ENVIRONMENTAL HEALTH POST FLASH FLOODS DISASTER (A STUDY CASE IN SOUTH-DOLO SUBDISTRICT, REGENCY OF SIGI)

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ABSTRACT

Flash floods hitted 5 villages in South Dolo Sub-district, Sigi regency, Central Sulawesi on April 24th, 2019. The flash floods disaster left environmental health problems for the refugees. This study was intended to obtain an overview of environmental health problems of post flash floods disaster and local potency which benefit to solve those problems. It was a descriptive qualitative research with case study method in Balongga Village, South Dolo Sub-district starting on April 30 to May 22, 2019. The location and the respondents involved in this study were determined purposively. Data collection was done by in depth interview with 7 family heads of refugees, focus group discussion with local community leaders, village secretary, social service office of Sigi regency, Youth of Disaster Preparedness and Public Health Office of Sigi regency. This study findings reveal that environmental health problems which emerged post flash floods disaster was the limitation of clean water, calcareous of drinking water source, the amount of littering waste especially noodles plastic packages, plastics cups and bottles of drinking water, a number of flies around the tents and the mosquitos bites were also felt by the refugees. Local potencies that might be applied to resolve those environmental health problems were the use of mountain water resource, water purification, recycling of plastics waste, constructing of natural aktractan and flies trap, making natural repellents as well such as Evodia sauveolens, Ocimum basilicum forma citratum, Cymbopogan citratus, Cosmos caudatus K, and Syzigium Aromaticum.

Keywords: flash floods, environmental health.

INTRODUCTION

Indonesia is also known as a disaster-prone area. A disaster can be caused by nature or human being. The sorts of a disaster are such as an earthquake, tsunami, floods and flash floods, landslide, volcano eruption, fires, forest fires, tornado or other horizontal conflicts. Based on such situations, program disaster management is properly needed. It such as giving help, rescued, a settlement, life basic needs, health care, clean water and sanitation (BNPB, 2009). The flash floods that hit 5 villages in South-Dolo Subdistrict, Sigi Regency, Central Sulawesi, caused heavy damage in that area (Faaiz, 2019). National Disaster Relief Agency of Sigi Regency Central Sulawesi reported that since post flash floods disaster on Saturday evening, April 28, 2019, the disaster has taken 1 people died, soaked 500 houses, and 2.400 people or 640 of a family forced to leave their houses to be evacuated in a safe area. Ballongga, Bangga, Walanata, Omu, and Tuva (Litha, 2019). The report revealed that the survivors begin to get diseases such as itching, cough, fever, and hypertension. With all the limitation that exists because of the disaster, the most affected groups were babies, toddlers, pregnant women, nursing mothers and the elderly (Kemenkes RI, 2012). The main health risks related to the floods were identified transmitted by vector and water (Abbas & Routray, 2014). An analysis by Alderman et.al stated that post flood disaster, mortality rate increase up to 50% in the first year. After the floods, it was found the increase of the high risk of diseases epidemics such as Hepatitis E, digestive disease and leptospirosis especially in the poor sanitation area and survivor population. Psychological pressure (prevalence of 8.6% up to 53% two years after the floods) also could worsen their physical illness (Alderman et al., 2012). The other findings reveal that problems faced by the family after the floods disaster were job loss, damage houses, traumatic children, children's health and education. All of the families who survived after the floods were susceptible to social and economic problems, while natural potency only could solve the temporary problems (Murni, 2010). Environmental health problems emerged post-flash floods on April 28, 2019, were the limited clean water sources, calcareous drinking water sources, the amount of littering waste especially noodles plastic packages, plastics cups, and bottles of drinking water. Many leftovers were thrown away around the tent caused the number of flies. Mosquitoes bites were also experienced by the survivors due to many clothes hang up along with the hot temperature in the tent. This study was intended to obtain an overview of environmental health problems post flash

floods disaster and local potency which benefit to solve those problems.

MATERIAL AND METHOD

This was a case study research in Bangga Village, South-Dolo Sub-district which conducted on April 30 until May 22, 2019. This type of research was a descriptive qualitative, where field data relied on views and perceptions of the respondents. The location was determined purposively, namely the area affected by floods disaster in South-Dolo sub-district. Informants were chosen also purposively by considering the condition of people who suffered from the disaster. The data collection was done through an in-depth interview to 7 family heads who suffered from the disaster, Focus Group Discussion (FGD) with the local community leaders, Village secretary, officers of social service office of Sigi regency, Youth of Disaster Preparedness and officers of Public Health Office of Sigi regency. In order to explore deeper information, besides being a member of FGD, The Village secretary of Bangga Village and social service officer of Sigi regency were also selected to be the informants. The observation was conducted towards the environmental condition and community activities, then documentation study to study the documents related to the flash floods disaster.

