

Work-related Skin Disease Symptoms in Tofu Makers in Cipayung District

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ABSTRACT

Introduction: One of the risks that may come from exposure to chemicals, physics, and biological agents in the interaction of processes in industrial activities, particularly in the business of making tofu in the tofu maker's environment, is a work-related skin disease. The number of years of employment, chemical exposure and the time spent each day, hand-washing routines, and the use of personal protective equipment while at work are additional risk factors known to influence the frequency of occupational skin disorders. This study seeks to obtain information about the symptoms and some risk factors of work-related skin diseases in tofu makers in Jalan Raya X, Cipayung District. **Methods:** The analytical cross-sectional design with a chi-square test was carried out with 50 tofu makers as the total research sample. Measurements were made using the modified Nordic Occupational Skin Questionnaire (NOSQ-2002)/LONG. **Results:** The study found that 46% (23 people) of tofu makers did experience symptoms of work-related skin diseases. As many as 84% (42 people) of tofu makers with a working period of more than 3 years, and as many as 96% (50 people) had exposure 3 hours per day. As many as 62% (31 people) had bad hand-washing habits, and 96% (48 people) did not fully use personal protective equipment. **Conclusion:** Improvement of supporting facilities and infrastructures in the production area, such as air circulation systems, modification of machinery and equipment, setting working hours, and providing proper cleaning facilities will increase the health status of workers.

Keywords: irritant contact dermatitis, NOSQ-2002, occupational skin diseases, symptoms of work-related skin diseases, tofu maker

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INTRODUCTION

One of the most common work-related skin diseases is work-related contact dermatitis. Contact dermatitis is a skin response in the form of inflammation caused by a substance or substances attached to the skin (Kurniawidjaja and Ramdhan, 2019).

Work-related skin diseases, or acquired while doing work, have many causes. Occupational skin diseases account for more than 35% of all work-related diseases, with an incidence of about one worker per thousand annually. However, the reported cases are still very few and incomplete, causing financial losses for workers and employers. Most occupational skin diseases originate from contact with chemicals in the form of dermatitis. More than 90,000 chemicals have been identified in the

environment today, all of which can irritate the skin under certain conditions, and about 2000 of these chemicals have been known as contact dermatitis allergens. In addition, workers with a history of pre-existing skin diseases can be exacerbated by their work (Kurniawidjaja and Ramdhan, 2019).

Based on Bhatia and Sharma (2017), about 25% of all lost workdays in the United States are due to occupational skin disorders, which comprise 30 and 45% of all occupational diseases. Although there are no figures on the size of the issue in Asia, it is known that occupational skin disorders are a major cause of occupational diseases, particularly in Asia, where the majority of the workforce works in the unorganized sector. The incidence and pattern of occupational skin illnesses reported in Asian nations as well as the allergen types present in various vocations, are the main topics of this review paper. One of the major health issues is occupational skin disorders, which are thought to affect 1.89 million people annually. Asian nations lack a framework for reporting occupational skin illnesses, in contrast to

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the West, where such a system exists; So, there are epidemiological data. The level of socioeconomic and industrial development in a region determines the prevalence of certain occupational skin disorders, leading to wide geographic variances. In the 2013 Occupational Health and Safety Statistics Report, just 56 and 141 new cases were reported for Singapore and China. In Korea, there are 0.19 occupational skin illnesses per 100,000 workers. Compared to 7.1% in Europe, skin disorders make up 2.5% of occupational diseases in Vietnam and 11% in Thailand. Exemplified in a study from Taiwan in 1994, when 84% of 18,942 Taiwanese workers replied to a questionnaire; the 12-month prevalence rate for skin problems of the upper extremities was 8.2%, and the respondents believed 56.7% of these skin diseases to be related to their jobs. Nearly 45% of people said they didn't go to a doctor for a formal diagnosis or treatment. In a cross-sector assessment of Nepal's small-scale companies, 26% of employees had unreported skin issues. Due to difficulties including child labor, subpar industry legislation, a sizable, unorganized informal sector, a lack of focus on industrial hygiene, and subpar supervisory standards, there are no specific data from the Indian subcontinent, where occupational research is a more complicated problem. (Bhatia and Sharma, 2017).

