

Causative Factors of Respiratory Tract Disorders among Agricultural Workers

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Abstract:

Agricultural workers are particularly susceptible to respiratory ailments. This results from exposure to various harmful substances in the workplace, including dust, insecticides, and smoking. Farmers may have acute respiratory illnesses, such as upper respiratory tract infections, or chronic respiratory conditions, such as asthma and chronic obstructive pulmonary disease (COPD). This article aims to examine the literature about respiratory problems encountered by farmers. The databases utilized are Google Scholar, Semantic Scholar, and Science Direct. The specified English keywords are "Dust exposure" AND "Farmer" OR "Rice mill" AND "Lung function". Meanwhile, Indonesian keywords employ the terms "Exposure to dust" AND "Farmers" OR "Rice mill" AND "Lung function". The research findings indicate that respiratory illnesses pose a significant health issue for farmers. To prevent respiratory problems in farmers, minimizing their exposure to harmful substances in their work environment is necessary. The way to overcome this is by using Personal Protective Equipment (PPE), ensuring adequate ventilation in rice mills, and carrying out regular health checks to detect and treat respiratory problems early.

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INTRODUCTION

Agricultural workers, particularly farmers, play a pivotal role in global food security by cultivating crops such as rice, vegetables, and other plants for subsistence or commercial purposes (Hemathilake & Gunathilake, 2021). In Indonesia, farming is a livelihood for millions, often involving prolonged exposure to environmental hazards inherent to agricultural practices (Achmad et al., 2021). While farming sustains economies and communities, it also exposes workers to occupational health risks, particularly respiratory tract disorders. These conditions arise from continuous contact with airborne pollutants, including organic and inorganic particulates, chemical agents, and biological contaminants, which collectively strain the respiratory system and compromise long-term health (Clarke et al., 2020).

Respiratory tract disorders among agricultural workers are a growing public health concern driven by environmental and occupational exposures unique to farming environments (Poole et al., 2024). Symptoms such as chronic coughing, excessive phlegm production, wheezing, dyspnea, and chest tightness are common indicators of lung damage caused by inhalation of harmful substances (O' Brien et al., 2023). Prolonged exposure to these irritants increases susceptibility to acute respiratory infections (ARIs), a leading cause of morbidity and mortality in Indonesia. ARIs

encompass a spectrum of illnesses affecting upper and lower respiratory tracts, ranging from mild infections to severe pneumonia, influenced by pathogen virulence, environmental conditions, and individual susceptibility (Carducci et al., 2024).

Among Indonesian farmers, one significant contributor to respiratory disease is inhaling agricultural dust, particularly during rice milling, harvesting, and field preparation (Mahawati, 2022). Dust particles from soil, plant debris, and grain processing contain respirable particulates that trigger inflammation and obstruct airways (Górny et al., 2023). These exposures are exacerbated by inadequate ventilation in rural workspaces and limited access to protective equipment. Studies indicate that farmers engaged in rice milling—a labor-intensive process generating high dust concentrations—are disproportionately affected, with elevated rates of chronic bronchitis and asthma-like symptoms reported in endemic regions (Choudhury et al., 2023).

Another critical factor is the widespread use of chemical-based pesticides, which introduce toxicants into the agricultural ecosystem (Bernasconi et al., 2021). Pesticides, including insecticides, herbicides, and fungicides, are designed to target pests but pose systemic risks to human health. Farmers are routinely exposed to these chemicals through dermal contact, oral ingestion, and inhalation, with respiratory absorption being a primary route of toxicity (Sachan, 2022). Organophosphates, carbamates, and pyrethroids—commonly used pesticide classes—have been linked to acute poisoning, pulmonary edema, and long-term respiratory dysfunction. Improper handling, lack of safety training, and inconsistent use of personal protective equipment (PPE) further amplify these risks, disproportionately affecting small-scale farmers with limited resources (Nguyen & Tsai, 2024).

