

***THE INFLUENCE OF WORKING PERIOD ON WORK DUE TO LUNG
DISEASES IN PRODUCTION WORKERS OF NATURAL STONE
PROCESSING, IN TULUNGAGUNG***

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ABSTRACT

Background of the Problem: In 2000, deaths caused by air pollution in the world reached 57,000 people per year and it is estimated that over the next 20 years this figure will increase to close to 14% or 0.7 per year. According to Calvin, 2020, in Gold Mining, incidents of Silica exposure among workers aged 45-55 years out of 2255 people, it was found that 1592 (71%) people died. From the number above, there were 1296 people (81%) suffering from silicosis and pulmonary Tuberculosis (TB). Chemical dust (Silica) causes lung disorders, which is one of the Occupational Lung Diseases. The above process has a danger to the environment and workers. According to BPJS Employment 2022, the number of cases of KK (working accidents) and PAK (occupational diseases) in 2021 is 234,370 cases.

Method of Research: Population of 100 workers aged 20 – 61 years, Natural Stone Processors located in Tulungagung, East Java, Indonesia. Workers inspection: (1) Interview and physical examination of workers, (2) Supporting examination: Spirometry and Thorax photos, (3) Work Environment Testing consisting of: Work climate, dust, gas (NO₂, CO₂).

Results: Worker habits: smoking as much as 55%, PPE (Personal Protective Equipment) used by the majority of cloth masks 71%, chemical dust (Silica) highest 4.6995 mg/m³, Climate in the workplace (temperature >32°C). These conditions can influence the occurrence of occupational lung disorders. Lung examination of Natural Stone processing workers in Tulungagung showed lung function disorders in 61 people (61%) and thorax photo examination showed abnormalities in 11 people (11%). WorkingPeriod has an influence on Occupational Lung Disease with a significance value of 0.03 (p-value < 0.05), with a confidence level of 95%.

Conclusion: Working Period influences Occupational Lung Disease in workers in the production department of the Natural Stone Processing Company, in Tulungagung. Other factors that are suspected to influence the health of workers include: Occupational Lung Disease, namely smoking habits, not using the correct PPE, a dusty work environment

(chemical substances) and a workplace climate with temperatures above the recommended values.

Keywords: PAK, KK, APD, Silica, Working Period, Lung Disease due to work

ABSTRAK

Latar Belakang: Pada tahun 2000 kematian yang disebabkan oleh pencemaran udara di dunia mencapai 57.000 orang per tahun dan diperkirakan selama 20 tahun kemudian angka tersebut naik mendekati 14% atau 0,7 per pertahun. Menurut Calvin, 2020, pada Pertambangan Emas, insiden paparan Silika pada tenaga kerja usia 45-55 tahun dari 2255 orang, didapatkan 1592 (71%) orang meninggal. Jumlah tersebut diatas terdapat 1296 orang (81%) menderita Silikosis dan TBC (Tuberculosis) paru. Debu kimia (Silika) menyebabkan kelainan paru, merupakan salah satu Penyakit Paru Akibat Kerja. Dalam proses tersebut diatas menimbulkan bahaya terhadap lingkungan dan tenaga kerja. Menurut BPJS Ketenagakerjaan 2022, jumlah kasus KK (kecelakaan Kerja) dan PAK (Penyakit Akibat Kerja) pada tahun 2021 dengan jumlah kasus sebanyak 234.370 kasus.

Metode penelitian: Populasi 100 orang tenaga kerja Usia 20 – 61 tahun, Pengelolah Batu Alam lokasi di Tulungaung, Jawa Timur, Indonesia. Pemeriksaan tenaga kerja: (1) Wawancara dan pemeriksaan fisik tenaga kerja, (2) Pemeriksaan penunjang : Spirometri, dan Thorax foto, (3) Pengujian Lingkungan Kerja terdiri dari: Iklim Kerja debu, gas (NO₂, CO₂).

