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Environment Risk Factors of Diarrhea Incidence in the Manado City

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Abstract **Background:** Diarrhea caused by bacteria, virus and parasite. Agent of diarrhea was spread through contaminated food and drinks with the agent of the disease. In addition, it can occur from person to person as a result of poor hygiene (personal hygiene) and the environment (sanitation). The purpose of this study is to analyze the correlation between source of drinking water and latrine existing with diarrhea incidence in Manado city. **Method:** This study was a cross sectional survey and using questionnaire. Samples of this study were 247 families in the Manado city. Variables in this research were source of drinking water, existing of latrine and diarrhea incidence. All the subjects were asked about diarrhea they had experienced in the six previous months. Data obtained were tested using the chi squared test with SPSS 18.0. **Results:** The findings of present study showed there was a significant correlation between source of drinking water ($r= 0.351$, $p<0.05$) and existence of latrine ($r = 0.007$, $p > 0.05$) with diarrhea incidence. **Conclusions:** This study identified that source of drinking water correlated with the diarrhea incidence in Manado city. According to this study that source of drinking water must be protecting from the pollution source such as septic tank, dump, etc so the water quality can be maintaining.

Keywords Source of drinking water, Latrine, Observational, Chi square test

1. Introduction

Diarrhea was a public health problem in developing countries such as Indonesia. According to the results of Basic Health Research in 2007 showed that the prevalence of clinical diarrhea in Indonesia amounted to 9.0% (4.2% -18.9%). Based on data obtained from the Ministry of Health (2013) showed that the incidence of diarrhea in 2012 as many as 2,843,801 people with morbidity as much as 214 events per 1000 population [1].

Diarrhea was health problem in North Sulawesi. This disease has a high morbidity. This disease is a disease that is a potential cause of Extraordinary Events. Based on the results of the study of National Planning and Development Ministry in 2010, Sulawesi Utara included in the category of medium and high incidence of diarrhea. The incidence of diarrhea in North Sulawesi in 2008 reached 19,286 cases [2, 3].

Based on data obtained from Manado city Health Department in 2008 and 2009 there were five diseases associated with poor environmental quality, namely malaria, leprosy, tuberculosis, dengue hemorrhagic fever (DHF) and the high prevalence of diarrhea. Number of patients with diarrhea increased from 2,445 cases in 2011 to 2,629 cases in 2013 [4].

Study from Strand were found that a high frequency of bowel movements, not breast fed, young age and had diarrhea in the rainy season is a risk factor for acute diarrhea [5]. Genser was showed that the major risk factors (determinants) of diarrhea are low socioeconomic status, poor sanitary conditions, the presence of intestinal parasites, and lack of prenatal examination. The influence of socioeconomic status largely mediated by the living and sanitary conditions [6]. Diarrheal disease is a disease that is based environment. Two dominant factors are water supply and excreta disposal. Both of these factors will interact with human behavior. If environmental factors unhealthy because contaminated with germs diarrhea and accumulates with unhealthy behaviors as well, namely through food and drink, it can cause diarrhea [7]. The purpose of this study is to analyze the environmental factors associated with the incidence of diarrhea in coastal communities in the city of Manado.

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2. Research Methods

2.1. The Type of Research

This study used a cross-sectional design. Two hundred and forty seven families were selected as a research samples. There were selected with purposive sampling.

2.2. Location Research

The location of research is in the city of Manado which lies between 1 ° .30'-1 [B1] ° .40' north latitude and 124 ° 40' 126 [B2] ° 50' east longitudes. Manado city administratively divided into nine sub-districts and eighty-seven urban/rural. Manado city has an area of 157.26 km^2, which Mapanget sub district has an area of 58.21 km^2 that most (37%), Bunaken 28.35 km^2 (28%) and the smallest land area of 1.75 km^2 sub district Sario (2%) [8].