The environmental persistence of pesticides also threatens ecosystems, contaminating soil, water sources, and air quality, extending health risks beyond immediate agricultural communities (Zhou et al., 2025). Non-target organisms, including beneficial insects and soil microbes, face population declines, disrupting ecological balance (Elhamalawy et al., 2024). For farmers, the cumulative impact of pesticide exposure manifests not only in acute intoxication but also in chronic respiratory conditions, such as occupational asthma and chronic obstructive pulmonary disease (COPD). These outcomes underscore the urgent need for sustainable pest management strategies and robust occupational health policies (Dhansoa et al., 2022).

To mitigate these hazards, adopting PPE, such as masks, gloves, and protective clothing, is strongly recommended to minimize direct contact with harmful agents (Aksüt & Eren, 2024). However, awareness and compliance with PPE usage remain low among Indonesian farmers due to economic constraints, cultural norms, and insufficient education on occupational health risks. Barriers to implementation include the perception of PPE as unnecessary, discomfort during use, and lack of access to affordable, high-quality equipment (Alebachew et al., 2023). Addressing these challenges requires targeted interventions to improve knowledge dissemination and promote behavioral change within farming communities (Aslam et al., 2024).

This study focuses on rice mill workers, a subgroup of agricultural laborers facing heightened exposure to dust and chemical pollutants. This research aims to inform policy frameworks and educational programs tailored to high-risk populations by evaluating their awareness and understanding of respiratory disease risks and preventive measures. Understanding the interplay between environmental exposures, occupational practices, and health outcomes is critical to reducing the burden of respiratory diseases in Indonesia's agricultural sector and safeguarding the well-being of vulnerable workers (Krismanuel & Hairunisa, 2024).

METHOD

The literature search process carried out in this systematic literature review uses three databases, namely Google Scholar, Semantic Scholar, and Science Direct, from the 2019-2024 publication year range. Keywords in this literature review are Indonesian and English. The English literature search used the keywords "Dust exposure" AND "Farmer" OR "Rice miller" AND "Lung function." The literature search in Indonesian used the keywords "Paparan debu" AND "Petani" OR "Penggiling padi" AND "Fungsi Paru"

The literature search was conducted in several stages. The first stage is the identification stage. At this stage, 2,181 were obtained by the keywords entered. The second stage is screening; at this stage, the article is selected according to the assessment criteria, namely the range of years published 2019-2024. At the screening stage, 576 articles were obtained. The third stage is the screening stage; at this stage, the selection of articles is adjusted to the inclusion and exclusion criteria. Three hundred fifty-nine articles met the inclusion and exclusion criteria. Inclusion criteria included full text, publication year (2019-2024), open access, and relevant sources. Exclusion criteria consisted of an article that do not discusses respiratory disorders in agricultural environments, articles that are reviews, are not open access, are not relevant sources, cannot be downloaded, or are not indexed. The next step is to focus on titles and abstracts that match the selected literature review criteria. At this stage, 10 articles were obtained that met the assessment criteria.