RESULT AND DISCUSSION

South Dolo sub-district is located in 0°45'53"–1°00'57" S and 119°32'30" 119°46'36" E. The total area is 592, 54 km², administratively it is divided into 12 definitive villages. The topography is varied of terrain, hills, and mountains. All villages can be traversed by two-wheeled or four-wheeled vehicles to connect between one to other villages and sub-districts. However, there are still some backwoods of the villages are difficult to be reached on foot and need one day to be traversed. The distance between villages and the capital of subdistrict of South Dolo is varied, the farthest village is Jono with 8 kilometres distances while the nearest ones are Bulubete and Rogo with 1 kilometres distance each. The majority of plantation crops cultivated by the people of South Dolo Subdistrict are coconut and cacao, namely 2,402 (Ha) of Coconut Plant, 1,587 (Ha) of Cocoa, and candlenut and coffee plantations of 2 (Ha). Based on the type of irrigation, 93.73% of paddy fields in the South Dolo sub-district are irrigated land (BPS, 2018).

Demographic and socio-economic conditions, the total population of South Dolo Subdistrict is 15,763 people, with an area of 664,78 km², the population density reaches 24 people / km². The highest population is in the Bangga Village with 2,420 people with an area of 185,08 km², the population density reaches 13 people / km². The highest population density is in Sambo Village with an area of 6,97 km² and a population of 1,069 people, population density is 153 people / km². In the view of households' number, the number of households in South Dolo subdistrict is 3.598 households with average population are 4 of each household. Bangga village becomes the most density with 552 households and the lowest is Jono Village with 145 households. Based on the age, the productive age in south Dolo sub-district is reached 63,54% of the total population or about 4.960 people. Health care facilities are Baluase Community Health Center, Supporting Community Health Center in 3 villages such as Bangga, Rogo and Sambo. Furthermore, there is 1 general practitioner, 28 nurses, and midwives. It has 1 public market with 35 stalls. Communications service that is used by the community is the mobile phone. Almost all of the area is easy getting the cellular network. There are 14 permanent bridges and 5 metres length of semi-permanent bridges. The number of two-wheeled vehicles dominates all the area due to almost all of the households own motorcycle [8]. Flood is a phenomenon or a condition where an area or a land is soaked due to the increase in water volume. The flash floods are floods that suddenly come with big water volume that is caused by the damming of the river in the river flows [1]. Nowadays, hydrometeorology shows the high tend. The flash floods disaster is a part of hydrometeorology which indicates to the living and the wealth. The main factors that caused the disaster are high rain intensity and erosion. The erosion blocked the river flows then construct a natural dam. The flows of river then pressure the natural dam which indicates with high speed of river flows containing mud, woods, and stones (Adi, 2013).

People suffered from tching since they bathe in a dirty river. They do this due to the unavailability of clean water and water storages. They consume instant noodles, eggs, and salty fish. People are cough is

caused by erratic weather. Learned from Bangladesh, the common problems which are felt by the survivors are fever (63, 6%), followed by respiratory (46, 8%), diarrhea (44, 3%), and skin problems (41,0%). There are only 1,0% and 6, 7% of survivors boil and chlorinate the water. There is 75% of water resources both dig well and river which contaminates (Kunii et al., 1998). Further analysis, parameter scoring about water quality post flash floods disaster use turbidity, total density, total dissolved solids, sulfate, chloride, nitrate, total bacterial, and total coliform group. The result from a study in Beijing post floods shows that different pollution rate, and mostly are not match with recommended parameters. The main component analysis and analysis factor disclose that two factors such as mineralization and agricultural run off, and floods entertainment are described by 82,50% of total variants. A study case delineates that this method benefit to evaluate and interpret the big and complex water quality data post flash floods disaster (Sun et al., 2016).

Poor people are very prone to the floods yet they are also very adaptive and strong against it. Middle-income households are also very prone since they are in doubt taking any job and receiving flooding donation; high-class households even they are less adaptive, they can more quick in recovering due to their material support (Kamal et al., 2018).