Based on the results of the statistical report on work-related skin diseases in the UK, it is stated that in 2019 there were around 1,015 people with cases of work-related skin diseases, then in 2020, it is estimated that there will be around 7,000 new cases related to work-related skin diseases every year. The annual report stated that among 1,018 workers diagnosed by specialist doctors, 876 (86%) had contact dermatitis, 22 (2%) had non-cancerous dermatitis, and the remaining 121 (12%) had skin cancer (Health and Safety Executive, 2020). In western states, about 90% of occupational diseases were contact dermatitis. In the workplace, irritant contact dermatitis was more common than allergic contact dermatitis, with a ratio of 4:1 (Rima and Manisha, 2018).

The percentage of people who had skin conditions due to their jobs varies by nation: 12,9-17,7% in the USA, 9,6% in France, 16% in Denmark and Finland, 22% in the UK, and 60% in industrialized nations (Park *et al.*, 2020).

Skin conditions are quite upsetting for the comfort of the sufferer, despite the fact that they do not result in death. The quality of life is impacted

by contact dermatitis, which also compromises hand function. Nearly 75 percent of respondents to the Centre for Research Expertise in Occupational Disease (CREOD) (2015) survey of 339 patients with contact dermatitis reported feeling itchy or in pain. A third of people said that contact dermatitis was embarrassing, interfered with their ability to work, and disturbed their sleep. One in five people said the treatment was annoying, and almost a quarter claimed that it made it difficult to do household and engage in social or recreational activities. The itch was most frequently connected to allergy and work-related contact dermatitis, while embarrassment was most frequently connected to hand dermatitis. In a study of patients with contact dermatitis, it was discovered that four out of five had decreased grip strength and half had numbness in their hands and upper extremities.

Therefore, skin disease is a very important factor in decreasing work productivity and increasing sick leave rates (Harrianto, 2008). Occupational skin diseases are caused by direct skin contact with the causative agent. Risk factors that cause occupational skin diseases can be classified into mechanical, physical, biological, and chemical factors. Mechanical factors such as contact with tools or surfaces that are contaminated with hazards such as workbenches, tools, or clothing. Physical risk factors in question include weather conditions (heat, cold, wind, rain), heat, sun, radiation (ultraviolet and other ionizing radiation), and irritation of mineral fibers, while biological agents are often bacteria and fungi. Meanwhile, other risk factors that are also known to influence the incidence of occupational skin diseases include years of work, allergy records, exposure to organic dust and duration of exposure per day, hand-washing habits, and the practice of wearing gloves during work (Hendra, Nirwana and Isahak, 2018).

Work-related contact dermatitis is one of the most common skin disorders in industries such as tofu factories which can reduce worker productivity. Exposure to chemicals used in the clotting process can cause contact dermatitis, resulting in irritation and other skin disorders in the form of redness, edema, itching, thick skin, cracked skin, and hyperpigmentation. The results of research from Daulay (2016) on 36 tofu makers in Binjai as many as 52.8% showed symptoms of contact dermatitis. Other research conducted on Mrican tofu maker workers showed that as many as 69.7% of workers suffered from contact dermatitis (Pradananingrum, Lestantyo and Jayanti, 2018).

One of the agricultural products that are widely used as the basic material for making products in the agroindustry sector in Indonesia is soybean. Soybean products are very diverse, one of which is tofu products. The number of tofu industries in Indonesia reaches 84,000 business units with a production capacity of more than 2.56 million tons per year. As many as 80 percent of the tofu industry is on Java island (Chafidz and Dwiyantri, 2017).