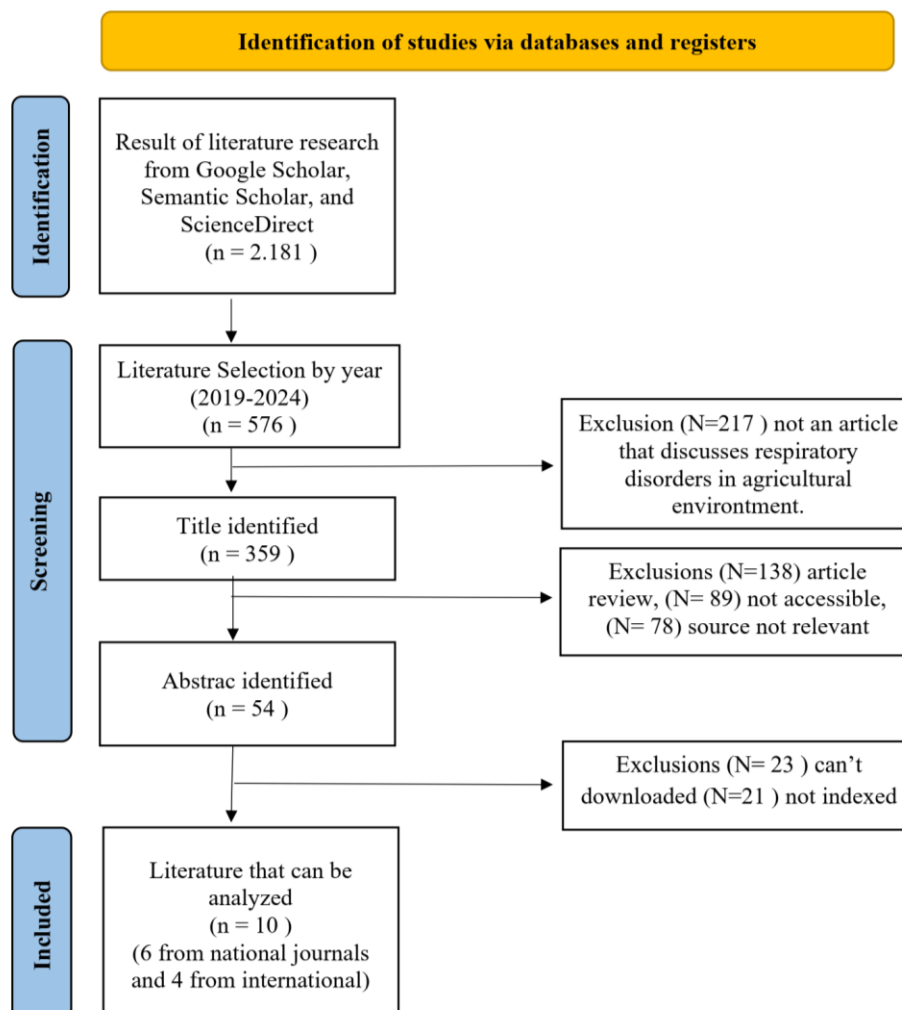


Figure 1. The flowchart of the literature search

RESULT

The article searches results found six studies with a cross-sectional design, one using a purposive sampling design, one using a qualitative direct interview design, one using aerodynamic determination, and one using collective data. So overall, the most frequently used design is the cross-sectional design. Articles taken using a cross-sectional design mainly explain the trend of factors associated with the state of pulmonary function capacity in rice mill workers (Suryadi et al., 2021; Rulla et al., 2023; Amalia et al., 2023; Yushananta et al., 2023; Sirait et al., 2020; Afgrianti et al., 2020). Research with a purposive sampling design explains the difference in dust concentration between each milling worker (Asri et al., 2020). Research with a qualitative direct interview method explains the management and impact of dust on workers (Hasibuan et al., 2023). Research with aerodynamic determined design explains the effects of dust exposure on the breathing of rice mill workers (Daniel et al., 2022). Research with collective data design explains the prevalence and risk factors for lung conditions of farmers and breeders (Puvvula et al., 2022). The articles retrieved for this study were primarily conducted in Indonesia, totaling seven studies: one in Malaysia, one in Nigeria, and one in the United States.

Six studies that discussed the trend of factors associated with the state of lung function capacity of rice millers showed that many factors, such as age, gender, exposure, intensity, and workload, can affect the risk of impaired lung function capacity of workers. One study explaining the differences in dust concentrations between rice mill workers showed that among rice mill workers, sawmills, furniture factories, and unexposed workers, the highest level of exposure was among sawmill workers. One study that discussed the management and impact of dust on workers showed a correlation between lifestyle habits, such as smoking and the use of Personal Protective Equipment at work, affecting lung function capacity. One study explaining the effects of dust exposure on the breathing of rice mill workers showed that the rice dumping area is the most dangerous point, which is the most likely cause of respiratory problems in workers. One study on the prevalence and risk factors of pulmonary conditions of farmers and ranchers showed that farmers and ranchers have a high prevalence of respiratory conditions associated with exposure to dust and gas in the workplace.