Hasil: Kebiasaan tenaga kerja: merokok sebanyak 55%, APD (Alat Pelindung Diri) yang dipergunakan mayoritas masker kain 71%, debu kimia (Silika) tertinggi 4,6995 mg/m³, Iklim ditempat kerja (suhu >32°C), keadaan tersebut dapat mempengaruhi terjadinya kelainan Paru Kerja. Pemeriksaan paru tenaga kerja Pengelolah Batu Alam, di Tulungagung menunjukkan adanya gangguan fungsi paru sebanyak 61 orang (61%) dan pemeriksaan photo thorax didapatkan kelainan sebanyak 11 orang (11%). Masa Kerja mempunyai pengaruh terhadap Penyakit Paru Kerja dengan nilai signifikansi 0,03 (p-value < 0,05), dengan tingkat kepercayaan sebesar 95%.

Kesimpulan: Masa Kerja mempengaruhi Penyakit Paru Akibat Kerja pada tenaga kerja bagian produksi Perusahaan Pengelolah Batu Alam, di Tulungagung. Faktor lain yang diduga mempengaruhi kesehatan tenaga kerja antara lain: Penyakit Paru Kerja yaitu kebiasaan merokok, tidak menggunakan APD yang benar, Lingkungan Kerja yang berdebu (zat kimia) dan iklim ditempat kerja dengan temperatur diatas nilai yang direkomendasikan.

Kata kunci: PAK, KK, APD, Silika, masa kerja, Penyakit Paru akibat Kerja

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INTRODUCTION

There are various processes in processing natural stone into crafts. Starting from cutting, grinding, forming and smoothing. In the production process, potential dangers will be produced in the form of noise, vibration and dust which is mineral dust(12). Types of natural stone can be differed by the creation process, level of hardness, mineral content and absorption capacity or size of pores. The type of mineral produced from the natural stone crafting process is Silica, which can cause disease if the dust enters the lungs (Silicosis, Silicotuberculosis).

Pneumoconiosis is a group of diseases that occur due to the accumulation of dust in the lungs, especially the accumulation of free form Silica (SiO₂) (8,13,16) In 2000, the deaths caused by air pollution in the world reached 57,000 people per year and it is estimated that over the next 20 years this figure will increase to close to 14% or 0.7 per year.(1) The incidence of Silica exposure in workers aged 45-55 years out of 2255 people, found that 1592 (71%) people died. In the above number, 1296 people (81%) suffered from Silicosis and pulmonary Tuberculosis. (6,20) Hearing loss (NIHL), lung disorders al. Silicosis and pneumoconiosis are occupational diseases (PAK), in accordance with Presidential Decree No. 22 Yr. 1993, there were 31 types of occupational

diseases. (10,11,15,18). According to data of Employment BPJS, the number of workers experiencing KK/PAK increases from year to year. The number of workers who experienced fatalities due to KK/PAK decreased from 4,007 people in 2019 to 3,410 in 2020 and increased again to 6,552 in 2021. (19) Problems found in the processing of natural stone in Tulungagung into a craft product, through the processes of cutting, grinding, forming and smoothing. The process mentioned above creates danger, depending on the length of time the workers is exposed to the work environment: dust above 10 μ , chemical dust and gas.(11)

METHODS

Research Subject

This research design is cross sectional analytic, sample of 100 natural stone processing workers in Tulungagung, East Java, Indonesia, workers aged 17 to 75 years. Research variables (1) Dependent variable: Occupational Lung Disease Process, (2) Independent variable: Work Period or length of time workers are exposed to the Work Environment.

Sample Examination

Methods used 1. Interview: Identity, length of service, educational status, habits, use of PPE and physical examination of workers 2. Supporting examination consisting of Spirometry: Spirolab.III version 2.7, and Thorax Photo: PA Projection (Postero-

Anterior) 3. Work Environment Testing consists of: dust: High Volume Dust Sampler (Gravimeter), NO2 gas (Bubber impager set), Saltzman, CO Gas (CO monitor).

Data Analysis

Correlation of Worker working period on the Occurrence of Occupational Lung Disease with supporting examinations: Spirometry and Radiology. Statistical analysis using Chi-Square Tests: Fisher's Exact Test.

