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RESEARCH ARTICLE

The Prevalence of Work-Related Respiratory Disease among Dairy Farmers

N. A. Athirah and A. A. Suhaimi*

Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, 26300 Pahang, Malaysia

ABSTRACT – Work-related respiratory disease is very common among dairy farming sectors. The respiratory problems and symptoms have been assessed using a validated respiratory health status questionnaire in 85 dairy farmers. This study involves a cross-sectional study design where descriptive analysis is being used to determine the prevalence of respiratory disease using frequency and the chi square test of independence was performed to determine the relationship between respiratory disease and work practices. Respiratory diseases with the highest prevalence include tuberculosis (31.8%) and asthma (8.2%). The most common respiratory disease symptoms among dairy farmers are productive cough (40.0%) and wheeze (21.2%). There is no correlation between the length of time dairy farmers worked and the feeding approach they employed and work-related respiratory disease. A significant frequency of respiratory difficulties is still experienced by dairy farmers. Although the precise cause is still unidentified but, it may be connected to extended exposure to dust during work.

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1. INTRODUCTION

The Malaysian economy is dominated by agriculture. Agriculture has played a vital role in the Malaysian economy's growth and success from the time of British colonial rule. A key source of export earnings, agricultural exports such as cocoa, rubber, and oil palm have contributed significantly to the agricultural industry and economy's growth. This industry continues to be a source of employment for the nation [1]. Agriculture also contributes significantly to rural development, particularly in terms of land use [2]. The development of agriculture, which allowed people to raise domesticated animals to produce surpluses of food that allowed people to live in cities, was crucial in the rise of stable human society [3] which has the greatest potential to promote employment and environmental services in rural development. It may be required for farming in remote regions and expected to be the main economic activity influencing the advancement of rural development in nations [2].

Dairy farming is one of the growing industries. It offers multiple opportunities to people and leaves a sustainable impact on society, the environment and the economy [4]. Dairying, also known as dairy farming, is a category of agriculture that deals with the breeding, care, and use of cows and other dairy animals to produce milk and other dairy goods [5]. Leading dairy sectors around the world include those in China, India, and New Zealand. These nations act as major milk producers, exporters, and importers [6]. Production and processing of dairy products are essential to both national economies and individual livelihoods. This industry contributes to nearly 13% of Ireland's exports, with the dairy industry producing 35% of the total production [7].

However, domestic milk production is growing somewhat slowly in Malaysia, whereas milk consumption grew by about a quarter between 2011 and 2017. The amount of milk produced in 2011 was 25.40 million liters, and it gradually grew to 36.60 million liters, showing an increase of RM11.20 million litres for seven years and indicating a growth rate of 5%. During the same time span, milk consumption increased by 44.10 million liters, from 18.90 million litres in 2011 to 62.80 million litres in 2017. During the same period, the annual increase rate of milk consumption was 22% [8]. The inhalation exposure patterns of dairy farmer also have changed as a result of the scaled-up dairy industry's output as well as substantial advancements in technology and working methods. This has had an impact on worker health and safety, particularly the links between inhalation exposures and occupational lung disease [9]. Primary hazards that are concern for respiratory health include exposures to organic dust and its microbial constituents [7].

Organic dust is a mixture of air-suspended particles derived from plants, animals, and microbes. Organic dust also is frequently produced by faeces, urine, livestock feed, dander, and hair on dairy farms. Dust contains microbial-associated compounds such as endotoxins from gramme-negative bacteria, glucans, muramic acid from gramme-positive bacteria, and peptidoglycan in addition to inflammatory and allergic agents such as fungal spores, bacteria, viruses, and pollen [10]. Research has demonstrated that endotoxin, a component of gram-negative bacteria's cell walls and a significant component of organic dusts, plays a crucial role in the development of respiratory illnesses in agricultural workers by inducing the production of cytokines and other inflammatory proteins [7].

