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#### ANALYSIS OF WATER QUALITY, SANITATION FACILITIES WITH INCIDENCE OF DIARRHEA IN CHILDREN UNDER FIVE YEARS OLD

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#### Abstract

This study aimed to analyze the quality of river water that used as a source of water for daily needs, and sanitation facilities, in correlating with the incidence of diarrhoea in children under five, in the subdistrict of Seberang Ulu I Palembang, Indonesia in 2015. This case-control study collected 230 respondents, divided by equal number of cases and control. To determine water quality, bacteriological examination (Coliform bacteria) was being examined by reference to the quality standard of clean water No: 416 / Menkes / per / IX / 1990. The results showed that the water quality of Musi River used by the public has been contaminated by Coliform bacteria and the amount of pathogenic bacteria has not qualified the quality of hygiene clean water standard. Results of Chi square analysis of variables unprotected water resources, unprotected drinking water resource, unimproved sanitation facilities, and the type of house floor showed significant relation to the increasing diarrhoea incidence among the children under five years old. It was inferred that water quality facilitated the diarrhoea as a water borne disease.

**Keywords:** water quality, sanitation facilities, diarrhoea, Coliform bacteria.

## 1. Introduction

Water is very important in life. Water is essential for daily necessities, such as drinking, bathing, washing, required for transportation, agriculture, fisheries, tourism, and others. Directly, the effect of water to health is the quality of water. Beside for drinking water, it also serves as media to spread of water borne diseases (Soemirat, 2011). Clean water and good sanitation is among of the seventh of the Millenium Development Goals, so hopefully the number of people who live with less access to water and sanitation suffering of water borne diseases in 2015 is expected can be reduced (Unicef, 2012).

In Indonesia, the proportion of households with access to improved drinking water is likely to increase from 2007 (62.0%), in 2010 (62.9%), in 2013 (66.8%) (Risksdas, 2013). Although access to clean water and sanitation has increased, yet there are many people who do not have access to clean water and proper sanitation, especially for the weak economic community lived along Musi river. For this reason it is impotant to reevaluate this contradictive phenomena in this area.

The area of this research was conducted in the subdistrict Seberang Ulu I, Palembang city, precisely in three villages in the region of Primary Health Center (Puskesmas) 4 Ulu Palembang. There are the Villages 2 Ulu, 3-4 Ulu, and 5 Ulu. Based on data from the subdistrict Seberang Ulu I Palembang, the source of water used by people of all study area is derived from Musi river consumed by 1.0611 (89, 71%), besides of 1182 (10%) families use clean water from PAM and 34 (0, 29%) only got their water from wells. This data claimed that 89,71% of the families in the subdistrict Seberang Ulu I Palembang using water sources from the river that are not worth supporting health profile.

Accordingly to the source of water for supporting their life, it was recorded that such villages above stated that cases of diarrhoea in the study site were higher than other regions (top five diseases from 10 disease causes) within the city of Palembang in 2013. Diarrhoea is 10 major diseases for all ages in 2013 in the region community health centers 4 Ulu Palembang city (total of 2.533 cases of diarrhea), some of 1,668 (65.8%) suffered by children aged under five years. Ranking showed above is higher than the case of infant diarrhea in Palembang city (47.61 %), (Dinas kesehatan Kota Pelembang, 2014).

The use of river water that has been contaminated with various pollutants can adversely affect health. Diarrhoea is a disease that can be caused by the use of water contaminated by feces containing germs (Coliform bacteria mainly). Diarrhoea is a health problem in children in Indonesia and around the world. Each year, approximately 2.5 billion

cases of diarrhoea occur among children under five years, and this estimation could indicate that the overall incidence has remained relatively stable over the last two decades. Incidence was highest in the first two years of life and decreases as the child grows older (UNICEF-WHO, 2009). Diarrhoea Incidence remains a tremendous burden on children in low and middle income countries (Fischer, 2012). Diarrhoea still accounts approximately 11% of all mortality among children under five years of age (Liu, 2013).

<sup>9</sup> The aim of this study was to analyze the quality of water, sanitation facilities and its relationship to <sup>5</sup> diarrhoea in children under five year old the age of in the subdistrict of Seberang Ulu I Palembang city.