Tofu is one of the processed products from soybeans which is an excellent source of vegetable protein and is widely consumed as a side dish of daily food in Indonesia. Tofu making begins by soaking soybeans in water for approximately 4 hours to facilitate the soybean milling process. After soaking, the soybeans are washed thoroughly and removed dirt so that it does not enter the tofu mixture. Next, the clean soybeans are ground using a grinding machine and continuously flowing water until it becomes soybean porridge with the desired thickness. After that, the soybean porridge is cooked using a steam heater furnace until it thickens and boils. After the soybean porridge has been boiled and thickened, the next process is to filter it using a filter cloth to separate it from the tofu dregs. After that, the tofu coagulation or deposition process is carried out by adding vinegar with a concentration of 5% as a coagulating agent. Then a layer of tofu sediment will be formed at the bottom and whey on top. This tofu precipitate is then put into a wooden mold that has been shaped according to the size of the tofu that will be marketed, the lid is covered with a thin filter cloth and pressed until the tofu texture is hard enough and does not crumble when removed from the mold. Then the tofu is cut into pieces, put in containers filled with water, and ready to be marketed (Rhizkiyana, 2019).

The tofu making is through a process of deposition and agglomeration by the coagulating material. Vinegar, lactic acid, and tofu stones are clotting agents that can be utilized. Tofu-making business is one small and medium enterprises with workers who use soybean raw materials and equipment and machines to support the production process. In making tofu, workers may come into intimate contact with chemicals, namely when using acid solution water used as a coagulation of tofu starch which comes from the boiling process of tofu. Acid solution water to coagulate tofu starch is usually added with vinegar of various types such as vinegar or acetic acid. The amount of vinegar that is dissolved is only a small amount at the beginning

of the manufacture of the liquid to agglomerate the year and is based on worker estimates only. In addition, tofu makers also have the potential to get work-related skin disorders due to exposure to heat hazards from the workplace environment that is directly adjacent to the tofu cooking furnace and the humid conditions of the tofu-making process that uses water at all stages of the processes (Chafidz and Dwiyantri, 2017).

The tofu-making business on Jalan Raya X, Cipayung District, East Jakarta is an association of tofu maker which have about 100 people who are divided into several groups of tofu maker with different work hours in the morning and nighttime for making white tofu and fried tofu.

In the semi-modern tofu production processes, the firewood is used as fuel that is burned in the boiler tanks, and then the water vapor produced from the boiler tanks flows through the pipes to be used as fuel in each cooking furnace. This causes the air temperature inside the production area to be high. The work process in a tofu-making factory is always related to water, including hot water, starting from the process of soaking, grinding, cooking, and cutting tofu involves some manual activities using manpower and always using large amounts of water. This causes the humidity in the workplace to be always high. In addition, the leftover water from cooking tofu always flows, causing the work floor to be always wet.

Through observations and brief interviews conducted with 3 (three) workers in this tofu-making business, they informed that they had experienced complaints of skin disorders such as itching and redness on the palms of the hands while working, but these symptoms would subside after finishing work. When carrying out the production process of making tofu, the tofu maker can meet ingredients such as soybeans, soaking water, and also acid solution water mixed with vinegar. From the information from the supervisor of the tofu maker, it was also found that workers had eczema on their hands, but these workers refused to be interviewed. This research aims to obtain information about the symptoms and some risk factors of work-related skin diseases in tofu makers in Jalan Raya X, Cipayung District, East Jakarta.

METHODS

This type of research was quantitative research with observational analytics with a cross-

sectional design where the data of the dependent and independent variables were observed at the same time. The research was carried out from October 2021 to January 2022 at the location of a small tofu-making business area on Jalan Raya X, Cipayung District, East Jakarta, with a sample of 50 tofu makers as the total samples. This location accommodated about 20 groups of tofu makers which had around 100 personnel and varying working hours and distribution channels. The number of workers also varied from 2 (two) people to 6 (six) people per production group who are in charge of producing, packing and selling tofu. They had been running this business for a long time from their parents. Currently, the production process used machines and equipment, although manual work activities were carried out without proper supporting work tools. This location had several production areas, some of which are in a closed building with minimal ventilation, doors, and windows, and some were in an open area that was closed at the top using a roof. Tofu production was marketed around East Jakarta; the furthest was sent to Slipi, West Jakarta.