Exposures often exceed recommended health limits for organic dusts and endotoxin, such as limits of 1.5 mg m^{-3} and 90 EU m^{-3} recommended by the National Health Council of the Netherlands [7]. Airborne respiratory hazards, such as

*CORRESPONDING AUTHOR | A. A. Suhaimi | ✉ afiza@umpsa.edu.my

inorganic and organic particulate matter, vapours, gases, and fumes, are common in a range of occupational settings and are associated with the development of chronic work-related respiratory diseases [10]. Due to the technological advance in dairy industry also has led to a high exposure towards airborne respiratory hazards which pose to a significant health risk.

When compared to the general population, dairy farmers have a higher commonness of respiratory problems such as chronic bronchitis than other types of farmers. Exposure to organic dust and its microbiological components has been identified as the main respiratory health risks. Fungi, bacteria, allergies, and microbial cell wall agents are some of them [7]. There has been an increase in the occurrence of respiratory conditions like organic dust toxic syndrome (ODTS), chronic obstructive pulmonary disease (COPD), rhinitis, sinusitis, hypersensitivity pneumonitis, and bronchitis. These illnesses have all been connected to exposure to endotoxins, peptidoglycans, organic dust, and gasses [7].

In the farming sector, there have been significant shifts in work procedures and methods. Dairy producers continue to have a high risk of occupational respiratory morbidity despite these advancements. Irish dairy farming practices continue to be different from those in other nations where housing animals in enclosed or partially enclosed spaces is common [11][12]. Consequently, the respiratory health of dairy farm workers has gained greater attention in the last decade, after being shown to have higher-than-expected proportionate mortality ratios for respiratory diseases [10]. Therefore, this study aims to identify the prevalence of respiratory problems among dairy farmers and to determine the relationship between work-related respiratory disease and work practices. It also verifies whether the environmental smoke, ventilation system and waste product are related with work-related respiratory disease.

2. METHODS AND MATERIAL

The research design for this study is an observational study design, as opposed to a cross-sectional study design, in which variables are observed without adjustment [13]. The research method was chosen based on the aims of the study, which focused on the prevalence of respiratory diseases among dairy farmers. Closed-ended questions are frequently used in the design of quantitative research. Then, the data will be analyzed and calculated using Statistical Package for the Social Sciences (SPSS) software. In this study, the sample was being chose based on convenience sampling. Convenience sampling is a non - probability sample that is selected for the inclusion criteria due to availability at a given time and willingness to participate in this study [14][15]. This sampling technique can be done via online or media social posts and in person with the respondents. Convenience sampling is a non-probabilistic sampling technique that can be utilized in both qualitative and quantitative research [16].

The questionnaire was divided into sections, Section A, Section B, Section C and Section D. Section A was being used to collect all the demographic information of the respondents while Section B was being used to collect data on dairy farmers' respiratory health status which consists of closed questions where symptoms of asthma, bronchitis, pneumonia, tuberculosis, pneumothorax have been asked to the dairy farmers. Section C gathers data on farm work procedures and feeding methods, whereas Section D collects data on other factors that may have an impact on dairy farmers' respiratory health. Likert-scale questionnaires that was being used which range from 1 = strongly disagree to 5 = strongly agree and 1 = rarely or none of the times to 5 = most or all the time.

To ensure that all the data that is obtained from this study is valid and reliable, a pilot study, validity assessment, and Cronbach's alpha have been done. The pilot test is a small-scale experiment that is carried out beforehand to test and improve procedures. Reliability and internal consistency will be evaluated using Cronbach's alpha, which can be done using Statistical Package for Social Science v29 software (SPSS). Testing the reliability of multiple-question surveys using the Likert scale is known as Cronbach's alpha. Cronbach's alpha values of 0.6 to 0.8 are considered acceptable [17]. The content validity was being measured by the experts of this study which will cover all aspects of the contents thoroughly. The content validity ratio (CVR) ranges from +1 to 1 meaning the closer to +1, the more valid the content. If the content validity index (CVI) value is high, it means that the test was accurately measured with what has been expected [18].