## 2. Material and Methods

This research was conducted in three villages in the target area of Primary Health Center in subdistrict Seberang Ulu I Palembang in the Year 2015. To determine the quality of river water used by the people in the region of research, we examined the sample of river water from 3 locations: 2 Ulu village, village 3-4 Ulu, and village 5 Ulu. Tests on water samples were carried out in the laboratory of Environmental Health Engineering of South Sumatra Province. The finding parameter examination is microorganisms of coliform bacteria. Water quality parameters refers to clean water Quality Standards <sup>6</sup> No: 416 / Menkes / per / IX / 1990, and to test the relationship between the quality of the clean water resource and sanitation and the incidence of diarrhoea. The case-control study was used to evaluate the relationship a source of clean water and sanitation and the incidence of diarrhoea with total of sample 230 sample, 115 mothers with children under five with diarrhoea (cases), and 115 mothers who have children do not suffer from diarrhoea lived in the study area (control). The sample was taken proportionally in the three study sites. The data collected in this study were the environmental data such as: sources of clean water, drinking water, sanitation facilities, waste management facilities, and the type of house floor. Collecting data through interviews using a questionnaire. Bivariate data were analysed with chi-square with 95% confidence interval, and the value at the level of significancy  $P < 0.05$  (Murti, 1997).

## 3. Results and Discussion.

Results of microbiological examination of water samples are presented in Tabel.1 coliform bacteria.

Tabel .1. Microorganisms Examination sampel water from Musi river.

Sampling Location	MPN / 100 ml coliform	Method	Category
Village 2 Ulu	>1600	APHA	not eligible
Village 3-4 Ulu	540	APHA	not eligible
Village 5 Ulu	>1600	APHA	not eligible

Water Quality Standard No: 416/Per/Menkes/IX/1990 : on water non piping,

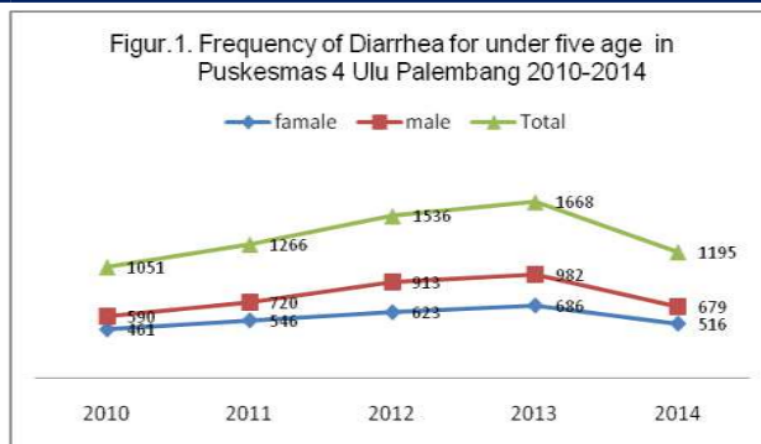
Coliform : 50/100 ml.

Standart Method : APHA = American Public Health Association

Based on the results of the microbiological examination of samples of river water at three locations to sample presented in table 1 can be concluded that the Musi river water at the study site was contaminated with abundant of Coliform from human feces. The amount of total coliform at three sampling sites have exceeded the quality standards of clean water as the quality standard of clean water No: 416 / Per / Menkes / IX / 1990 on clean water non Piping, the total number of eligible water quality standard maximum net Coliform : 50/100 ml.

At the sampling location 2 Ulu village, and the Village 3, 4 Ulu Total MPN / 100 ml Coliform were the same > 1600/100 ml coliform. This is probably because in the village 2 Ulu and and the village 5 Ulu, the population take more dense than the population village 3-4 Ulu. River water pollution is also caused by the community on the outskirts of the river are still used to defecate into the river. It can be concluded that the Musi river water at the study site was contaminated with feces. Research Budiamurti, et al found that the amount of water contained coliform in Cikapundung proportional to the value of the incidence of diarrhoea.

The number of cases <sup>5</sup> of diarrhoea in children aged under five years from 2010 - 2014 in the target area 4 Ulu Palembang Health Centers (Puskesmas), as in Figure 1.



Source : Dinas Kesehatan Kota Palembang, 2014

Figure 1. showed the number of diarrhoea cases since 2010 until 2015 tended to increase. The number of cases of diarrhoea in men is higher than of women's diarrhoea. Diarrhea is on top five diseases from 10 ceuses based on the medical records of Palembang city.

Results of bivariate analysis and odds ratios values of the independent variables on the dependent variable in this study are presented in Table .2, below:

**Table .2. Results of bivariate analysis using Chi-square test, and odds ratio value of the study variables.**

Variable	Cases	Contro ls	p value	Odd Ratio
<b>Clean water sources:</b>				
unprotected	87	46	0,000	4,661
protected	28	69		
<b>Drinking Water Sources:</b>				
unprotected	75	36	0,000	4,115
protected	40	79		
<b>Sanitation facilities:</b>				
unimproved	72	31	0,000	4,537
improved	43	84		
<b>waste management facilities:</b>				
unsanitary	86	80	0,462	1,297
sanitary	29	35		
<b>type of house floor:</b>				
not water proof	69	35	0,000	3,429
water proof	46	80		

The variables showed a significant association between water resources and the incidence of diarrhoea in children aged under five, since they consumed unprotected clean water sources, unprotected drinking water sources, unimproved sanitation facilities, and lived at house floor not water proof. On the other hand variables that have no significant relationship with diarrhoea was just in waste management facilities.