A study in Aceh that analyze factors those affect the risk of flash floods disaster and to take a dangerous floods zone in the watershed of Krueng Teungku. This study uses a weighted overlay method through Information Geographical System (IGS). The result discloses the information about the dangerous flash floods zone in the watershed of Krueng Teungku as a model of early warning. By using this method, the ability to predict floods in watershed without measuring instruments could be increased. Factors influence the flash floods disaster including highest water volume, declivity, the shape of the watershed, flow gradient, destruction, drainage density, erosion, the slope of stability and the reservoir volume (Azmeri, 2016).

Flash floods risk management in stages moves from the risk-based approach to an integrated approach among other elements. It also considers Risk Communication (RC) as a way to lift up the tenacity. The potency of risk dialogue approach (based on RC ad-hoc strategy) change attitude and behavior related to the flash floods disaster. RC strategy consists of the briefing, quiz, telling a tale, videos and photos competition about floods a few years ago, and intergenerational workshop (Bodoque et al., 2019).

Lesson learned from Khartoun Flash Floods that there are 7 integrated approaches for flash floods management, they are; rainfall data analysis, affected of documents and housings analysis, field study in the worst affected areas, people perceptions about the cause and mitigation phases through interviews, reporting drinking water quality, reporting diseases related to the water and social risk scoring (Mahmood et al., 2017).

Considering the significance of community health from the impact of groundwater vulnerability and exacerbation of climate change, it is needed a strategy to elevate the awareness of potential contamination sources and motivation of preventive behavior (Andrade et al., 2018). Field observation shows that Baluase Health community center preparedness as the head of the health administrator is quite enough. At the first day after the disaster, the health workers of Baluase Health Community Center give caring treatment to the survivors. A study in Jember shows that commonly categorized good enough. It is expected in health environment aspect could give a PPGD Workshop to health workers and complete some resources such as PAC, chlorine, aquatab, mist blowers, AICON, plastic bags, drums/cans, emergency toilets, disinfectants and generators (Prasetyowati et al., 2016). Another research from Aceh shows that there is a significant relationship between attitudes and knowledge of health workers' preparedness to face the risk of flood disasters at the Pidie Jaya Regional General Hospital. As many as 60% or 18 health workers have good knowledge about flood disasters, 56,7% or 17 health workers have a good attitude about floods, on the contrary for preparedness variables, as many as 53,3% or 16 health workers are not ready to face the risk (Fakhrurrazi, et al., 2015). Considering the sudden disaster and detriment of many aspects, preparedness is needed to anticipate disasters. Therefore, disaster education and emergency simulation training are needed to improve preparedness. The results of the Palan study

(2019) showed an increase in preparedness in nursing students after being given counseling and training on emergency simulation.

Furthermore, for recovering the survivors, the community can take advantage of the Rural Community National Empowerment Program (RCNEP) and its impact on the economic recovery in Tangse Subdistrict of Pidie Regency. The results of the study show that during the rehabilitation and reconstruction period carried out the rehabilitation of village road infrastructure, where the implementation of RCNEP was very effective due to the proposed activities were directly from the results of village community consultations which aimed to free movement and mobilize the community to repairs economy damaged by the disaster. The perceived impact is that the acceleration of the development of village axis road improvements is more quickly handled and can provide comfort for road users. In addition, to the labor-intensive pattern, the community was very enthusiastic to be involved as daily workers both men and women in these projects so that they could add financial income to cover economic needs (Rahmadi et al., 2016). Murdiana et al (2015) suggested that structural mitigation related to flash floods reducing the impact of disasters such as the construction of sewers or good sanitation channels in the city center, the construction of cliff barriers, and the construction of talud along the river channel that is prone to disasters. Non-structural mitigation is carried out to increase public awareness and community empowerment by providing training and simulation of flash floods disasters. Community capacity for flash floods disasters is still moderate, and the steps that should be taken to increase community capacity and reduce the level of vulnerability are networking between the village government and BPBD Sigi. Research in Aceh suggests disaster preparedness by establishing non-governmental organizations in tackling disasters, increasing roles government to make policies to reduce disaster risk and make disaster curricula in schools (Wahyuni et al., 2015).