Due to the sample size exceeded 50, the Kolmogorov-Smirnov test was utilized to determine the normality of the data in this study [19]. The data in this study was found to be non-normal, necessitating the application of a non-parametric statistical test. If the p-value is less than 0.05, the data is not deemed normal, and vice versa [20]. Thus, to determine the prevalence of respiratory problems among dairy farmers, descriptive analysis was used to determine the frequency of workers' respiratory health status, and non-parametric statistical analysis, specifically the Chi-Square test of independence, was used to determine the relationship between two categorical variables.

3. RESULTS

3.1 Descriptive Analysis: Prevalence on Respiratory Health Status

This cross-sectional study merely describes the prevalence of a specific health outcome in a particular population. Prevalence can be measured at a single point in time, point prevalence or over a specified time which is known as period prevalence [21]. To answer the first research question, frequency analysis was used to determine the percentages of the

respiratory health status of dairy farmers which contain two items which are respiratory disease and symptoms of respiratory disease. The results of percentages from the analysis as in Table 1 below.

Table 1. Frequency analysis of respiratory health status

Respiratory Health Status	n (%)	
Respiratory disease	Yes	No
Asthma	7 (8.2)	78 (91.8)
Chronic bronchitis	0 (0.0)	85 (100.0)
Pneumonia	4 (4.7)	81 (95.3)
Tuberculosis	27 (31.8)	58 (68.2)
Silicosis	0 (0.0)	85 (100.0)
Pneumothorax (collapsed lungs)	0 (0.0)	85 (100.0)
Lung cancer	0 (0.0)	85 (100.0)
Broken ribs	0 (0.0)	85 (100.0)
Any chest injuries or surgeries	1 (1.2)	84 (98.8)
Symptoms of respiratory disease	Yes	No
Shortness of breath	10 (11.8)	75 (88.2)
Productive cough	34 (40.0)	51 (60.0)
Coughing that occurs mostly when you are lying down	12 (14.1)	73 (85.9)
Coughing up blood within the last month	3 (3.5)	82 (96.5)
Wheezing	18 (21.2)	67 (78.8)
Chest pain when you breathe deeply	10 (11.8)	75 (88.2)

** n (%)- number of respondents (percentages of dairy farmers)

The table above, under the respiratory disease item, it shows that tuberculosis is the most common disease among dairy farmers with the highest percentage of 31.8. Not only that, respiratory diseases such as asthma, pneumonia and experiencing chest injuries or surgeries also show a small number of percentages which are 8.2%, 4.7% and 1.2%. The remaining diseases like chronic bronchitis, silicosis, pneumothorax (collapsed lungs), lung cancer and broken ribs show no number of percentages which brings a meaning that none of the dairy farmers that answered the questionnaire had those diseases.

The symptoms of respiratory disease show that most of the respondents were experiencing the symptoms of it but not severe. Symptoms of productive cough have the highest percentage among the other symptoms which is 40.0%. The high percentage of the symptoms followed by experiencing wheezing and coughing occurs mostly when lying down with the percentage of 21.2 and 14.1. For the symptoms of shortness of breath and having chest pain when breathing deeply hold the same number of percentages which is 11.8%. The least frequent symptom among the respondents is coughing up blood within the last month which is only 3.5%.

3.2 The Relationship Between Work-Related Respiratory Disease and Work Practices

As the collected samples are not normally distributed, the non - parametric statistical analysis is used. The Chi Square test of independence is being applied to answer the research question as stated before which is to identify the relationship between work-related respiratory disease and work practices. This test is being selected due to find the relationship between two categorical variables whether it is related. If two variables are connected, the likelihood of one variable having a specific value is determined by the value of the other variable [22]. The summary of the chi square test of independence as per below.

Work-related respiratory disease is a nominal variable, whereas work practices, such as working hours and feeding system, are ordinal variables. Table 2 reveals that there is no significant difference in work-related respiratory disease, asthma across working hours and feeding system. However, there are a few questions that mark the p-value of below than 0.05. Automated feeding system work efficiently shows p-value of 0.005. Pasture-based do not need external inputs and this feeding method use substances that affect respiratory health shows p-value of 0.024 and 0.002. The questions of cows need to be fed two times a day also show a p-value less than 0.05 which is 0.016. Lastly, the formulation of TMR method frequently change also may affect the respiratory health among dairy farmer with the p-value of 0.026.

