ANALYSIS OF LIVER FUNCTION DISORDERS ON WORKERS OF CRUMB RUBBER FACTORY IN PALEMBANG CITY, SOUTH SUMATERA

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ABSTRACT

Workers are required to receive Occupational Safety and Health protection. Work accidents can be influenced by physical, chemical, biological, ergonomic and psychological factors. Natural rubber factory is one of the industries that have risks to these factors. This study used a cross-sectional design. Data analysis used the CHAID (Chi-Square Automatic Interaction) method. P value < 0.05 was considered statistically significant. The results of the study showed that the average concentration of H_2S in the air and in solids was above the quality standard and the average concentration of H2S in water was still below the quality standard. The average concentration of NH_3 in water and in solids is above the quality standard and the average concentration of NH_3 in the air is still below the quality standard. The results of the CHAID method analysis showed that glucose levels were associated with impaired liver function (p = 0.000; chi square = 48.766) and the risk of H_2S exposure in the air with impaired liver function (p = 0.007; chi square = 7.944). In addition, 3 segments of liver function disorders were also found, namely Segment 1: Workers with abnormal BBS levels, high air exposure H_2S; segment 2: Workers with abnormal glucose levels, low air exposure H_2S; segment 3: Workers with normal glucose levels. Based on this segment, it was also found that the percentage of risk of experiencing liver function disorders were workers in segment 2 (36.3%) and segment 1 (17.4%).

Keywords: natural rubber, industry, occupational diseases, impaired liver function

1. INTRODUCTION

Workers are entitled to Occupational Safety and Health.[1] Workers died due to Occupational Diseases Approximately 2.4 million (86.3 percent).[2] Workers affected by Occupational Diseases are around 1,700 cases with an average of 13.0 per 10,000 workers.[3] Work Accident Cases in Indonesia have increased from 114 thousand cases to 177 cases.[4] Work accidents can be caused by physical, chemical, biological, ergonomic and psychological factors.[5] Natural rubber factory is one of the industries that have risks to these factors.[6] There are 31 natural rubber factories in South Sumatra. Most of this natural rubber industry is in the city of Palembang.[7]

These natural rubber factory has an average number of workers as many as 400 people. In the rubber factory environment, the chemical factor caused is air pollution in the form of H_2S and NH_3 gases.[8] H_2S is toxic at high concentrations. Exposure to H_2S can cause irritation, respiratory problems, and death. H^2S inhibits mitochondrial respiration and the induction of oxidative stress in eukaryotes.[9] H_2S can affect blood sugar levels in workers.[10] H_2S and NH_3 gases are also at risk of causing impaired liver function.[11] In addition to exposure to H_2S and NH_3, work activities are also at risk of having an impact on work accidents such as processing raw materials,

drying blankets and processing blankets in dryers, using forklifts.[12] Based on the above background, the purpose of this paper is to find out what factors are associated with impaired liver function in workers in a crum rubber factory and the percentage of segments with impaired liver function.

2. METHOD

This study used a cross-sectional design. The study was conducted at a crumb rubber factory in Palembang City, with a total sample of 380 workers. Samples of H_2S and NH_3 gases were taken and measured in the factory work area. The activity was accompanied by experts from the Palembang City Baristan. H_2S and NH_3 are seen in H_2S in air, water, solid, air & solid, Air, water & solid. NH3 in air, water, solid, water & solid. This is done based on exposure to H_2S and NH_3 in workers in the work area. Meanwhile, blood glucose level, cholesterol, SGPT and SGOT levels were measured using blood samples. Blood samples were taken as much as 3 ml in the area of the median cubital vein. The sample was taken and analyzed by a team of analysts from the Sriwijaya University Health Clinic. Body Mass Index (BMI) and blood pressure were measured according to a live standard protocol. Information about age, gender, education, length of work, smoking status, and place of residence were collected using a questionnaire. The CHAID (Chi-Square Automatic Interaction) method was used in this study. CHAID uses the chi-square test criteria to construct a tree diagram. In each of its branches, CHAID performs a merging and splitting stage.[13] Data were analyzed using SPSS version 25. P value < 0.05 was considered statistically significant. This study was approved by the Health Research Ethics Commission, Faculty of Public Health, Sriwijaya University No. 371/UN9.1.10/KKE/2019 December 12, 2019.