Influence of water resources to diarrhoea was found the value of the odds ratio (OR= 2,617), it means the risk of diarrhoea in children with clean water sources Unprotected 2,617 is higher than that using improved sources of clean water. Using water from the source of river directly is at big risk to cause diarrhoea because the river water was contaminated by waste disposal. Source of drinking water used comes from, household connection, water refill, and rivers. According to the indicator WHO/Unicef that river water is the source of water Unimproved (WHO/Unicef, 2012).

This finding is consistent with studies done Gadona (2011), Umiati (2010), these findings are also consistent with studies conducted Kumar (2014), who found that the source of drinking water was significantly associated with the incidence of diarrhoea in children. Children who use unprotected sources of drinking water are at risk to get diarrhoea. These findings are similar to findings Sayed (2014), there was a significant relationship between the water source with diarrhoea. Access to clean water in Indonesia in 2010 has decreased approximately 7% percent compared to 2007. The condition is due to a decrease case in urban areas (23%) since 2007. Access to clean water in Jakarta has declined from 27% in 2007 to 63% in 2010. One-third of urban households in Indonesia was persuaded to buy bottled water or bottled (Unicef, 2012).

WHO reported, In 1990, global coverage of the use of improved drinking water source and sanitation facilities stood at 76% and 54%, with respective MDG targets of 88% and 77% by 2015. This report shows how the world has changed since 1990. 91 per cent of the global population now uses an improved drinking water sources, 2,6 billion people have access to an improved drinking water source since 1990, 96% of global urban population uses improved drinking water sources, compared with 84% of the rural population. In 2015, 663 million people was still lack improved drinking water sources (WHO, 2015).

The effect of sanitation facilities to diarrhoea was found the value of the odds ratio (OR =2.674), it means the risk of diarrhea in children with using unimproved sanitation facilities 2,674 is higher than using improved sanitation.



The behavior of a group throwing feces caused unimproved water sanitation is in 72 cases (62.6%). Type of sanitation facilities owned by the case group is open pit latrine, without a septic tank latrine, public latrine. This finding is similar to other studies (Agustina, 2013; Godana, 2013; Joshi, 2013). Sanitation and poor hygiene behaviors, inadequate drinking water, contributing to 88% of childhood deaths from diarrhoea worldwide. The importance of personal hygiene and environmental sanitation is often overlooked. Mortality and diarrheal diseases are generally preventable (Unicef, 2012).

WHO reported, <sup>2</sup> 68 per cent of the global population now uses an improved sanitation facility, 2.1 billion people have gained access to an improved sanitation facility since 1990. The least development countries did not meet the sanitation target, in 2015, 2.4 billion people remained lack improved sanitation facilities (WHO, 2015).

Type of floor of the house that are not water proof at risk of diarrhea, odds ratio (OR) = 3,429. The test results show the chi-square statistic P Value = 0.000, meaning that there is a significant relationship between the type of floor house with diarrhoea. Type of floor is not water proof at risk of diarrhoea, wet floor of the house which strongly supports the development of germs, such as bacteria. Generally happy children playing on the floor, if the house floor damp, dirty and have an impact on infant health, according Notoatmodjo (2003), the requirements of a healthy home is the type of floor that is not dusty in the dry season and wet in the rainy season. Type of floor houses of the cases are majority made of wood and are not water proof. These results are consistent with the findings of Umiati (2010), who found no association with the type of floor houses to the incidence of diarrhoea in children.

In this study found that Waste management was not significant with diarrhoea. Although waste management is not significant with diarrhoea, but it really need to pay serious attention to the problem of waste management in the area of study. The majority of waste management were not sanitary 166 (72,2%), such as: trash dumped into rivers, garbage dumped around the house, burned. Good sanitary of waste management by bringing trash to landfills while the services of garbage collectors is only 64 (27,8%).

Habits of people throw garbage into the river is very risky to health and environmental pollution, especially the aquatic environment. The public has no awareness to protecting the environment. Increasingly heavy burden of environmental pollution due to

human behavior is not environmentally friendly. Environmental damage happened due to clean water crisis, and public health problems, such as diarrhoea, skin diseases, and others.

### Conclusion

Water quality was significantly associated with the incidence of diarrhoea in children aged under five, and it was determined by the risk factors of unprotected water resources, unprotected drinking water sources, unimproved sanitation facilities, and the type of house not water proof floor.

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