Table 2. Summary of the relationship between respiratory disease (asthma) and work practices

Questions	Respiratory disease: Asthma		
	Value	df	P-value
Duration of working			
I always work 8-hours per day	4.022	3	0.259
I always work overtime (>8-hours per day)	5.298	4	0.258
I always follow shift work schedule	0.865	4	0.930
Work schedule is not fix, depends on workload	0.6802	4	0.147
Regular break hour can reduce exposure	0.878	3	0.831
Feeding system			
Manual feeding uses a lot of body's movements	3.484	2	0.175
I need to work overtime if using manual	2.823	4	0.588
I always wear adequate PPE	1.341	4	0.854
Automated feeding work efficiently	12.657	3	0.005
Automated feeding make work become slower	6.247	4	0.181
Automated feeding not using too much body movement	2.207	2	0.332
Pasture-based do not need external inputs	11.212	4	0.024
I always work more time to make sure pasture produce high minerals	4.029	4	0.402
Pasture-based use substances that affect respiratory health	17.079	4	0.002
The cows will be fed at least two times a day	10.391	3	0.016
The feeds that are weighed should meet the total nutrients	0.379	2	0.827
Does the formulation are frequently change?	11.074	4	0.026
TMR use a lot of process and time consuming	4.506	4	0.342
The use of TMR lead to poor housekeeping	1.987	4	0.738

**Relationship is significant at the level of 0.05 (2-sided)

Table 3 reveals no significant difference in work-related respiratory disease or pneumonia across working hours and feeding systems. From the result above, both work practices, duration of working, and feeding system did not affect respiratory disease; pneumonia excluded the question of wearing adequate personal protective equipment (PPE), showing a p-value of less than 0.05, which is 0.042.

Table 4 reveals that there is no significant difference in work-related respiratory disease, tuberculosis across working hours and feeding system. One of the questions from work practices of duration of working which is working overtime shows a p-value of 0.016. While for the work practices of feeding system shows that many questions have a p-value less than 0.05. Working overtime when using manual system show the p-value of 0.025. While automated feeding system make work become slower and this system not using too much body movement show the p-value of 0.015 and 0.034. In addition, for question of pasture-based method use substances that affect respiratory health show p-value of 0.008. Three questions of TMR method show a p-value of less than 0.05. The p-value of questions the feeds are weighed should meet the total nutrients, the formulation is frequently change and this method use a lot of process and time consuming are 0.049, 0.039 and 0.017.

Table 5 reveals that there is no significant difference in work-related respiratory disease, chest surgeries across working hours and feeding system. The result that has been run above shows that all the p-values of duration of working and feeding system are above 0.05 except for the question under TMR method which is the feeds that are weighed should meet the total nutrients with the p-value of 0.008.

Table 6 reveals no significant difference in work-related respiratory disease across working hours and feeding system. The respiratory disease that shows a constant result were chronic bronchitis, silicosis, pneumothorax, lung cancer and broken ribs due to 100% of the respondents were answering no for these respiratory diseases.

Table 3. Summary of the relationship between respiratory disease (pneumonia) and work practices

Questions	Respiratory disease: Pneumonia		
	Value	df	P-value
Duration of working			
I always work 8-hours per day	3.713	3	0.294
I always work overtime (>8-hours per day)	3.899	4	0.420
I always follow shift work schedule	4.336	4	0.362
Work schedule is not fix, depends on workload	2.280	4	0.684
Regular break hour can reduce exposure	1.997	3	0.573
Feeding system			
Manual feeding uses a lot of body's movement	0.489	2	0.783
I need to work overtime if using manual	1.708	4	0.789
I always wear adequate PPE	9.925	4	0.042
Automated feeding work efficiently	2.010	3	0.570
Automated feeding make work become slower	4.915	4	0.296
Automated feeding not using too much body movement	3.559	2	0.169
Pasture-based do not need external inputs	7.685	4	0.104
I always work more time to make sure pasture produce high minerals	3.113	4	0.539
Pasture-based use substances that affect respiratory health	3.491	4	0.479
The cows will be fed at least two times a day	3.567	3	0.312
The feeds that are weighed should meet the total nutrients	2.727	2	0.256
Does the formulation are frequently change?	2.028	4	0.731
TMR use a lot of process and time consuming	5.621	4	0.229
The use of TMR lead to poor housekeeping	0.770	4	0.942