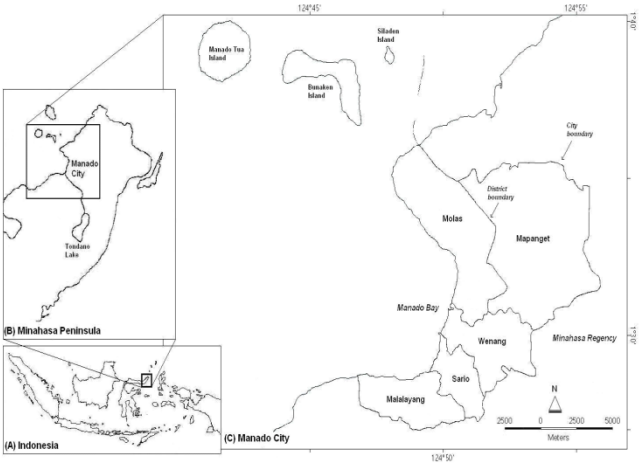

Figure 1. Location of the study

2.3. Research Variable

The variable of this research were the drinking water sources, existence of latrines (independent) and the incidence of diarrhea (dependent).

2.4. Analysis of the Data

Data obtained were tabulated and analyzed using SPSS 18.0 with chi squared test.

3. Results and Discussion

Table 1 shows the basic characteristics of the study's subjects. Drinking water sources and existence of latrines of the sample with and without diarrhea were almost similar. There were statistically significant differences between drinking water sources and diarrhea incidence ($p<0.05$). Eight families in group with diarrhea and 56 families in group without diarrhea reported to have not good of drinking water source.

The results of this research in line with Azhar et al.. That research showed that diarrhea was influenced by drinking water source like the difficulty of the access and water quality. The conclusion of this study was water-borne diseases occurred if the access of water was limited and inadequate water's physicalquality [9].

Table 1. Results of cross tabulation and chi squared analysis

		Event of Diarrhea		Total	Chi square Value	p-value
		With	Without			
Source of drinking water	Not good	8	56	64	**0.351**	**0.002 (p< 0.05)**
	Good	32	151	183		
	Total	**40**	**207**	**247**		
The existence of latrines	No	7	11	18	**0.007**	**0.212 (p> 0.05)**
	Yes	33	196	229		
	Total	**40**	**207**	**247**		

Nugraheni showed that drinking water source has correlation with diarrhea incidence in the Semarang city [10]. A study in coverage area of Belopa Health Center Luwu regency showed that water source has correlation with under three children diarrhea incidence [11].

There were no statistically significant differences between existence of latrine and diarrhea ($p>0.05$). Seven families in group with diarrhea and 11 families in group without diarrhea reported to have no latrine.

The results of this research were not in line with research of Semba et al. Semba et al was analyzed the relationship of the presence of a household latrine with diarrhea incidence and under-five children mortality in Indonesia. This research found that the lack of quality latrines associated with diarrhea incidence and mortality in Indonesia [12].

This study is a systematic review of academic research field of public health. This study found that the risk factors for diarrhea is the most widely studied environmental factors (water supply and latrines) [13]. A study on the use of spatial analysis sources of drinking water, basic sanitation and physical accessibility of diarrhea incidence in the sub-district Gandus Palembang. This research was carried out observational case-control analytic approach to 70 cases and 70 control group. This study found that the risk factors for the incidence of diarrhea in infants drinking water sources [14].

Nugraheni showed that drinking water source, garbage disposal facilities, hand washing after defecates and hands washing before eat has correlation with diarrhea incidence in the Semarang city [10]. A study in coverage area of Belopa Health Center Luwu regency showed that water source, breastfeeding and mother's knowledge has correlation with under three children diarrhea incidence [11].

According to the study done in Gorontalo Indonesia, there was correlation between clean water source and type of latrine with under five children diarrhea in coverage area of Pilolodaa Kota Barat region city of Gorontalo [15].

Results of this research showed that as much as 60.2% of respondents have a sanitary latrine families who are not eligible, 54.2% of respondents have a poor knowledge, 57.8% of respondents said the role of health workers is not

good. The results of the bivariate analysis showed that significant relationship between family latrine sanitation with diarrhea incidence [16].

According the study in the village of Sei Musam Kendit, Langkat regency. The result of statistic analysis indicates that there was a significant correlation to the education and ownership of household's latrine, the income ownership of household's latrine, the knowledge on ownership of household's latrine, the ownership of latrine with diarrhea incidence and personal hygiene with diarrhea incidence [17]. *According the study in Tualang Sembilar village Aceh Tenggara regency Indonesia, the results of the statistical test using Chi-square tests were conditions of latrines, knowledge, and attitudes have a significant relationship with diarrhea* [18].