3. RESULTS

The results of the analysis were carried out on 380 workers, but 215 workers who were willing to take blood samples. The results of the measurements of H_2S and NH_3 are described in table 1 below:

Table 1. Average concentrations of H_2S and NH_3 in the natural rubber factory area

Variabel	Average Concentrations	
	H₂S	NH₃
In Air	1,63 (0,24-9,34) ± 2,92	0,78 (0,32-1,51) ± 0,36
In water	0,47 (0,09-1,70) ± 0,62	22,92 (0,50-65,0) ± 22,18
In solid	0,94 (0,42-1,37) ± 0,39	94,64 (27,98-194,88) ± 62,63

In Table 1, the average concentration of H_2S in the air is above the quality standard (0.02 ppm) and the average concentration of NH_3 is below the quality standard (2.0 ppm) .[14,15] The concentration of H_2S in water has not exceeded the quality standard for liquid waste (<0.8 mg/L) and NH_3 has exceeded the quality standard for liquid waste (15 mg/L).[16,17] The concentration of H_2S in solids exceeds the quality standard in the slab (> 0.8 mg/Kg) and NH_3 exceeds the quality standard in the slab (> 15 mg/Kg). [16,17]

Table 2. Internal Characteristics of Respondents

Variabel	Total (%)
Age	
Old	74,9
Young	25,1
Gender	
Wan	93,6
Woman	6,4
Education	
< high school	59,5
≥ high school	40,5
Length of working	
> 2 years	91,0
≤ 2 years	9,0
Merokok	
Yes	76,6
Not	23,4
IMT	
>25	34,4
<25	65,6
Blood pressure	
Hypertension	45,1
Normal	54,9
Glucose Level	
Abnormal	6,5
Normal	93,5
Cholesterol	
Abnormal	55,8
Normal	44,2

Based on Table 2, the most dominant respondents are old age, male gender, education < high school, length of work > 2 years, history of smoking, normal blood pressure, normal glucose levels and abnormal cholesterol levels.
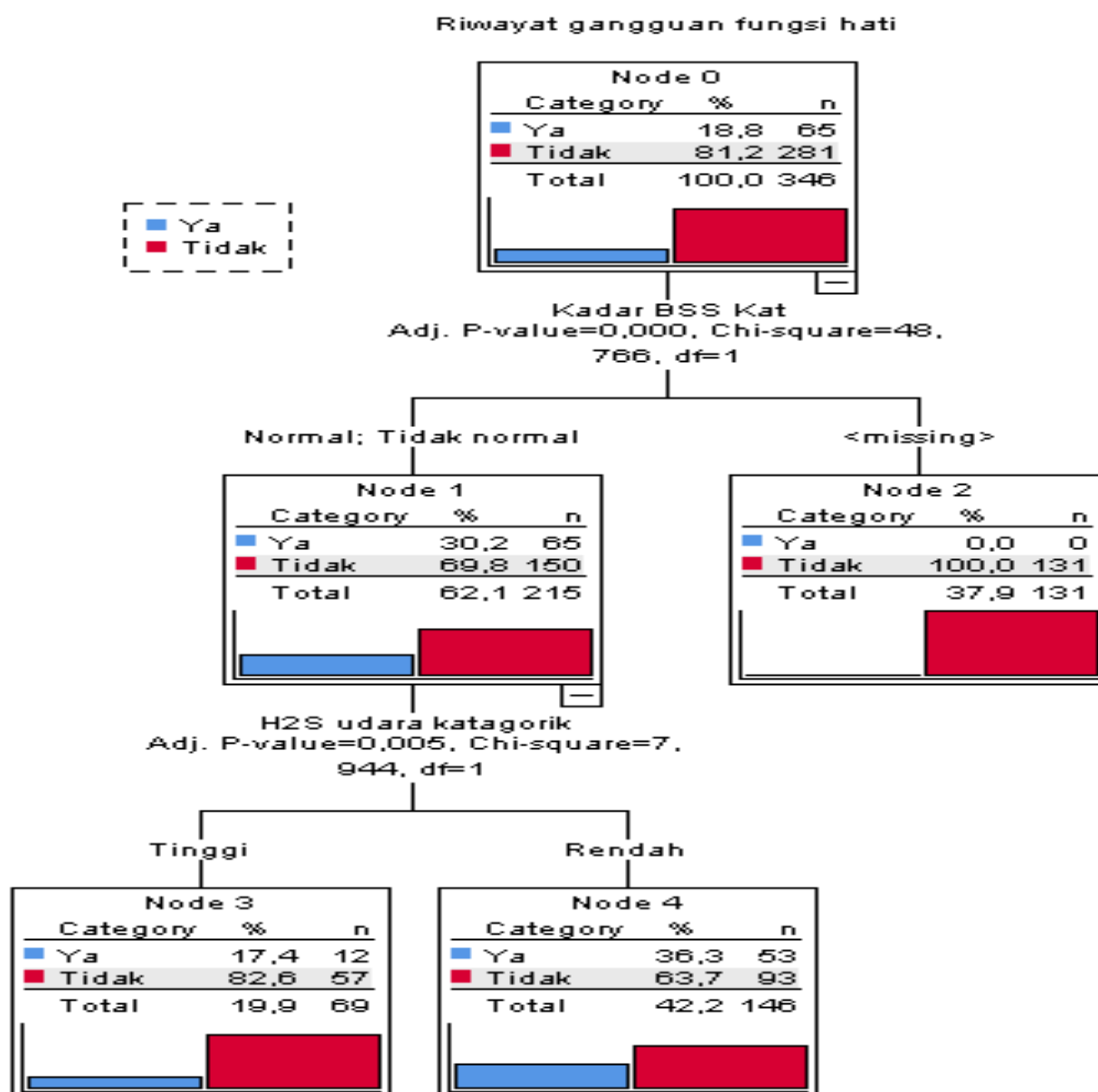
Table 3. External Respondents Characteristics