**Relationship is significant at the level of 0.05 (2-sided)

Table 4. Summary of the relationship between respiratory disease (tuberculosis) and work practices

Questions	Respiratory disease: Tuberculosis		
	Value	df	P-value
Duration of working			
I always work 8-hours per day	5.369	3	0.147
I always work overtime (>8-hours per day)	12.223	4	0.016
I always follow shift work schedule	5.750	4	0.219
Work schedule is not fix, depends on workload	7.545	4	0.110
Regular break hour can reduce exposure	1.158	3	0.763
Feeding system			
Manual feeding uses a lot of body's movement	3.006	2	0.222
I need to work overtime if using manual	11.181	4	0.025
I always wear adequate PPE	0.544	4	0.969
Automated feeding work efficiently	2.413	3	0.491
Automated feeding make work become slower	12.314	4	0.015
Automated feeding not using too much body movement	6.744	2	0.034
Pasture-based do not need external inputs	5.634	4	0.228
I always work more time to make sure pasture produce high minerals	8.472	4	0.076
Pasture-based use substances that affect respiratory health	13.817	4	0.008
The cows will be fed at least two times a day	2.233	3	0.526
The feeds that are weighed should meet the total nutrients	6.019	2	0.049
Does the formulation are frequently change?	10.112	4	0.039
TMR use a lot of process and time consuming	12.011	4	0.017
The use of TMR lead to poor housekeeping	5.281	4	0.260

**Relationship is significant at the level of 0.05 (2-sided)

Table 5. Summary of the relationship between respiratory disease (chest surgeries) and work practices

Questions	Respiratory disease: Chest Surgeries		
	Value	df	P-value
Duration of working			
I always work 8-hours per day	5.132	3	0.162
I always work overtime (>8-hours per day)	2.898	4	0.575
I always follow shift work schedule	5.132	4	0.274
Work schedule is not fix, depends on workload	5.132	4	0.274
Regular break hour can reduce exposure	3.767	3	0.288
Feeding system			
Manual feeding uses a lot of body's movement	0.581	2	0.748
I need to work overtime if using manual	4.722	4	0.317
I always wear adequate PPE	4.722	4	0.317
Automated feeding work efficiently	1.377	3	0.711
Automated feeding make work become slower	1.446	4	0.836
Automated feeding not using too much body movement	3.767	2	0.152
Pasture-based do not need external inputs	2.415	4	0.660
I always work more time to make sure pasture produce high minerals	1.755	4	0.781
Pasture-based use substances that affect respiratory health	4.987	4	0.289
The cows will be fed at least two times a day	6.987	3	0.072
The feeds that are weighed should meet the total nutrients	9.560	3	0.008
Does the formulation are frequently change?	1.765	4	0.779
TMR use a lot of process and time consuming	2.558	4	0.634
The use of TMR lead to poor housekeeping	1.014	4	0.908

**Relationship is significant at the level of 0.05 (2-sided)

Table 6. Summary of the relationship between respiratory disease and work practices

Questions	Respiratory disease: Chronic bronchitis, silicosis, pneumothorax, lung cancer, broken ribs		
	Value	df	P-value
Duration of working			
I always work 8-hours per day		Constant	
I always work overtime (>8-hours per day)			
I always follow shift work schedule			
Work schedule is not fix, depends on workload			
Regular break hour can reduce exposure			
Feeding system			
Manual feeding uses a lot of body's movement			
I need to work overtime if using manual			
I always wear adequate PPE			
Automated feeding work efficiently			
Automated feeding make work become slower		Constant	
Automated feeding not using too much body movement			
Pasture-based do not need external inputs			
I always work more time to make sure pasture produce high minerals			
Pasture-based use substances that affect respiratory health			
The cows will be fed at least two times a day			
The feeds that are weighed should meet the total nutrients			
Does the formulation are frequently change?			
TMR use a lot of process and time consuming			
The use of TMR lead to poor housekeeping			