Primary data was data obtained directly by the researcher from tofu-making workers in the Jalan Raya X, Cipayung District. It also explained the research objectives until the respondents understood and agreed to assist with the research and were willing to sign the informed consent. Primary data to be studied can be obtained from questionnaires the modified Nordic Occupational Skin Questionnaire (NOSQ-2002)/LONG (Flyvholm *et al.*, 2002). The questionnaire included the characteristics of workers such as the name, age, sex, workplace location, tasks, years worked, duration of exposure to hazardous materials, more questions about individual factors, symptoms of work-related skin diseases and the body parts affected, and also practices relating to workplace safety.

The information was gathered to explain the frequency of work-related skin disease symptoms and the risk variables, including working hours, daily exposure amounts, hand hygiene practices, and the usage of personal protective equipment at work. A computer-aided statistical tool was used to analyse the data and determine the distribution frequency and proportions of the independent and dependent variables. The chi-square test was used in the subsequent bivariate analyses to determine the relationship between each independent variable (working time, exposure time, hand hygiene practices, and use of personal protective equipment/

PPE) and the dependent variable (symptoms of work-related skin diseases). The degree of confidence used was 95%. If the P value < 0.05, then the statistical calculation demonstrates that the independent and dependent variables have a substantial relationship.

RESULT

This study involved all male workers, although, in practice, several female workers helped to load the finished cooked and printed tofu into packaging for delivery. All respondents were workers who make tofu in the cooking area, sales, or who handle the whole process. There were also 2 (two) supervisors who were interviewed and observed for helping with the cooking process.

As shown in Table 1, 23 (46%) tofu makers had symptoms of work-related skin diseases. There were more workers with more than 3 years of service ($n = 42$, 84%) than those with <3 years of service ($n = 8$, 16%). Based on the work process of making tofu, the risk of long exposure was the contact of workers with exposures such as chemicals or hot water for more than 3 hours per day as many as 48 people (96%). Table 1 below also shows that as many as 31 (62%) workers had bad hand washing habits, namely less than 5 times using soap and clean water during working hours. It was also known that 48 (96%) workers used personal protective equipment (PPE) while working.

Table 1. Distribution of Working Period, Duration of Exposure, Hand washing Habits, and Use of PPE and Work-related Skin Disease Symptoms on Tofu Maker in Cipayung District year 2021

Variables	Categories	n	%
Work-related Skin Disease Symptoms	With symptoms	23	46
	No symptoms	27	54
Working Period	< 3 years	8	16
	≥ 3 years	42	84
Duration of Exposure	< 3 hours	2	4
	≥ 3 hours	48	96
Hand Washing Habits	Good	19	38
	Bad	31	62
Use of PPE	Complete	2	4
	Incomplete	48	96

Notes:

n = The number of samples

Based on Table 2, the results of this study obtained that the working period of tofu makers in the category <3 years who suffered from work-related skin disorders symptoms amounted to 4 (50%) people and 4 (50%) people who did not suffer from work-related skin disorders symptoms. The working period of tofu makers in the category of more than 3 years, who suffered from symptoms of work-related skin disorders were 19 (45.23%), and those who did not suffer from symptoms were 23 (54.77%). Based on the table above, the value of $p = 1.000$ was greater than $= 0.05$. The results of the chi-square test showed that there was no relationship between a work period and symptoms of work-related skin disorders in tofu makers in Cipayung District.

From the results of this study, the duration of exposure for tofu makers with the category <3 hours a day who suffered from work-related skin disorders symptoms was 1 (50%) person and 1 (50%) person do not suffer from work-related skin disorders symptoms. The duration of exposure to tofu makers in the category of more than 3 hours a day, who suffered from symptoms work-related of skin disorders were 22 people (45.83%), and those who did not suffer from symptoms were 26 people (54.17%). Based on the table above, it is obtained that the value of $p = 1.000$ was greater than $= 0.05$. The results of the chi-square test, it showed that there was no relationship between the duration of exposure per day with symptoms of work-related skin disorders symptoms in tofu makers in the Cipayung District.

