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Study of Knowledge, Attitude and Action of Buffalo Breeders in the Villages Around Nagan Raya Power Plant on the Impact of Fly Ash Exposure

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Abstract

One of the biggest contributors of air pollution is the production of coal fly ash from power plant industry. Fly ash has an immediate impact on human and animal health around the power plant. Many buffaloes in Nagan Raya usually grazing near the 110-megawatt steam power plant that using low rank coal. This action raises concerns about buffalo's health due to exposure to fly ash. This study aimed to examine the relationship of knowledge, attitude and action of buffalo breeders to the impact of fly ash exposure on the buffaloes. This research used analytical survey with cross sectional design. This study was conducted in February 2018 with 30 respondents from four villages around Nagan Raya Power Plant to evaluate their knowledge, attitudes and actions by using questionnaires. The data were analyzed statistically with Chi Square Test with SPSS for Windows version 17.0. The results showed that there was no significant correlation between the knowledge of buffalo breeders and the impact of fly ash exposure (P> 0.05), while the attitude and actions of buffalo breeders had a significant correlation with the impact of fly ash exposure (P <0.05). These results concluded that the buffalo breeders in the villages around the power plant did not realize the impact of fly ash arising from coal of power plant. It is expected that the associated institution would conduct a counseling about the impact of fly ash exposure as well as good management of buffaloes.

Keywords: Buffalo breeders, knowledge, attitude, action, impact, fly ash.

Background

Coal is widely used in the power generation industry and it is used as the main fuel. The industrial advantages of using coal include abundant coal resources, it can be used directly in solid form, liquid or converted to gas (gasification), and competitive price compared to other energy sources (Gunara, 2017). Therefore, the number of coal-fired power plant construction (PLTU) has increased in Indonesia. However, as a result of coal combustion in the steam power plant will emit smoke from industrial plant chimneys which produce burning residues in the form of 25% bottom ash and 25% fly ash (Goodarzi et.al, 2008). Fly ash is particles of ash carried by flue gas, while the bottom ash is the remaining ash removed from the bottom of the furnace. This ash waste contains toxic elements because of the heavy metal oxide content that will naturally pollute the environment (Sunaryo and Legowo, 2003), so the largest contributor of fly ash coal production is the power generation sector (Yusuf, 2005).

Aceh province also has a power plant industry located in the village of Suak Puntong Nagan Raya. The location of the steam power plant is located in a residential area and is about 200 m from Suak Puntong beach. This power plant began operating in 2013 with a capacity of 2 x 110 MW of power plants and uses the main fuel in the form of low-calorie coal (low rank coal). Near this steam power plant there are Gunong Kleng Village, Peunaga Cut Ujong, Suak Puntong and Lhok village which are close to Nagan Raya power plant. Location of Suak Puntong village is only about 200 meters up to 4 Km from PLTU. The people occupation are mainly farmers and ranchers. Farming communities and livestock grazing are located around the steam power plant.

According to Bambang et al., 2013, air pollution caused by processing or coal mining industry will negatively impact the health of workers and the community.

Exposure to coal dust particles can decrease air quality that endanger health and eventually cause and increase respiratory disease disorders such as acute respiratory infections (ISPA). Based on reports of Puskesmas Kuala Baro and Meureubo, in the last 2 years there have been an increase in Upper Respiratory Infection (ARI) and common cold. Among the top ten cases found in both Puskesmas from 2013 until 2014, ARI was the highest case found in the community. The results of community self-survey conducted by village midwives and cadres in the village of Gunong Kleng and Peunaga Cut Ujong in May 2017 also stated that 60% of respondents were suffered from ARI.

Besides the direct impact to humans, there are also indirect impacts of fly ash through food chain. Wei et al. (2011) revealed significant mercury (Hg) contamination in coal fly ash and atmospheric deposition due to coal burning processes in Tianjin China. Hg levels were found to be higher in suburban land than in rural areas and agriculture due to steam power plants.

Based on research conducted by Mahajan et al. (2012), there were changes in biochemical parameters and increased levels of mercury in the cow blood grazing near the power plant due to long-term exposure to fly ash coal. Water and feed contaminated with heavy metals would impact health and production of livestock, it will cause symptoms such as chronic diarrhea, growth and weight problems, increase the risk of chronic pulmonary obstruction, and decrease the absorption of drugs in the digestive tract (Swarup and Dwivedi 2002 in Mahajan et al. 2012). In addition, heavy metals in grass fed by cattle will accumulate in some tissues throughout the body and increase in blood, milk and urine (Mahajan et al., 2012). Particulate material contained in fly ash coal is able to inhibit antimicrobial activity in the respiratory tract (Buonfiglio et al., 2017). Heavy metals absorbed by livestock will enter the human food chain through animal products such as milk, meat, eggs, liver, and kidneys. Heavy metals will accumulate in the human body and have an impact on health (Makaron et al., 2013). Therefore, based on the above reviews, we were interested to examine the relationship between knowledge and attitude and the actions of buffalo breeders to the impact of fly ash exposure.