**Relationship is significant at the level of 0.05 (2-sided)

4. DISCUSSION

4.1 The Prevalence of Respiratory Problems among Dairy Farmers

From the analysis above, it shows that 27 (31.8%) of the respondents are experiencing tuberculosis as dairy farmers. Tuberculosis disease occurs among them might be because of exposure to the organic dust and inhalable dust especially among the feeders as they were applying the total mixed ratio (TMR) or pasture based to feed the dairy animals. Organic dust also can be the animal waste such as hair, feathers and feces which frequently occurs in the barns and other confined spaces [23]. In the same vein, Adane et al. [24] discovered that the prevalence of tuberculosis appears to be higher in the livestock farmer population (59.7%), which could be attributable to a lack of information about bovine tuberculosis, its transmission channels, and prevention strategies [25][26].

Asthma also is one of the diseases or problems that affect the dairy farmers' respiratory health which shows 7 (8.2%) respondents experiencing this disease. The major hazard in the dairy farming industry is dust either organic dust or inhalable dust. This is aligned with the previous study that identified that asthma development in dairy farmers is substantially associated with occasional and frequent exposure to high-intensity dust, as well as periodic and regular exposure to gasses, fumes, and vapors [27]. Asthma also can be caused by the exposure to endotoxin which is a lipopolysaccharide component of the bacteria that present in organic dust. A long exposure to the endotoxin might cause an inflammatory reaction in the lungs especially when inhaled [28].

The pneumonia disease has the lowest respondents which is only 4 (4.7%) dairy farmers who are experiencing this disease. This disease might happen to the respondents who have a smoking habit or are exposed to a variety of organisms, such as bacteria, viruses and fungi. These organisms might occur from the endotoxin that has been aerosolized which is then taken up by the surface of particulate matter and disperses it through the air [28]. Exposure to the non-infectious agents such as endotoxin and or particulate matters also could trigger pneumonia [29]. Organic dust also can cause pneumonia to the dairy farmers [29]. The remaining disease problems are any chest injuries or surgeries with only 1 (1.2%) respondent have the surgery. This problem can lead to pneumonia if the workers prolonged exposure to the organisms.

All the symptoms in Tables 1 have been showing towards the respondents which affect their respiratory health. The frequent symptoms that commonly occur among the dairy farmers are productive coughs that produce phlegm and wheezing which have 40.0% (34) and 21.2% (18). When dairy farmers are exposed to dust for a long duration of time, it will affect their health and show symptoms like wheezing and productive cough [23][27]. These two symptoms also show the membrane inflammation syndrome which can be categorized by symptoms of the nose, eyes and throat. There are 12 (14.1%) dairy farmers who respond to the symptoms of coughing that occurs mostly when lying down. Since the largest number is among male which is 9 respondents experiencing this symptom shows that this might be the effect from smoking habit [30] while for the remaining 3 female respondents might be prolonged exposure to dust. This is aligned with the article that says that organic dust toxic syndrome (ODTS) and a farmer's lung can develop over time as a result of exposure to organic dust [23][31].

For the symptoms of shortness of breath and chest pain when breathing deeply, each of these symptoms have 10 respondents (11.8%), respectively. This shows a high possibility of the dairy farmers getting asthma syndromes and tuberculosis as these two diseases are in the higher prevalence. The remaining symptom which is coughing up blood (3.5%) can also lead to tuberculosis disease. Symptoms of active tuberculosis disease in the lungs usually begin gradually and worsen over a few weeks. They may include chest pain, pain with breathing, and coughing up blood [32][33].