The results of the study on the habit of washing hands on tofu makers in the good category who suffered from work-related skin disorders symptoms were 8 people (42.10%) and 11 people (57.90%). The habit of washing the hands of tofu makers in the bad category, who suffered from symptoms of work-related skin disorders 15 people (48.38%) and those who do not suffer from symptoms 16 people (51.62%). Based on the table above, it is obtained that the value of $p = 0.888$ was greater than $= 0.05$. The results of the chi-square test showed that there was no relationship between hand-washing habits and symptoms of work-related skin disorders symptoms in tofu makers in the Cipayung District.

Moreover, it is also known that the results of research on the use of personal protective equipment in tofu makers with a complete category who suffered from work-related skin disorders were 2 people (100%) and none of them did not suffer from work-related skin disorders symptoms. The use of PPE for tofu makers in the incomplete category, who suffered from symptoms of work-related skin disorders 21 people (43.75%), and those who did not suffer from symptoms 27 people (56.25%). Based on the table above, it is obtained that the value of $p = 0.401$ was greater than $= 0.05$. The results of the chi-square test showed that there was no relationship between the use of PPE with symptoms of work-related skin disorders symptoms in tofu makers in the Cipayung District.

Based on Table 2, it can be seen below the distribution of tofu makers based on the symptoms of work-related skin diseases and the variables

Table 2. Risk Factors Associated with Work-related Skin Disease Symptoms on Tofu Maker in Cipayung District

Variables	Categories	With work-related skin disease symptoms (n = 23)		Without work-related skin disease symptoms (n = 27)		Total	p value	PR	95% CI	
		n	%	n	%					N
Working Period	< 3 years	4	50	4	50	8	100	1.000	1.105	0.512-2.384
	≥ 3 years	19	45.23	23	54.77	42	100			
Duration of Exposure	< 3 hours	1	50	1	50	2	100	1.000	1.091	0.264-4.511
	≥ 3 hours	22	45.83	26	54.17	48	100			
Hand Washing Habits	Good	8	42.10	11	57.90	19	100	0.888	0.870	0.459-1.651
	Bad	15	48.38	16	51.62	31	100			
Use of PPE	Complete	2	100	0	0	2	100	0.401	0.438	0.317-0.603
	Incomplete	21	43.75	27	56.25	48	100			

Notes:

PR = Prevalence ratio, CI = Confidence interval, n = The number of samples

studied. The results of the analysis showed that there was no statistically significant relationship between the variables of the working period, duration of exposure, hand washing habits, and use of PPE with symptoms of work-related skin disease in the tofu maker.

DISCUSSION

Work-related Skin Disease Symptoms

From this study, it is known that the prevalence of work-related skin diseases among tofu makers in the Cipayung District was 46%. Research on tofu factory workers in Semarang also found that the proportion of white tofu factory X workers and yellow tofu factory Y showed 42.9% and 35.3% of workers incidence of contact dermatitis (Megantari, 2020). The tofu production supervisor claimed not to add harmful ingredients such as formalin to their tofu. The seasoning ingredients used are only salt and turmeric (for yellow tofu). Most the tofu makers generally do not know specifically the chemical substances contained in the coagulation solution used to precipitate soy protein. They only call it vinegar acid. This clotting solution is not made every day. It is used as the first seed of the clotting solution. If the clotting solution made from the vinegar is finished, it will be stored and reused in the next cooking process. The remaining clotting solution that is used again the next day is called vinegar water. Vinegar is a liquid left over from the clumping process in making tofu which can still be used again as an ingredient for further clumping. To be used again to coagulate protein in the manufacture of tofu, the remaining liquid vinegar must be stored for 1 x 24 hours to give the vinegar acid bacteria a chance to ferment it. Vinegar has no expiration date (Chafidz and Dwiyanti, 2017).

The symptoms occurred among tofu makers because of inflammation that developed while in contact with tofu materials and also the large amount of water used during the tofu-making work process. The coagulation material and also hot water usage in the process of making tofu contains acid which can cause damage to the outer layer of skin cells, the longer contact with chemicals will further damage the deeper layer of skin cells and make it easier for dermatitis to occur. In the process of cooking work, the filtering workers are in direct contact with the tofu coagulation solution. The process starts with boiling the milled soybean porridge, mixing the

stew with the coagulation solution, and ending with filtering the clumping results. From these stages, it can be said that the filtering section is at risk for contact dermatitis, possibly due to exposure to an acidic coagulation solution and supported by exposure to hot water when mixing the coagulation solution with boiled soybean porridge (Chafidz and Dwiyanti, 2017).