Materials and Methods

This research was conducted in February 2018 in Gunong Kleng village, Peunaga Cut Ujong Subdistrict, Meureubo District of West Aceh, and in Suak Puntong Village, Lhok District of Kuala Coastal of Nagan Raya Regency. Tools and materials used in this study was a questionnaire compiled by our group based on Notoatmodjo (2010). This research was an analytic survey research. The study design was a cross-sectional survey, one of the most common method of observational studies covering all studies where measurements of variables were performed only once at a time (Arikunto, 2010)

The population in this study were all buffalo farmers who lived in the village around Nagan Raya power plant including Suak Puntong Village and Lhok Village in Sub Pesisir District of Naga Raya, Peunaga Cut Ujong Village and Gunong Kleng Village in Meureubo District, West Aceh Regency. The samples in this research were 30 buffalo breeders in Gunong Kleng Village, Peunaga Cut Ujong, Suak Puntong and Lhok, which only had buffaloes as their livestock.

The research variables consisted of knowledge, attitude and actions of buffalo breeders who lived in Gunong Kleng, Peunaga Cut Ujong, Suak Puntong and Lhok villages as independent variables. The impact of Nagan Raya power plant activities was the dependent variable. Data analysis using univariate statistic method is used to analyze variables and displayed in the form of frequency distribution table. Bivariate analysis is used to test the hypothesis that determined independent and dependent relationship through chi square test statistic test.

Results and Discussion

1. Description of Research Location

Nagan Raya District is a part of Aceh Province with Geographical Location 03˚.40 - 04˚.38 North Latitude and 96˚.11 -96˚.48 East Longitude with an area of 3,363,72 Km2 or 336,372 Hectares. Nagan Raya Regency in the north is bordered by West Aceh and Central Aceh districts; the South is bordered by the Indonesian Ocean; Regency of Gayo Lues and Aceh Barat Daya in the west. Regency of West Aceh in the east.

2. Univariate Analysis

Data processing of respondents of 30 buffalo breeders in the four villages around the Nagan Raya power plant had the following results:

2.1. Knowledge

The dominant distribution of knowledge of respondents was in good category, with 56.7% of total respondents, while 43.3% respondents had less knowledge, as shown in Table 1.

Table 1. Distribution of the frequency of knowledge of buffalo breeders in the villages around the Nagan Raya power plant

No	Knowledge	N	%
1	Less	13	43,3
2	Good	17	56,7
	Total	30	100

2.2. Attitude

Distribution of respondents attitude was 66.7% in not good category, while respondents with good attitude was only 33.3%. The data is provided in Table 2.

Table 2. Distribution of the frequency of Attitude of buffalo breeders in the villages around the Nagan Raya power plant

No	Attitude	N	%
1	Not good	20	66,7
2	Good	10	33,3
	Total	30	100

2.3. Action

Distribution of respondents actions was 50% for both category, as shown in Table 3.

Table 3. Distribution of the frequency of buffalo breeders' actions in the villages around the Nagan Raya power plant

No	Action	N	%
1	Less	15	50,0
2	Good	15	50,0
	Total	30	100

2.4. Impact of Fly ash Exposure

The most dominant distribution of the impact of fly ash exposure was in poor category with 56.7% respondents, while in good category was only 33.3% (Table 4.)

Table 4. Distribution of the impact of fly ash exposure in the villages surrounding the Nagan Raya power plant

No	Impact of fly ash exposure	N	%
1	Poor	20	66,7
2	Good	10	33,3
	Total	30	100

3. Bivariate Analysis

Data processing of knowledge, attitudes and actions of buffalo breeders in the four villages around Nagan Raya power plant on the impact of fly ash exposure was as follows:

3.1. Knowledge relationship of buffalo farmers to the impact of fly ash exposure in the village around Nagan Raya power plant

The result of the analysis of the knowledge of the buffalo breeder's relationship with the impact of fly ash exposure was found that there were 11 buffalo farmers (84.6%) who had less knowledge in recognizing the impact of fly ash exposure, while among buffalo breeders who have good knowledge, nine buffalo breeders (52.9%) had distinguishing the negative effects of fly ash exposure. Chi Square Test results showed that there was no correlation between knowledge of buffalo breeders and the impact of fly ash exposure (P> 0.05). The correlation value was 1.598 (0.956-2.647), meaning that respondents with less knowledge would likely get the impact of fly ash exposure two times greater than that of good knowledge (Table 5).