RESULTS

Characteristics of Workers

1. Result of Interview

Characteristics of workers:

Table 1., According to lenght of service distribution of examined workers

No	Lenght of Service (Years)	Numbers (People)	Percentage (%)
1	≤ 5	51	51
2	>5	49	49
	Total	100	100

The working period ranges from 3 months to 33 years with an average of 8.4 years and the highest range is for working period ≤ 5 years, namely 51%, while working period > 5 years is 49%.

1.4. Education Status

Consisting of 3 university graduates, 38 senior high school graduates, 35 junior high school graduates and 24 Elementary school

From 100 people examined, the characteristics of the workers at the time of the examination were as follows:

1.1. Genders

Consisting of 82 males and 18 females

1.2. Age

The age of the workers ranges from 17 to 75 years, with an average of 41.4 years and the largest range is between 31 and 40 years old, namely 33 people (33%), second: 41-50 years old, 20 people. , 20%; third: 51-60 years old, 16 people, 16%. Most of the workers is young, namely aged 31-40 years and 41-51 years.

1.3. Lenght of Service

graduates (24%). Most education level is senior high school and junior high school.

1.5. Habits of workers

There are 55 people smoking (55%), 51 people doing exercise (51%), drinking alcohol and taking drugs. The workers in this company has fairly balanced habits but the habit of drinking alcohol and drugs needs to be approached to increase the productivity of the workers.

1.6. PPE worn by workers during working
 Most of workers only know and wear cloth mask are 71 people (71%), use of respirator is only 12 people (12%), according to us, they do not know respirator yet.

2. Doctor's physical examination results
 From 100 people examined by doctors, it was found that: The most common disease was tooth decay (97%). It is suspected to be due to lack of health promotion or chemical exposure; hypertension 14%; 2% of asthma

is thought to be work-related asthma, namely allergic asthma, sensitivity to exposure to chemicals; TB 1%, possibly Silicotuberculosis.

3. Supporting Examination Result

There were 100 people examined, it was found as follows:

Table 2., Physical examination of workers: Spirometry and Thorax Photo

No	Health Status	Numbers of people	Percentage (%)	
1	Pulmonary physiology			
	- Normal	39	39	
	- Obstruction	2	2	Consult to Pulmonologist
	- Mild restrictions	30	30	
	- Moderate - severe restrictions	23	23	
	- Restriction and obstruction	3	3	
	- Cannot maneuver well	3	3	
2	THORAX PA PHOTO			
	- Normal	89	89	
	- Pleural Effusion	1	1	Konsul ke dokter Sp. Paru
	- Former lung inflammation	1	1	
	- Lung inflammation – Pneumonia	1	1	
	- Pulmonary silicosis	6	6	
	- Pneumonia and suspected pulmonary mass	1	1	
	- Pulmonary Silicosis, Pneumothorax, Pleural Effusion	1	1	

Lung examinations revealed functional disorders in the lungs of 61 people (61%) and 11 workers (11%) had abnormalities in the lungs, namely pneumoconiosis, silicotuberculosis, scarred silicosis and pleural effusion (suspected

silicotuberculosis), suspected pneumonia, DD lung mass, suspected pneumonia and former lung inflammation.

4. Statistic Analysis

The influence of length of working due to occupational lung disease

1). Crosstabulation

Length of working * Occupational Lung Disease

		Occupational Lung Disease		Total
		Normal	Lung abnormality	
Length of Working	≤ 5 years	47	2	49
	> 5 years	42	9	51
Total		89	11	100

2). Statistic Test

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.697 ^a	1	.030		
Continuity Correction ^b	3.414	1	.065		
Likelihood Ratio	5.059	1	.024		
Fisher's Exact Test				.052	.030
Linear-by-Linear Association	4.650	1	.031		
N of Valid Cases	100				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.90.

b. Computed only for a 2x2 table

The statistical data above states that work experience has an influence on occupational lung disease in natural stone processing workers in Tulungagung, East Java, Indonesia with a significance value of 0.03

(p-value < 0.05), with a confidence level of 95%.