Table 1. List of Search Result Articles

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
A1	Author: Suryadi et al. Journal Identity: INCRID 2020. IOP Conf. Series: Earth and Environmental Science 623 (2021) 012033. doi:10.1088/1755-1315/623/1/012033	Correlation with dust exposure rice milling worker's lung function capacity in Sub-District Kerjo	This study examines the correlation between environmental dust exposure and mill workers' pulmonary function capacity.	The research was conducted in November 2019 - June 2020 in all rice mills in Kerjo District. The number of mills is 25, with 50 respondents used as research samples based on the total sampling method.	The research method was observational and cross-sectional to see cases and effects simultaneously. The total sampling technique was used to calculate the number of samples. Lung function capacity was measured by spirometry, and the questionnaire assessed other variables.	The results showed a significant relationship between dust exposure ($p = 0.001$; $r = -0.648$) and lung function capacity, where dust exposure had a strong correlation and a negative direction. Workers should use PPE during work to minimize the risk of exposure.

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
A2	Author: Rullah et al Journal Identity: Journal of Health and Medical Science Vol 2 (1), January 2023. 123-132 https://pusdikra-publishing.com/index.php/jkes/home	Factors Associated with the Tendency of Acute Respiratory Tract Infection (ARI) Symptoms in Rice Mill Workers in Sukamakmur District, Aceh Besar Regency in 2022	The purpose of this study was to see the relationship between the use of PPE face cover and the tendency of symptoms of Respiratory Tract Infection (URTI) in rice mill workers in Sukamakmur District in 2022.	The population of this study was rice mill workers in Sukamakmur District, Aceh Besar Regency, in 2022. The sample consisted of 75 respondents. Data collection was conducted February 8-14.	This type of research is descriptive-analytic with a cross-sectional design. Sectional Study Design. Data were analyzed using the Chi-Square test with a degree of significance 0.05.	The results showed that rice mill workers with a long working period 68.4%, who used PPE 56.1%, had a smoking habit 60.0%, and high dust exposure 49.0%. The results of the chi-square test showed that there was a relationship between work mass ($p=0.041$), the use of PPE ($p=0.024$), smoking habits ($p=0.018$), and prolonged exposure to dust ($p=0.029$): dust ($p=0.029$) and age ($p=0.011$) with the tendency of ARI in rice mill workers. Rice mill workers.
A3	Author: Asri et al. Journal Identity: Malaysian Journal of Medicine and Health Sciences (eISSN 2636-9346)	Inhalable Dust Exposure and Lung Function Among Rice Mill, Sawmill, and Furniture Factory Workers	This study aims to compare the total inhalable dust exposure among rice mills, sawmills, furniture factories, and non-exposed workers and to correlate dust exposure with lung function.	The population of this study were rice mills, sawmills, and furniture factory workers. Where these workers are constantly exposed to dust from their work. The sample consisted of 77 exposed to dust and 39 non-exposed respondents.	The method of this study is purposive sampling. The total inhalable dust concentration was collected using an Institute of Occupational Medicine (IOM) personal airborne sampler loaded with a glass microfibre filter connected to a sampling pump via Tygon tubing attached to the workers. A post-shift lung function test was also measured.	The result showed there was a significant difference in the dust concentration between rice mill, sawmill, furniture factory, and non-exposed workers ($p = 0.001$) with the highest median value of $2.4 \times 10^3 \mu\text{g}/\text{m}^3$ (IQR: $1.1 \times 10^3 - 5.8 \times 10^3$) among sawmill workers. A significant difference ($p = 0.001$) was shown between workers for measured forced expiratory value in one second (FEV1), measured forced expiratory value in one second, and forced vital capacity ratio (FEV1/FVC), and predicted FEV1/FVC. Among the exposed workers, weak negative significant correlations were portrayed between total inhalable dust with the predicted forced vital capacity (FVC) ($r = -0.282$, $p =$