The tofu maker had received the program of occupational health from the local community health center, but only once in the last 3 years in the form of counseling activities from the medical team. Many workers of tofu makers did not know that the symptoms they feel are contact dermatitis, most of them did not routinely take treatment because minor symptoms such as itching and burning can disappear if they stop working.

There was an improvement in knowledge and attitudes of car wash workers in Pangkalan Masyhur, Medan related occupational contact dermatitis when the interventions in the form of health education regarding personal hygiene and the use of personal protective equipment with flip charts. It is expected that the related governmental agencies will pay attention to the health and safety of informal sector workers with intensive and ongoing health education activities regarding personal hygiene to avoid health problems such as contact dermatitis. It is recommended that business owners make efforts to minimize contact dermatitis by increasing the awareness of workers to use gloves and other personal protective equipment related to the type of work as well as personal hygiene facilities (Parinduri and Siregar, 2020).

Based on Park *et al.* (2020), the characteristics of the workforce self-employed individuals, small-business owners, those who worked longer shifts, and manual and service employees were more likely to develop work-related skin illnesses. Even though skin disease is a prevalent occupational condition, there are very few occurrences of work-related skin disorders documented in Korea and no epidemiological information for these illnesses. Occupational physicians, allergists, and dermatologists have little interest in work-related skin diseases because patients are difficult to diagnose quickly and on time, workers rarely seek medical advice, pursue compensation plans, and think that conditions are transient rather than serious and life-threatening. This is also stated in the results of Holness *et al.* (2017), which examined employer representatives from the restaurant/ food service,

retail/ wholesale, tourism/ hospitality and vehicle sales and service sectors which highlighting the low awareness and low level of knowledge about work-related skin diseases in these sectors. Barriers to awareness and prevention include low reported incidents of work-related skin diseases, low priority, lack of training materials, lack of training time and costs, lack of management support and workplace culture.

Skin disorders are diseases that are often found in the community, especially in informal workers, due to a lack of attention to personal hygiene and the workplace environment. Several types of skin diseases include psoriasis, leprosy, dermatitis, scabies, tinea versicolor, smallpox, and others. The skin that is most often or commonly found includes abrasion or loss of the epidermal layer, the skin becomes rough, dry, scaly, and usually on the hands and feet (Isro'in and Andarmoyo, 2012). The situation and conditions of the work environment in the informal sector can also affect workers' awareness of occupational skin diseases. A study on service sector employer representatives including the restaurant and food service industries revealed insufficient knowledge of occupational skin disorders in the industry. Low priority, lack of training materials, lack of time and money for training, lack of management support, low reported incidence of occupational skin disorders, and workplace culture were among the obstacles to awareness and prevention (Holness *et al.*, 2017).

Working Period

As 8 (eight) workers with less than 3 years of service tended to have a greater risk than workers with more than 3 years of service, in line with Hendra, Nirwana and Isahak (2018) which found 189 (39.6%) shoe factory workers with less tenure than 3 years tended to have a greater risk because new workers were more sensitive and concerned with the perceived symptoms of work-related skin diseases, while workers with a working period of > 3 years sometimes stopped reporting about skin damage.

The results of the bivariate analysis showed that the risk factor of the working period did not have a significant relationship with symptoms of work-related skin disorders in tofu makers. This result is not similar to the study conducted by Meilanda, Cahyani and Joegijantoro (2022) fishermen in Pamekasan that there was a significant relationship between years of work and work-related skin

diseases. This can be caused by other dominating risk factors such as individual susceptibility, history of allergies, skin diseases, or previous work which in this study were not included in the studied variables. And it is also shown by research from Rhizkiyana (2019) on tofu-making workers in Bondowoso which showed that there was no significant relationship between years of service and the incidence of contact dermatitis.