Household access to protected drinking water sources according to criteria of the Millennium Development Goals (MDGs) by 45,1%, but this has decreased from 2007. When taking into account the bottled water and water from drinking water depot, percentage of households with access to water resources protected drinking to 66,7%. Access to drinking water sources 'quality' which takes into consideration the type of water source protection (including bottled water and drinking water depot), the distance to the source of drinking water, access to drinking water and the physical quality of drinking water for 67,5% [19].

Provision of drinking water/clean yet become a priority, especially in the provincial governments. Lack of access to clean water and sanitation remains a serious challenge, especially in slums and rural areas. This is a major concern because of the lack of clean water reduces the level of sanitation in the community and also increases the chances of developing diseases such as diarrhea. Failure to promote behavior change, especially among low-income families and people in slums, has worsened the health effects of poor water and sanitation situation in Indonesia [20].

According to the results of the Joint Monitoring Programmed for Water Supply and Sanitation of the WHO and UNICEF in 2010, access to water sources are eligible up to 82% and access to sanitation facilities by 54%. Indonesia one level of ownership sewerage coverage lowest in Asia with only 2% access in urban areas [21].

Other studies are conducted to determine the distribution of the incidence of diarrhea in infants spatially, determine the relationship between risk factors sources of drinking water, household toilets, wastewater disposal, garbage disposal, sanitation distance to source of drinking water, and physical accessibility to health services with events diarrhea in infants in Sub-District Gandus Palembang. This type of study is analytic observational case-control design. The results showed the most dominant risk factor diarrhea incidence drinking water sources [14].

Sanitation behavior of the mother (personal hygiene, feeding habits in children under five, and the management of drinking water) and environmental sanitation (excreta disposal, wastewater disposal, and landfills) are risk factors for diarrhea incidence in Jetis Yogyakarta. This study was conducted using the analytical observational case control study. The results of this study showed that the variables that influence the incidence of diarrhea in children under five, namely bacteriological quality of drinking water, personal hygiene, feeding habits of children under five, the management of drinking water and excreta disposal facilities [22].

Most feces and waste water discharged is not processed first before being discharged into the local sewer or water bodies. This causes environmental pollution. Dense housing, seasonal floods and drains are clogged with solid waste also exacerbate this problem [23]. Some studies have found that coli form bacteria can be an indicator of household waste water pollution in estuaries tropics and indicators of water quality in the area of reclamation [24-26].

There are seven criteria of healthy latrines that do not pollute the water (wells, rivers and sea), does not pollute the soil surface, free of insects, odorless and convenient to use, safe to use by the wearer, easy to clean and does not cause disruption to the wearer as well as using wall coverings and doors. Healthy latrine meet several requirements that the lighting (light and fresh air can get in), clean the walls and roof, pit latrines are clean (without any residual dirt and closed), like clean water, waste water is not stagnant on the floor, like dirt away from wells and pit latrines clean and closed [27].

In urban communities, especially in densely populated areas, this requirement is difficult to be fulfilled so that people prone to health problems and diseases such as diarrhea. One solution to this problem that is making a communal septic tank (one hole-do/Salume). This method is made with a toilet inside the house, but the discharge channel leading to the septic tank that will accommodate community stool in a certain capacity [28].

Some studies have found that, the most dominant determinant environment i.e. the distance between the source of drinking water, latrines conditions, and septic tanks. In addition, the quality of drinking water sources, types of excreta disposal site, the type of home flooring, kitchen hygiene associated with the incidence of diarrhea in infants [29-33]. In other hand, contamination of clean water sources and condition the garbage were influenced to incidence of diarrhea in under 1 year children [34, 35].

The correct and proper way in preventing diarrhea in infants is to provide exclusive breastfeeding for 6 months and continued until 2 years, throwing feces baby properly, and provide age-appropriate complementary feeding. In addition, by providing drinking water that has been boiled and use of clean water, wash hands with water and soap before eating and after defecation, defecation in the toilet, as well as providing measles immunization is a preventive measure toddler diarrhea [36].

4. Conclusions

This study identified that source of drinking water correlated with the diarrhea incidence. Further extensive

studies involving social economics, behavior and health service are needed to validate our results for Manado city community.

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