To get clean water, survivors use water from the mountain which is collected then distributed by piping to the tents where they were staying. Hendro (2008) stated that various ways are done by humans to get clean water; one of them is by taking it below the ground. Taking it directly is the most popular way. It is done for several main reasons, they are easily obtained, relatively clean through filtering the soil and also cheaper. While the clean water availability really depends on the level of infiltration and percolation in the water catchment area (Murtianto, 2008).

The solution for water purification, Moringa seeds can be used as a water purification material since inside the Moringa seeds there is a positively charged protein content that acts as a cationic polyelectrolyte and is important as a water purification agent. This argues that grains that produce positive electrically charged components can be used as natural water purification materials. With the knowledge of plant parts as water purification materials, we can develop the use of natural resources that we have and are well known. Only adjustments are needed for the initial turbidity conditions of the raw water in each area. Moringa seed powder when stirred with water, the dissolved protein has a positive charge. This solution can act as a cationic natural polyelectrolyte. This fact is beneficial since most of the colloids in Indonesia are negative since it comes from organic material. The coagulant ion with a similar charge to the colloidal charge will be rejected. Otherwise, a different ion will be pulled. The principle of this difference in charge between coagulants and colloids is the basis of the coagulation process. The higher the ion with different charge is, the faster the coagulation occurs. The use as biokoagulant, especially in tropical countries, provides benefits since its availability in nature is huge, easily cultivated, and has not been utilized intensively (Hidayat, 2009).

The solutions for controlling flies is by utilizing natural ingredients and simple fly traps. Some plant such as herbal clove oil, basil plant extract, and vitex herbs have been reported as natural pesticides which can be developed as fruit fly bait since they contain eugenol compounds to control fruit flies. Plants containing eugenol have been reported and are often found growing in the highlands of Sigi district can be used by the community. Learning from a training in making natural attractants from aromatic plants to control fruit flies shows that pest control, especially fruit flies, uses botanical pesticides from natural plant materials such as vitex and basil without using synthetic pesticides. Making vitex plant extracts (*Vitex*

negundo L.) and basil plants extracts *(Catharanthus roseus L.)* as attractors for male fruit flies and Steiner fruit flies traps made from used mineral water bottles (Humaira et al., 2013)

Another solution for controlling flies is to use clove leaf extract (*Syzygium aromaticum*) at a concentration of 10%. *Syzygium aromaticum* can be used as an alternative controller in vectors, especially for flies and is also used as a natural insecticide that is safe for the environment and humans [26]. In addition, plants that are thought to be vegetable insecticides are basil. During this time, basil is only known as a vegetable that is used as fresh vegetables and traditional medicines. The results of the Iffah study showed that basil extract (*Ocimum basilicum forma citratum*) as the best larvae of Musca domestica at a concentration of 20% (H DI et al., 2017).

The solution for controlling mosquito is by utilizing the extract of the plant zodia *(Evodia sauveolens)* and lemongrass *(Cymbopogon citratus)* as mosquito repellents. Budiman's study (2014) showed that the effectiveness of *Evodia sauveolens* was better than *Cymbopogon citratus* (Budiman & Rahmawati, 2010). In addition, natural ingredients that were safer in avoiding mosquito bites was the use of basil. Kardinan (2006) shows that basil has the potential repellent mosquitoes with the highest protection power of 79,7% for one hour and an average of 57,6% for six hours (Kardianan, 2007). Furthermore, to control mosquitoes, you can also use the the kecombrang flower extract (*Etlingera elatior)*. According to the Gurning study, *Etlingera elatior* is very effective as a repellent at 30 minutes of observation and at 60 minutes of observation, it was very effective to kill the Aedes aegypti (Guming et al., 2013). In addition, it can also use kenikir plants *(Cosmos caudatus K)* to reject mosquitoes (Wirastuti & Marlik, 2016).

CONCLUSION

Environmental health problems arising after flash-floods found such as limited availability of clean water sources, calcareous drinking water sources, a large amount of garbage scattered especially plastic packaging noodles, plastic cups and mineral bottles. Lots of flies are around the tent. Mosquito bites are also felt by survivors. Local potentials that can be used to overcome these environmental problems are by utilizing

mountain water sources, conducting water purification, processing plastic waste, making natural tractans and trapping flies, as well making natural repellents such as *Evodia sauveolens, Cymbopogan citratus, Ocimum basilicum, Syzigium aromaticum, Cosmos Etlingera elatior, Ocimum basilicum forma citratum, and Cosmos caudatus K.*

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