Duration of Exposure

The risk factor that is also considered to contribute to the symptoms of work-related skin diseases that occur in tofu makers is the duration of exposure in a day to tofu-making ingredients. Like Chafidz and Dwiyantri (2017) at a tofu factory in Kediri, it is known that the average length of contact for tofu-making workers with the chemicals used for the clumping process is 4.68 hours/day. According to Hudyono (2002) the coagulation material and also hot water usage in the process of making tofu contains acid, which can cause damage to the outer layer of skin cells, the longer contact with chemicals will further damage the deeper layer of skin cells and make it easier for dermatitis to occur. Many exposures are associated with work-related contact dermatitis, particularly wet work. Wet work has a strong link to job-related contact dermatitis; a CREOD study indicated that hospital staff who performed wet work were 4.8 times more likely to report hand eczema in the previous year than those who performed dry work (Centre for Research Expertise in Occupational Disease (CREOD), 2015).

The relationship analysis of the risk factor of exposure duration showed no significant relationship with symptoms of work-related skin disorders in tofu makers. This result is not in line with the research conducted on tofu makers in Kediri by Chafidz and Dwiyantri (2017), which stated that there was a significant relationship between the duration of exposure and the incidence of contact dermatitis in tofu makers in Kediri. This can happen because the character of the group of tofu makers who are included in small and medium enterprises are diverse, starting from the division of work tasks, working time, group members in charge of preparing tofu production, cooking tofu, and also selling tofu to the market. So that the working time and division of labor will affect the duration of exposure to symptoms of work-related skin disorders.

It is also possible that the duration of exposure is influenced by the type of task performed at the time of making tofu. The process of the filtering section is in direct contact with significant exposure to the tofu coagulation solution. The process starts with boiling the milled soybean porridge, mixing the stew with the coagulation solution, and ending with filtering the clumping results. From these stages, it can be said that the filtering section is at risk for contact dermatitis, possibly due to exposure to an acidic coagulation solution and supported by exposure to hot water when mixing the coagulation solution with boiled soybean porridge (Chafidz and Dwiyanti, 2017). This is in line with research from Daulay (2016) showed that the most dominant factors that influence the incidence of contact dermatitis are the duration of exposure. workers who are in the filtering section 2.2 times will experience work-related skin disease symptoms when compared to respondents who are not in the filtering section.

Hand-washing Habits

Most the tofu makers (62%) did not pay attention to their hygiene and had poor hand-washing habits, in line with a study from Fera and Said (2018) can be concluded that the variables of personal hygiene are associated with the incidence of irritant contact dermatitis in farmers. In some areas of a tofu factory, found a lack of supporting facilities such as a hand washing area with a running water faucet, hand soap, and clean dry cloth to dry hands for washing hands which affects the personal hygiene of workers. This is in line with research conducted at the Mrican tofu factory that 87.5% of workers with poor personal hygiene experience contact dermatitis due to the lack of support and inadequate facilities for workers (Pradananingrum, Lestantyo and Jayanti, 2018). Based on observation conducted at the area of tofu production, the workers wash their hands with water in a bucket and use it to wash their hands many times. Some workers have to wash their hands with running water using a water hose because hand washing places are located far from their location. This hand-washing habit should be able to reduce the potential causes of dermatitis due to chemicals that stick after work (Megantari, 2020).

The statistical analysis result of the relationship of hand washing habits showed no significant relationship with symptoms of work-related skin disorders in tofu makers. This is in line with the results of research from Megantari (2020) which

stated that workers at the factory of yellow tofu and white tofu do not pay attention to their hygiene. This could be due to the lack of supporting facilities for hand washing. Other research is in line with the study of Garmini (2018) showing that there was no relationship between personal hygiene and the incidence of irritant contact dermatitis in tofu workers Primkopti. To avoid occupational skin diseases, workers should pay attention to personal hygiene while in the work environment, such as washing hands before and after doing work processes using soap and running water, using clean clothes during the work process, and bathing after work (Badriah and Heriana, 2020). In another study, the habit of hand-washing was discovered to be the most dominant risk factor for work-related skin disease symptoms in a shoe manufacturing company with a high OR (Hendra, Nirwana and Isahak, 2018).

