklieng, 2019)   | Cross-sectional study<br>The study aimed to assess MSDs health risk among potato-chip processing workers   | 107 randomly sampled workers                                    | A self-report questionnaire, ergonomics risk assessment (RULA)   | MSDS risk assessment can be useful for surveillance screening before implementing a risk control program. Furthermore, ergonomics training programs and workstation repair for high-risk groups arealso recommended based on the ergonomics and health risk assessments in this study.   |
| 5 | Health assessment of self-employed in the foodservice industry(Grégoris, Deschamps, Salles, & Sanchez, 2017)  | Cross-sectional study<br>To assess the morbidity of self-employed in the foodservice industry, industries with many occupational health risks.   | 437 participants  | The health questionnaire included an interview, a clinical examination, and medical investigations   | The main adverse health conditions are joint pain, ear disorders, and heart disease—the need for occupational health services for workers to benefit from occupational risk prevention and health surveillance.  |

|   |  |  |                                      |                             |  |
|---|--|--|--------------------------------------|-----------------------------|--|
| 6 | Work activity in foodservice: The significance of customer relations, tipping practices and gender for preventing musculoskeletal disorders (Laperrière, Messing, & Bourbonnais, 2017) | Cross-sectional study<br>This is to determine the workers' exposure to MSDs and gender interactions with MSDs. | 64 workers from 44 other restaurants | Questionare and observation | Customer service in restaurants has a unique effect on work, emotional, and cognitive activities, which correlate with MSDs. Women are known to have a higher risk of MSDs related to direct customer service. |
|---|--|--|--------------------------------------|-----------------------------|--|

## Discussion

The results of the review of 6 articles indicate that several risk factors can cause musculoskeletal disorders in the food industry or food processing workers. It is known that musculoskeletal is one factor that can affect work productivity at (Bevan, 2015; Vargas et al., 2018; Yusuf, Santiana, & Lokantara, 2017). All articles that met the PRISMA flow diagram guidelines and the type of data used in the selected articles were quantitative in hazard exposure assessment.

### Risk Factors for Musculoskeletal Disorders in the Food Industry

The results of the study from a review of 6 scientific articles found several risk factors related to the occurrence of musculoskeletal disorders in food industry workers, namely age, work stress, gender, manual load handling process or manual handling, extreme temperature excess weight (work environment), smoking habits and workers who consume alcohol. Information obtained from the Rapid Upper Limb Assessment (RULA) results from Some workers are at very high risk. The subjective self-report assessment showed that workers rated themselves at a lower level of risk, i.e., only 11.21% were moderate to very severe for the upper body, 9.35% for lower limbs, and 8.41% for upper limbs, and 4.66% for the neck.

Risk factors with at least reasonable evidence of a causal relationship for the development of work-related musculoskeletal disorders include strenuous physical work, smoking, high body mass index, high psychosocial work demands, and presence of comorbidities (Da Costa & Vieira, 2010; Hämmig, Knecht, Läubli, & Bauer, 2011). Although there is debate about work-related musculoskeletal disorders (WMSDs), there is confusion about epidemiological principles and gaps in the scientific literature; one reason that some people accept is job stress (Punnett & Wegman, 2004). Reports regarding the severity of musculoskeletal disorders can be found in several parts of the body, including the shoulders, lower back (spine), neck, upper legs, upper back, wrists, and fingers (Cromie, Robertson, & Best, 2000; Yun, Lee, Eoh, & Lim, 2001).

### Control of Musculoskeletal Disorders

Each article's results show that manual handling has a significant effect on the occurrence of musculoskeletal disorders in food industry workers. With the various types of work in each article, there are also different levels of severity at each level of work performed. The incidence of musculoskeletal disorders has a significant effect on decreasing the work productivity of employees due to the high level of severity that occurs. The control measures mentioned for controlling musculoskeletal disorders and also increasing employee productivity are using ergonomic training interventions for employees. Ergonomic training

based on protective motivation theory effectively reduces musculoskeletal risk factors and increases productivity(Abareshi et al., 2015).

Other types of controls needed to reduce musculoskeletal disorders include workplace adjustment, work management, improved occupational health services (including periodic checks), and manual handling load adjustments.(Brandt et al., 2018; Grégoris et al., 2017; Laperrière et al., 2017; Thetkathuek et al., 2015). This type of participatory ergonomic intervention can increase the success of interventions aimed at reducing excessive physical exposure to workers(Brandt et al., 2015). In addition to intervention through ergonomics training, technical and administrative control can also positively reduce the incidence of musculoskeletal disorders in workers.(Silverstein & Clark, 2004).

### Conclusion

Several risk factors have a significant influence on musculoskeletal disorders in the food industry, among others; age, work stress, gender, manual load handling process or manual handling, heavy overload, extreme temperature (work environment), smoking habits, and workers who consume alcohol.It was found that there are five methods to control the incidence of musculoskeletal disorders in the food industry, namely, ergonomics training, workplace adjustments, work management, occupational health services (including periodic checks), and manual handling load adjustments. With decreasing musculoskeletal disorders, worker productivity will increase.

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