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
A4	Author: Hasibuan et al Journal Identity: Zahra: Journal Of Health and Medical Research Vol. 3 No. 3 Juli 2023, page 420-428	Analysis of Dust Management and Impact in Rice Mills on Workers at PT. MSG Tanjung Selamat, Pancur Batu District, Deli Serdang Regency	This study aims to determine the impact of dust exposure and other supporting factors on respiratory function in rice mill workers at PT MGS Tanjung Selamat.	The population of this study was rice mill workers in PT. MGS Tanjung Selamat Kec. Pancur Batu Kab. Deli Serdang. The sample consisted of 34 permanent workers at the PT. MGS Tanjung Selamat refinery	The method used in this research is qualitative, and the data collection method used is direct interviews with respondents. This research design is field research.	0.013) and predicted FEV1 (r = -0.241, p = 0.035) The results show that other contributing factors are smoking habits and non-compliance in the use of PPE. Smoking habits can cause changes in the structure and function of the respiratory tract and lung tissue, thus accelerating the decline in lung fauna. Most workers also do not wear personal protective equipment masks, so rice dust will be more easily inhaled by workers, resulting in impaired lung function capacity.
A5	Author: Daniel et al. Journal Identity: International Journal of Research in Environmental Science (IJRES) Volume 8, Issue 3, 2022, PP 5-12 ISSN No. (Online) 2454-9444 DOI:http://dx.doi.org/10.20431/2454-9444.0803002 www.arcjournal.org	Effects of Dust Particles on Human Respiratory System among Otukpo Rice Mill workers	This study aims to determine the effect of dust from rice processing in two large rice mills on the human respiratory system.	The population of this study was rice mill workers at (Ijami Road Rice Mill and Okete-Oglewu Rice Mill) in Otukpo LGA, Benue State, Nigeria. In 2022 The sample consisted of 12 respondents. The research was carried out from February 2 to March 14, 2022.	The method used in this research is aerodynamics, which is determined using a cascade impactor. The particle size distribution of the possible inhalation product	The results showed that the rice dumping site was the most dangerous point of the two sampled rice mills, with the most significant possibility of causing respiratory problems for workers.
A6	Author: Amalia et al. Journal Identity: PROMOTOR : Jurnal Mahasiswa Kesehatan Masyarakat Universitas Ibn Khaldun Bogor, Indonesia Vol. 6, No. 3,	Factors Related to Subjective Complaints of Respiratory Disorders (ARI) in Farmers in Cideruem Village, Caringin District, Bogor Regency in 2022	This research aims to determine the factors related to ISPA complaints among farmers in Ciderum Village.	The population of this research is farmers in Cideruem Village, Caringin District, Bogor Regency, in 2022. The sample consisted of 50 respondents. The research was carried out from April to June 2022.	The method used in this research is an observational analytical research design with a cross-sectional approach. The population used was 50 farmers using Total Sampling techniques. Next, it was analyzed	The research results showed that as many as 64% of respondents experienced complaints, 82% of respondents were ≥35 years old, 80% of respondents were male, 66% of respondents had a long service life of ≥5 years, 42% of respondents had low

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
	Juni 2023, pp. 197~203 ISSN: 2654-8127, DOI: 10.32832/prohttp://ejournal2.uika-bogor.ac.id/index.php/PRO MOTOR				using the Chi-square test. In this study, data collection used a questionnaire to obtain data about factors related to subjective complaints of acute respiratory infections (ARI).	educational status, 36% of respondents had lack of knowledge, 74% of respondents did not use complete PPE and 58% of respondents had high exposure to pesticide use.
A7	Author: Puvvula et al. Journal Identity: Journal of Agromedicine , Vol. 27, No. 4, 378-390	Prevalence and Risk Factors for Pulmonary Conditions among Farmers and Ranchers in the Central United States	The journal study aimed to assess the risk factors and prevalence of respiratory diseases associated with the workplace. (medically diagnosed) asthma, farmer's lung, sinusitis, rhinitis, and environmental allergy among Central American farmers and ranchers	The population and sample were 4,064 operators, consisting of farmers and ranchers in the Central United States region. Of these, 69% were first (main) operators, 24% were second operators, and 7% were third operators (Table 1). third operators. The proportion of male operators was higher among the three operator classes. The median age of the first operators was 61 years, the second operators 53 years, and the third operators 34 years.	The North American Regional Reanalysis (NARR) climate database, the Farm Market iD (FMiD) operations database and the Health and Safety Survey (FRHSS) are the three data sources used in this study—the climate database for the North American Regional Reanalysis (NARR). Unsupervised machine learning techniques were used to perform geographic hotspot analysis (Getis-Ord Gi* method) based on the level of operators identified as having respiratory problems on the farm. A fixed distance band (50 miles) was used to find cool and hot locations for spatial correlation with Euclidean distance. Furthermore, using the false discovery rate of ArcGIS Pro version 2.6.0, hotspot and	This research resulted in 3,268 agricultural operations (19.4%), with details on 4,064 individual operators. Farm/ranch operators had an 18% incidence of respiratory diseases (any). Exposure of the respiratory system to grain, feed, or straw dust increases the risk of acquiring any respiratory disease. Feed and straw dust more than double the likelihood of respiratory ailments. In general, respiratory disorders are more prevalent among farmers and ranchers. They are linked to occupational exposure to gases and dust, which increases the usage of respiratory protection and other more efficient protective measures based on the hierarchy of control.