4.2 The Relationship Between Work-Related Respiratory Disease and Work Practices

From the results above, it is clearly shows that there is no significant difference in respiratory disease between the duration of working and the feeding method. According to the prevalence results above, it displays that the highest prevalence was tuberculosis, followed by asthma and pneumonia. Indirectly, this align with the result of chi-square test that has been done.

For the first work practices which is duration of working, working overtime which more than eight hours per day may lead to a tuberculosis as the exposure towards the health hazard has increases each day. Next, for the respiratory disease, asthma shows that the duration of working not affecting the respiratory health as less respondents experiencing this disease. For pneumonia disease also shows no effect towards the respiratory health that might lead to this disease from the aspect of duration of working. Majority of the dairy farmers are not working more than eight hours per day, and they also have fixed break hours which mean the exposure to the major hazard such as organic dust is low. Dairy farmers also follow the shift work schedule that has been set up for them so that each of them has less exposure towards the hazard and minimize the risk of getting respiratory disease.

There is no relationship between respiratory disease and the feeding system. However, from the analysis above, it shows that by working overtime when using manual system may lead to a tuberculosis due to the high exposure towards the health hazards. Not only that, pasture-based method also uses substances that might affect the respiratory health and may lead to a tuberculosis and asthma. Other than that, for TMR method, some of the respondents admit that the formulation of TMR is always changed which this also may lead to a tuberculosis and asthma. Although most of the respondents are wearing an adequate personal protective equipment, they still expose to the health hazard which later

might affect them too. They all agree that using an automated feeding system can lessen the workload because it can be done by the machine provided and they just need to watch the machine work properly and prepare the correct quantity of substances especially for total mixed ration (TMR) which is no longer being mixed manually [34]. This shows that the dusts from TMR are less and might not affect respiratory health but may lead to symptoms such as cough.

4.3 Other Related Factors

From this study, there are three confounding factors which may be related to the respiratory health of dairy farmers which are environmental smoke, ventilation system and waste products. The table above shows a relationship between respiratory disease and the ventilation system and waste products. Those two confounding factors show the p-value of less than 0.05 which is 0.010 and 0.038. Indoor air includes pollutants that penetrate from the outdoors, as well as sources that are unique to the indoor environment which may lead to respiratory consequences such as lower respiratory tract infection, COPD and asthma [35]. The waste products of dairy animals are likely to produce an unpleasant odor, and it is one of the examples of organic dust [23] which means that waste products are the major hazard in dairy farming and may contribute to respiratory health risk. The environmental smoke does not have a relationship with respiratory disease as most dairy farming areas are far from any factory and the number of vehicles that cross the road are very less than usual.

Table 7. Summary of Chi Square test of independence of other related factors

	Chi Square test of independence		
	Value	df	P-value
Respiratory disease			
Respiratory disease * Environmental smoke	16.955	20	0.656
Respiratory disease * Ventilation system	42.961	24	0.010
Respiratory disease * Waste products	35.116	22	0.038

**Relationship is significant at the level of 0.05 (2-sided)

5. CONCLUSION

The study looks into the prevalence of respiratory problems among dairy farmers in Pahang. This study found that the common respiratory problems among dairy farmers are tuberculosis, asthma, and pneumonia. These three respiratory problems occur due to the exposure towards dust either organic dust or inhalable dust. Animal manure, grain, fuel chips, straw and hay are some sources of organic dust. Animal waste such as hair, feathers and feces, as well as bacteria, insecticides and chemicals are also examples of organic dust [23].

This study finds that there is no significant difference in respiratory disease between the duration of working and feeding method. The working hours of dairy farmers is not related to respiratory disease. This shows that their duration of working is still not exceeding 8-hours per day, and they have less exposure towards the hazard. Moreover, the relationship between respiratory disease and feeding system also shows no significant difference which means that the feeding system, which is manual, automated, total mixed ration (TMR) and pasture-based feeding system does not lead to respiratory disease.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHORS CONTRIBUTION

N. A. Athirah (Methodology, Formal analysis; Visualisation, Writing-original draft)

A. A. Suhaimi (Conceptualisation, Supervision; Writing - original draft; Resources)

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