DISCUSSION

The characteristics of the Natural Stone Processing workers in Tulungagung, East Java were 100 workers, who were examined

in 2018, the majority of whom were 82 men. The age of most workers is between 31 - 40 years, namely 33 people. Occupational Diseases (PAK) are influenced by many Physical, Chemical, Biological, Physiological, Psychological factors. (11) Occupational Lung Diseases are influenced by an average working period of 8.4 years, consisting of a minimum working period of 3 months and a maximum of 33 years. , details of working period ≤ 5 years (51%) while working period > 5 years (49%). The majority of education is junior high school (Junior High School) and Senior High School (Senior High School) graduates, while 24 elementary school graduates (24%) are the older generation which traditionally influences the young workers. Meanwhile, the habits of the workers include smoking as much as 55%, PPE (Personal Protective Equipment) which is used by the majority of cloth masks 71% for chemical dust (Silica), Climate in the workplace (temperature $>32^{\circ}\text{C}$). These conditions can influence the occurrence of lung disorders Work. (21,22) Another research on the Batu Padas industry in Silakarang, Gianyar, 2014 (47 workers, aged 22-50 years) the results of lung function examination using Spirometry, found 66% of workers with restrictive disorders 2% and 32 % is classified as normal. (9)

The highest proportion of lung function disorders was in workers aged 40-55 years (87.5% restrictive, 4.2% obstructive), workers with obesity (100% restrictive), workers who smoked (80% restrictive, 3.3 % obstructive), and workers who have worked for 6-15 years (71.4% restrictive). (2,4,14,17) Another study examining the lung function of the Batucadas Industry, Gianyar was similar to the lung examination of Natural Stone Processing workers, in Tulungagung. Lung function disorders were found in 61 people (61%) and the examination used radiology (photo thorax) was found that 11 workers (11%) had lung abnormalities, namely pneumoconiosis, silicotuberculosis, silicosis scars and pleural effusion (suspected Silicotuberculosis), suspected pulmonary DD pneumonia, suspected pneumonia and traces of lung inflammation.

Measurements of the work environment, namely dust, CO, NO₂ levels, at 9 Natural Stone Processing locations in Tulungagung, especially dust which is chemical dust (Silica), obtained the lowest data at 0.2266 mg/m³ while the highest was 4.6995 mg/m³, and Climate in the workplace Dry temperature (Sk) $> 32^{\circ}\text{C}$. This condition can affect Lung Function Abnormalities as much as 61%, while thorax photo abnormalities are Pleural Effusion (1), Scar

Lung Inflammation (1), Lung Inflammation (1), Pneumonia suspected of being a Lung mass (1), Pulmonary silicosis, Pneumothorax, Pleural Effusion (1) and Pulmonary Silicosis (6). The number of Lung Disorders in Workers is 11 people (11%). Lung disorders in Natural Stone Processing workers have the same causes as Calvin's 2020 research on Gold Mining, the incidence of Silica exposure in workers aged 45-55 years out of 2255 people, it was found that 1592 (71%) people died. In the above number, 1296 people (81%) suffered from silicosis and pulmonary Tuberculosis. (5,6,7) According to Suma'mur 2014, it is stated that the type of disease Pneumoconiosis is caused by mineral dust forming scar tissue, the type of Lung and respiratory tract disease due to work is caused by hard metal dust, Occupational asthma is caused by sensitizers and substances stimulant in the work process. (11, 13) Another study, Wong 2019, shows that long working hours affect the health of workers. (21) Another study, Varghese, 2019, stated that hot workplace temperatures can affect the health and safety of workers, the recommended temperature is 25°C. (22)

Data from the research above, statistical analysis and the results of other researchers show that work experience has an influence on occupational lung disease in natural

stone processing workers in Tulungagung, East Java, with a significance value of 0.03 (p -value < 0.05), with a confidence level of 95%.

CONCLUSION

1. Working period influences occupational lung disease in workers in the production department of the Natural Stone Processing Company, in Tulungagung, East Java, Indonesia.
2. Factors that are thought to influence the health of workers include occupational lung disease, namely smoking habits, not using the correct PPE (cloth masks), a dusty work environment (chemicals, silica) and a workplace climate with temperatures above the recommended values.

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