	Total (%)
Housing of Industry	
Yes	46,5
No	53,5
Risk of exposure H_2S in air	
High	36,4
Low	63,6
Risk of exposure H_2S in water	
High	6,1
Low	93,9
Risk of exposure H_2S in solid	
High	23,4
Low	76,6
Risk of exposure H_2S in air & solid	
High	15,6
Low	84,4
Risk of exposure H_2S in air, water & solid	
High	6,1
Low	93,9
Risk of exposure NH_3 in air	
High	
Low	100%
Risk of exposure NH_3 inwater	
High	33,8
Low	66,2
Risk of exposure NH_3 in solid	
High	73,1
Low	26,9
Risk of exposure NH_3 in water & solid	
High	33,8
Low	66,2

Based on Table 4, the most dominant respondents live in the mess, the risk of exposure to H_2S in the air, in water, in rubber solids, in air & rubber solids, and the risk of exposure to H_2S in air, water & rubber solids is low; the risk of exposure to NH_3 in the air, in the water, and the risk of exposure to NH_3 in water & rubber solids is low, the risk of exposure to NH_3 is high rubber solids, high noise and high biomechanical weight splinting.

Liver function health disorders refer to Figure 1, which shows a detailed picture, which can be seen below:

Figure 1 Liver Function Disorder Tree

Based on Figure 1 analysis using the CHAID method, it was found that glucose levels were associated with impaired liver function (p = 0.000; chi square = 48.766) and the risk of exposure to H_2S in the air with impaired liver function (p = 0.007; chi square = 7.944). In addition to these results, it was also known that at the top node, 18.8% had impaired liver function and 81.2% had no liver function disorders. From Figure 1, Three different segments are formed, which can be seen in Table 4, as follows:

Table 4. Segments of liver function disorders

Segmen	Keterangan
Segment 1	Workers with abnormal BBS levels, high air exposure H2S
Segment 2	Workers with abnormal BBS levels, low air exposure H2S
Segment 3	Workers with normal BBS levels.

Based on Figure 1, the percentage data from each of these segments can be seen in Table 5 below. It can be seen that workers who have a percentage risk of experiencing liver function disorders are workers in segment 2 (36.3%) and segment 1 (17.4%).