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
A8	Author: Yushananta et al. Journal Identity: Jurnal Kesehatan Lingkungan Ruwa Jurai, Vol 14, No 1, 2023,	Risk factors for pesticide poisoning in horticultural farmers in West Lampung Regency.	This study uses the cross-sectional method to determine the risk factors for pesticide poisoning among horticultural farmers in West Lampung Regency.	The population and samples in this study were horticultural farmers, with as many as 289 people residing in 4 sub-districts: Balik Bukit, Sukau, Sikincau, and Way Tenong. Sample selection was done using a random method, and the sample size at each location followed the proportion of horticultural farmers. Data collection was done by interviewing and observing each respondent.	coldspot clusters were modified. This study used a cross-sectional method. Furthermore, the study was conducted using SPSS 20.0 statistical software to analyze the data and was conducted in stages. Univariate analysis uses frequencies and proportions; bivariate using chi-squared and odds ratio; and multivariate with logistic regression.	The conclusion of this journal provides valuable information about pesticide exposure in horticultural agriculture. Incomplete use of PPE, exposure to pesticides with excessive doses, and a high frequency of spraying are risk factors for pesticide poisoning. Improving knowledge about the dangers of pesticides and skills on how to manage and apply pesticides is an urgent demand that must be made to reduce the risk of pesticide poisoning. On the other hand, monitoring and measuring pesticide exposure and health effects due to exposure for farmers must also be carried out periodically to ensure and protect the safety and health of workers.
A9	Author: Afgrianti et al. Journal Identity: Jurnal Media Kesehatan Masyarakat Indonesia ISSN: 1412-4920, DOI: 10.14710/mk.mi.19.5.338-344	Characteristics of Workers in Rice Mills in Rowosari District, Kendal Regency	The objective of the research journal is to analyze the characteristics of rice mill workers in the Rowosari District of Kendal Regency, Indonesia, specifically focusing on how factors such as age, length of service, duration of exposure, smoking habits, and exercise habits can influence respiratory function disorders. The study aims to highlight the impact of dust exposure in rice milling industries on respiratory health and the need for protective measures to safeguard workers' health in these environments.	The population of the research journal is 95 rice mill workers in the Rowosari District of Kendal Regency, Indonesia. The sample comprises 57 male workers selected using the Slovin formula and simple random sampling technique.	The research journal used a cross-sectional and observational analytic design to analyze the characteristics of rice mill workers in the Rowosari District of Kendal Regency, Indonesia. The study population consisted of 95 rice mill workers, with a sample of 57 male workers selected using the Slovin formula and simple random sampling technique. Descriptive statistical	The study found that a significant proportion of rice mill workers in the Rowosari District of Kendal Regency, Indonesia, exhibited lung function disorders, with 86% of respondents experiencing such issues. The most common types of disorders were restrictive (38.6%), obstructive (24.6%), and mixed (22.8%). Factors such as age, years of service, duration of exposure, smoking habits, and exercise habits were identified as potential influencers of respiratory health