Based on the observations of tofu makers, they washed their hands with water in a bucket and used it to wash their hands many times instead of using a clean running water source. In some areas observed, the workplace did not provide a place to wash their feet and hands while working, so workers used water which will also be used for tofu processing. In this study, workers also could not ensure that their body parts remained dry because there were no drying towels available, and the production area was always wet with water from the production process.

Use of PPE

On the other hand, it was found in the workplace that the awareness of workers to use personal protective equipment such as gloves and rubber shoes to protect the hands and feet of workers from the risk of skin diseases caused by work was also still low. Almost all respondents did not use complete personal protective equipment during work. Many workers even took off their upper clothes while working, because the air around the production area was hot, from the hot steam of the furnace and also the inadequate air circulation system. This is in line with the research of Febriana, *et al* (2023) that 25.2% of traditional batik factory workers in Yogyakarta routinely used PPE which was based on direct observations at work, this finding could be due to some of the personal protective equipment used by workers being damaged.

The bivariate analysis results showed that the risk factor of using personal protective equipment did not have a significant relationship with symptoms of work-related skin disorders in tofu makers. It

was also stated on the result of the research among traditional batik factory workers, which showed that inadequate use of PPE was not significantly associated with the emergence of work-related skin diseases (Febriana *et al*, 2023).

Other research on tofu factory workers in Kediri found that all respondents who wore safety boots did not experience contact dermatitis on their feet, while respondents who did not wear or rarely used safety boots experienced dermatitis on their feet so statistically, it seemed that the use of personal protective equipment had a significant relationship with the incidence of contact dermatitis (Chafidz and Dwiyantri, 2017). The findings in a study in a shoe manufacturing company in which the use of gloves was found to be the most dominant risk factor for work-related skin disease symptoms (Hendra, Nirwana and, Isahak, 2018).

Control of the risk of work-related skin disease can be done by modifying the work process by installing a filter machine and a tofu stirrer to replace the manual work process, this can reduce the duration of exposure and the risk of tofu maker work-related skin diseases. The use of personal protective equipment such as gloves, arm cuffs, aprons, and rubber boots can also be used as additional control in the workplace.

However, this study controlled for all factors in small-tofu-making factories such as physical risk factors such as weather and climatic conditions with good ventilation systems. The fuel used for the tofu production process used firewood that was burned in the boiler tank, then the water vapor produced from the boiler tank was flowed through the pipes to be used as fuel in each cooking furnace. This caused the air temperature inside the production area high. Controlling the mechanical risk factors such as contact with hot tools and, surfaces or the emergence of biological agents such as bacteria and fungi in a humid environment and using a lot of water in the manual work processes will increase the worker's risk experience symptoms of work-related skin disease. In addition to administrative controls, it is necessary to establish a program for promoting occupational health toward healthy behavior for workers, particularly in the small and medium enterprise sector, beginning with identifying potential occupational health hazards and controlling their risks in the tofu maker's work environment.

This study has certain limitations in collecting data on symptoms felt by workers because not all workers were willing to openly inform the

symptoms of skin disorders that were felt and were not supported by medical examination data and other work environment factors that contributed to work-related skin disease symptoms.

CONCLUSION

The study found that most of the tofu makers had experienced work-related skin disease symptoms including redness of the skin, peeling, and cracked skin (fissures), itching, pain and water blisters (vesicles). Most of the tofu makers had worked for more than 3 years and had an exposure of 3 hours per day. From this research, it is known that the tofu makers had bad hand-washing habits, and did not fully use personal protective equipment. Statistical data on risk factors such as years of work, history of allergies, daily exposure, hand-washing habits, and use of personal protective equipment showed no significant association with the incidence of occupational disease symptoms.

Controlling for all risk factors of work-related skin diseases in the tofu-making area will increase awareness and the health status of workers. Creating an occupational health promotion program for tofu-making workers is necessary to control the risk of work-related skin diseases. Improvement of supporting facilities and infrastructures in the production area such as air circulation systems, modification of machinery and equipment, setting working hours, and providing proper cleaning facilities will increase productivity and health aspects in the workplace.

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