Table 5. Percentage of Classification Segments

Segment	Liver disfunction	
	%	n
1	17,4	12
2	36,3	53
3	0,0	0

4. DISCUSSION

Based on Figure 1 analysis using the CHAID method, it was found that glucose levels were associated with impaired liver function (p = 0.000; chi square = 48.766).

relationship between abnormal blood sugar levels and liver cirrhosis: genetic type 2 diabetes is a risk factor for chronic liver disease. On the other hand, abnormal blood sugar can occur as a complication of cirrhosis. This type of diabetes is known as hepatogenic diabetes [18]. The results of research by Bai et al (2021) also revealed that people with diabetes always have liver cirrhosis.[19] Cirrhosis patients who have abnormal blood sugar as much as 30%. The pathophysiology of diabetes may be based on insulin resistance in muscle and adipose tissue and hyperinsulinemia in patients with hepatic impairment.[20] Diabetes mellitus is a condition in which the metabolism is not controlled and high glucose levels in the blood.[21]

Abnormal glucose levels are one of the main risk factors for the occurrence of Non-alcoholic fatty liver disease (NAFLD), in addition to obesity, hyperlipidemia, and metabolic syndrome. The prevalence of NAFLD with patients with abnormal glucose levels is 34-94% worldwide. This is caused by insulin resistance. This condition is caused by defective lipid metabolism and triglyceride

deposition in the liver. Patients with type 2 diabetes mellitus (DMT2) with complications of NAFLD are at risk for developing advanced liver disease, such as fibrosis, cirrhosis, and hepatocellular carcinoma.[22] Diabetes and NAFLD are related diseases. If a person has both of these diseases occurring then diabetes is more difficult to manage and NAFLD will develop. NAFLD causes simple steatosis to cirrhosis .[23]

Liver glycogen and enzymes, in patients with abnormal blood sugar levels, found high liver glycogen content, normal molecular structure and normal enzyme activity. Therefore, some patients with diabetes mellitus are at risk for elevated liver glycogen levels due to unstable blood sugar.[24]

Hydrogen Sulfide (H_2S) gas and impaired liver function

Based on Figure 1 analysis using the CHAID method, the risk of H_2S exposure in the air with impaired liver function (p = 0.007; chi square = 7.944). H_2S is a colorless gas and smells like rotten eggs. It has long been recognized as a toxic gas and pollutant in the environment.[25] H2S is also a third emitting gas besides nitric oxide and carbon monoxide.[26] H2S is toxic at high concentrations. Exposure to high concentrations of H2S results in irritation, respiratory distress, and death. Toxic levels are also produced by mammals by dysregulation of endogenous H2S metabolism. This results in pathologies ranging from inflammation to B cell dysfunction and diabetes. Mechanically, H2S toxicity in eukaryotes is related to inhibition of mitochondrial respiration and induction of oxidative stress. [9]

H2S is associated with liver function, oxidative stress, glucose and lipid metabolism, blood vessels, mitochondrial function, differentiation, and circadian rhythm. In addition, H2S contributes to the pathogenesis and liver diseases, such as liver fibrosis, liver cirrhosis, liver cancer, hepatic ischemia/reperfusion injury, nonalcoholic fatty liver disease/nonalcoholic steatohepatitis, hepatotoxicity, and acute liver failure. [25] H2S can also result in antioxidant stress effects.[27] H2S can affect liver function.[28] and brain.[29] NaHS reduces serum aspartate transaminase (AST), alanine transaminase (ALT) and ammonia concentrations. [29]

5. CONCLUSION

The average concentration of H_2S in the air and in solids is above the quality standard and the average concentration of H_2S in water is still below the quality standard. The average concentration of NH_3 in water and in solids is above the quality standard and the average concentration of NH_3 in the air is still below the quality standard. The results of the CHAID method analysis showed that glucose levels were associated with impaired liver function (p = 0.000; chi square = 48.766) and the risk of H_2S exposure in the air with impaired liver function (p = 0.007; chi square = 7.944).

In addition, 3 segments of liver function disorders were also found, namely Segment 1: Workers with abnormal BBS levels, high air exposure H_2S; segment 2: Workers with abnormal glucose levels, low air exposure H_2S; segment 3: Workers with normal glucose levels. Based on this segment, it was also found that the percentage of risk of experiencing liver function disorders were workers in segment 2 (36.3%) and segment 1 (17.4%). Suggestions for factory management to always control the blood sugar levels of workers, especially workers who are exposed to H_2S gas.

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