ID Number	Author and Journal Identity	Journal Title	Objective	Population and Sample	Method	Result
					analysis used frequency distribution to examine variables such as age, years of service, duration of exposure, smoking habits, and exercise habits.	among these workers.
A10	Author: Sirait et al. Journal Identity: Jurnal Kesehatan Masyarakat & Gizi, e-ISSN: 2655-0849 Vol. 2 No.2 Edisi September 2019 – April 2020	Relationship Between The Use Of Personal Protective Equipment (PPE) And The Incidence Of Acute Respiratory Infection (ARI) In Rice Mill Workers	The research journal aims to investigate the relationship between using Personal Protective Equipment (PPE) and the occurrence of Acute Respiratory Tract Infections (ARI) among rice mill workers. The study highlights the importance of using PPE to prevent ARI among workers exposed to dust in the workplace.	The research journal studied rice mill workers in Desa Dalu XB, Kecamatan Tanjung Morawa, Kabupaten Deli Serdang. The study population included all workers involved in the processing at two rice mills, totaling 62 individuals. The sampling method used was total sampling, where all 62 workers were included in the study.	The research journal utilized an analytical observational method with a cross-sectional study design to investigate the relationship between the use of Personal Protective Equipment (PPE) and the occurrence of Acute Respiratory Tract Infections (ARI) among rice mill workers. The study was conducted through direct interviews using questionnaires to collect data on workers' age, length of employment, and education level. Data analysis included both univariate and bivariate analyses.	The study's results indicated a significant relationship between the use of PPE and the occurrence of ARI among the rice mill workers. It was found that there was an increased incidence of ARI among workers in the rice mills, which was attributed to dust exposure. PPE, such as masks, was highlighted as essential in reducing the risk of dust exposure and ARI. Overall, the study emphasized the importance of using PPE to prevent ARI among rice mill workers exposed to dust in the workplace.

DISCUSSION

Agro-nursing, an interdisciplinary field integrating agricultural practices with healthcare, is critical in addressing the unique health challenges agricultural workers face, particularly respiratory tract disorders. Agricultural environments expose workers to numerous causative factors, including inhalation of organic dust (e.g., grain, mold spores), chemical irritants (e.g., pesticides, fertilizers), and bioaerosols from livestock or decomposing matter. These agents can trigger conditions like asthma, chronic bronchitis, hypersensitivity pneumonitis ("farmer's lung"), and chronic obstructive pulmonary disease (COPD). Agro-nursing professionals are trained to identify these occupational hazards, assess their impact on respiratory health, and design preventive strategies. By bridging

agricultural practices with clinical knowledge, they educate workers on risk mitigation, such as using protective equipment, improving ventilation, and adhering to safety protocols during pesticide application, thereby reducing exposure to harmful agents (Kurniyawan et al., 2023; Nur et al., 2024).

Furthermore, Agro-Nursing emphasizes early detection and management of respiratory disorders through tailored health surveillance programs. Agricultural workers often face barriers to healthcare access, and symptoms like persistent coughing or shortness of breath may go unreported due to labor demands. Agro-nurses advocate for workplace policies prioritizing respiratory health, such as implementing engineering controls to reduce dust levels or promoting vaccination against respiratory infections. They also provide training on recognizing early signs of lung damage and ensuring timely medical intervention. By addressing both environmental risk factors and systemic healthcare gaps, Agro-Nursing directly contributes to mitigating the prevalence of respiratory diseases in agricultural communities, fostering safer and healthier working conditions (Afandi et al., 2023; Kurniawan et al., 2023).

Milling activities have factors and potential dangers that pose a risk of causing work accidents and work-related diseases. Dusty work environments need attention from rice milling business actors because rice milling activities that generate dust can reduce lung function capacity. In line with research conducted by Suryadi et al. (2020), there is a relationship between dust exposure and the lung function capacity of rice mill workers; workers exposed to dust are at risk of experiencing lung function disorders compared to workers who are not. This is supported by research by Asri et al. (2020), which shows significant differences in lung function tests between workers exposed to dust and those not. Decreased FEV1 and FVC result in restrictive disorders in exposed workers. Relatively high dust concentrations can affect workers' respiratory systems. Continuous exposure to dust can cause a decrease in lung function in exposed workers.

Acute respiratory infection (ARI) is a disease of the upper or lower respiratory tract, usually infectious, that can cause a broad spectrum of diseases ranging from asymptomatic disease or mild infection to severe and deadly disease, depending on the pathogen that causes it, environmental factors, and host factors. Like the research conducted by Rullah et al. (2023) related to ARI in rice mill workers, several factors that can cause ARI in these workers are using the wrong PPE, smoking habits, dust exposure, and tenure. Of these factors, tenure can hurt performance. A heavy work period will tire workers, potentially leading to various diseases. In line with this, in a study by Amalia et al. (2023), ARI respiratory disorders also often occur in farmers. The research results also showed a relationship between tenure and knowledge with subjective complaints of ARI respiratory disorders in farmers. Knowledge related to the respiratory tract and the risk of disorders that can attack the respiratory tract needs to be improved by farmers because ARI that attacks them will cause adverse effects on health and work results.