Table 5. The relationship of knowledge of buffalo farmers to the impact of fly ash exposure in the village around Nagan Raya power plant

Knowledge	Impact of Fly ash Exposure		Total	*P*	OR (95%CI)
	Bad	Good			
Less	11 (84,6%)	2 (15,4%)	13 (100%)	0,152	1,598 (0,965-2647)
Good	9 (52,9%)	8 (47,1%)	17 (100%)		
Total	20 (66,7%)	10 (33,3%)	30 (100%)		

There are several factors that can affect knowledge, including level of education. Based on the results of this study, we found that the respondents were mainly graduated from junior and senior high school. There were two respondents who had high education showed good level of knowledge about the impact of fly ash exposure. However, there was no relationship between knowledge and the impact of fly ash exposure. The higher level of respondent's education, the more knowledge they had. The knowledge of respondents about the impact of exposure to fly ash was limited to health problems and pollution, they did not realize the impact through food chain. Adriano et al. (2002) and D'Emilio et al. (2013) reported that heavy metals in fly ash could be found in soil, water and plants that would accumulate into the human body through the food chain. Therefore, to comprehend the negative effect of fly ash exposure especially related to food chain, a counseling was necessary for the breeders.

3.2. Relationship of buffalo breeders' attitude towards the impact of fly ash exposure in the village around Nagan Raya Power Plant

The result of buffalo breeders attitude analysis on the effect of fly ash exposure showed that there were 17 breeders (85%) who had bad attitude could feel the impact of fly ash exposure, while among the buffalo breeders who had good attitude, three people (30%) could feel the bad impact of fly ash exposure. Chi Square test results showed that there was correlation between buffalo breeders attitude and the impact of fly ash exposure (P <0.05). The value was 2,8333 (1,080-7,433), meaning that respondents with bad attitude had the chance to get the impact of fly ash exposure three times bigger than the good attitude, as shown in Table 6.

Table 6. Relationship of buffalo breeder attitude to the impact of fly ash exposure in village around Nagan Raya Power Plant.

Attitude	Impact of Fly Ash Exposure		Total	*P*	OR (95%CI)
	Bad	Good			
Not Good	17 (85%)	3 (15%)	20 (100%)	0.009	2,833 (1,080 - 7,433)
Good	3 (30%)	7 (70%)	10 (100%)		
Total	20 (66,7%)	10 (33,3%)	30 (100%)		

There are several factors that can affect a person's attitude, including the influence of others who are considered important, and also personal experience (Azwar, 2007). Personal experience can be assessed from the length and experience in breeding, the longer experience as breeder will form the attitude in breeding. This caused the relationship between farmer attitude toward the impact of fly ash exposure. Although the level of education of many buffalo breeders was in junior and senior high school, did not show good attitude in livestock.

The common practice of buffalo breeders who had large quantities of buffaloes, they did not care about animal welfare. The buffaloes not only feed grass or green plants, but also consume waste. Arifin et al., 2005 reported that the waste disposal site contained a variety of heavy metals such as Pb, Hg and Cd which would accumulate in livestock body and would cause residue in animal products. Kumar et al. (2017) reported that heavy metals were also detected in soil and plants with fly ash exposure.

3.3. The relationship of buffalo ranchers' actions to the impact of fly exposure ash in the village around Nagan Raya power plant.

The results of the analysis of the relationship between buffalo breeders' actions and the impact of fly ash exposure found that there were 14 breeders of buffalo (93.3%) who had a bad action to feel the impact of fly ash exposure, while among buffalo breeders who had good action, six people (40%) realized the effect of fly ash exposure. Chi Square Test results showed there was correlation between buffalo breeder actions and the impact of fly ash exposure (P <0.05). The OR value was 2,333 (1,237-4,400), meaning that respondents with unfavorable actions have the chance to get the impact of fly ash exposure twice as big as those having good actions as shown in Table 7.

Table 7. Relationship of buffalo farmer's actions to the impact of fly ash exposure at village around Nagan Raya Power Plant

Action	Impact of Fly Ash Exposure		Total	*P*	OR (95% CI)
	Buruk	Baik			
Not Good	14 (93,3%)	1 (6,7%)	15 (100%)	,007	2,333 1,237-4400
Good	6 (40%)	9 (60%)	15 (100%)		
Total	20 (66,7%)	10 (33,3%)	30 (100%)		

The buffalo breeders around the Nagan Raya power plant had grazed their buffaloes near the power plants even before it was built. It still continues until now. Farmers in this area did not have other grazing land. Livestock did not only feed grass or other plants around the power plant, but they also feed waste. Some farmers acknowledged that some of their animals had health problems since the steam power plant was built. This disease was assumed to have relationship with the exposure of smoke from Nagan Raya power plant and the polluted environment. PLTU fumes that use coal fuel contain fly ash and can pollute the surrounding air, soil and water (Koschke et al., 2011; Ruhl et al., 2012). This is also in accordance with a research conducted by Kalkreuth et al. (2014) who found harmful metal content in soil and plants around Figueira power plant, in Brazil.

Conclusion

Based on the result of this research, it can be concluded that the knowledge of buffalo breeders on the impact of fly ash exposure is not related, while attitudes and actions of buffalo breeders were related to the impact of fly ash exposure in the village around Nagan Raya power plant. It is suggested to related parties to improve the knowledge of buffalo breeders through counseling and training methods so they would have better understanding about the importance of good buffalo management. It is also important to anticipate the longterm impact of fly ash exposure of Nagan Raya power plant so that the effects of pollution indirectly through food chain to humans can be prevented

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