Workers at rice mills have a significant risk of dust exposure from rice milling and processing operations. This dust may contain various hazardous particles, including silica, endotoxins, and pesticides. Prolonged exposure to dust can adversely affect the respiratory health of workers, perhaps leading to severe respiratory diseases. Hasibuan et al. (2023) conducted a study that found rice mill workers have reduced lung capacity values compared to non-rice mill workers, indicating the presence of lung function abnormalities. The factors linked to reduced lung function in rice mill workers include age, duration of labor, length of service, and exposure to dust. There is a direct correlation between the duration of employment in a rice mill and the level of dust exposure, and the likelihood of acquiring respiratory illnesses increases accordingly. According to a study by Daniel et al. (2022), dust particles smaller than 10 μm generated during rice milling might adversely affect pulmonary function. Particulate matter generated during the rice milling can readily penetrate the respiratory system, decreasing workers' pulmonary function.

Respiratory conditions, especially in farmers in the respiratory sector, are also one of the potential hazards that can threaten health. According to Puvvula et al. (2022), respiratory conditions in farmers can be triggered by many factors such as age, gender, genetic factors, work factors such as workload, use of Personal Protective Equipment (PPE), contamination such as dust exposure, and environmental factors such as air, temperature, weather, etc. This study found that respiratory conditions are at higher risk due to contamination from exposure to dust from grain/straw than exposure to other contaminants. In addition, increasing age can also increase the risk of susceptibility to respiratory diseases, and the possibility is twice as high in female workers, such as asthma, sinusitis, throat irritation, and inflammation of the nasal membranes that occur due to higher workloads in women. This aligns with research conducted by Afgrianti et al. (2020). These factors can affect lung function disorders, such as internal factors (age, gender, lifestyle, smoking habits) or external factors (work duration, workload, dust exposure), so the characteristics of workers exposed to this dust affect lung function.

One of the main factors causing farmers to suffer from respiratory disorders is the use of personal protective equipment. Many other factors can cause respiratory problems, as mentioned by Puvvula et al. (2022) and Afgrianti et al. (2020), but Personal Protective Equipment (PPE) is the factor that farmers most often ignore. In line with research conducted by Sirait et al. (2020), there is a significant relationship between using Personal Protective Equipment (PPE) and respiratory tract disorders in rice refinery workers. Personal protective equipment greatly influences respiratory function in rice refinery workers. However, in a study conducted by Sirait et al. (2020), only 8 out of 62 respondents used personal protective equipment; farmers expressed this because, by using personal protective equipment, they would feel uncomfortable because they felt they were disturbing their airway. This aligns with research conducted by Yushananta et al. (2020), which showed a relationship between the use of personal protective equipment (PPE) and pesticide poisoning among farmers. Most of them are reluctant to use personal protective equipment because they are used to not using personal protective equipment when working. In addition to avoiding dust exposure, personal protective equipment can also protect farmers from pesticide exposure to farmers when farmers spray pesticides. Personal protective equipment can effectively help farmers maintain their health from dust, pesticides, or other dangerous things that come from the work environment. Personal protective equipment is essential for farmers because pesticides can enter the human body in several ways, including the skin, respiratory tract, and digestive tract.

CONCLUSION

Respiratory disease is one type of disease that affects many people from various backgrounds. This disease is caused by various factors, one of which is occupational. Farmers and rice millers are examples of jobs that have the potential for workers to get respiratory diseases. It can be caused by age, exposure to dust, pesticides, improper use of personal protective equipment, length of service, and several other factors. Risk factors that can cause respiratory diseases are also related to lung function, where a person's lungs will decrease their capacity if they are often exposed to respiratory problems. Ten journals have researched the high risk of farmers and rice mill workers being affected by respiratory system problems.

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