



## The Incidence of Diarrhea in Babies Affected through the Cleanliness of Eating Utensils and Hands

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### Abstract

**Background:** In Bandar Lampung, the highest case of diarrhea in the <1 year age group occurred in Simpur Health Center, amounting to 9.73% exceeding the incidence in Bandar Lampung City, the capital, at 2.68%.

**The Objective:** The study used a cross-sectional design with the aim of knowing the effect of the microbiological quality of clean water on the incidence of diarrhea in infants through the cleanliness of cutlery and hands.

**Method:** The type of this research was quasi-experiment with the pre-test and post-test with group design. A total number of the subject was 139 households with infants aged 1-11 months. The study was carried out in the work area of Simpur City Health Center Bandar Lampung.

**Result:** The results of the study found that coli bacteria contaminated 62.6% of clean water sources, 82.0% of mother's hands contaminated and 59.7% of baby eating utensils contaminated with coli bacteria. The risk of pollution of fresh water in water sources whose distance and construction do not meet the requirements of 16.87 times and 13.29 times, respectively. The risk of hand contamination due to bad behavior and hand washing methods is 15.65 times and 15.47 times, respectively. Further, the risk of disease of cutlery due to inadequate washing and storage is 9.32 times and 9.96 times, respectively. The risk of diarrhea in the group whose source of contaminated clean water and contaminated hands is 3.74 times and the risk of diarrhea in the group whose sources of fresh water are polluted and how to wash their hands poorly is 3.33 times. The magnitude of the risk of diarrhea in the group whose sources of clean water are contaminated and how to wash the cutlery is 7.37 times.

**Conclusions:** Good storage of cutlery is a protective factor for the incidence of diarrhea in infants.

**Keywords:** Bacteria, Coli, Contamination, Clean Water, Hand, Cutlery.

### Introduction

Diarrhea is a disease that is recognized by changes in shape and consistency of soft stools until it melts and increases the frequency of defecation more than usual, which is 3 times or more in 24 hours which may be accompanied by vomiting or bloody stools (WHO, 2005).

Based on the research results of Adisasmito, (2007) it is known that the factors that are closely related to the incidence of diarrhea in children under five are maternal factors, child factors, socio-economic factors, and environmental factors. Diarrhea is caused by infection or poisoning. The disease can be caused by bacterial,

viral and parasitic organisms, which are generally transmitted through contaminated water (Kemenkes, 2012). *Escherichia coli* (E.coli) is a microorganism-derived from feces that can be used as an indication of contamination, especially in clean water facilities.

Transmission of diarrheal diseases can occur due to the entry of infectious germs into the mouth (oral-fecal) through fluids or objects contaminated with feces, such as drinking water, fingers, tableware (Kemenkes, 2014). So that some possible pathways that can cause diarrhea to a person can be through food itself, contamination by handlers or from contaminated eating utensils.

Bandar Lampung City is the capital of Lampung Province which consists of 20 sub-districts and 28 community health center areas. According to data from the Health Office of Bandar Lampung City, the number of diarrhea cases during 2016 was 13,503 cases where the number of cases of diarrhea in the age group <1 year and under five was 1,445 cases (Incident Rate = 6.73%) and 1,292 cases ( Incident Rate = 2.68%). Based on the scene, the highest cases occurred in Simpur health center, which was 249 cases ( Incident Rate = 34.06%) and 354 cases ( Incident Rate = 9.73%) respectively.

From the description above, the authors are interested in research to determine the effect of microbiological quality of clean water on the incidence of diarrhea in infants through eating/drinking equipment in the city of Bandar Lampung.

### Materials and Methods

This study uses a cross-sectional design that aims to determine the effect of water microbiological quality clean against the incidence of diarrhea in infants through eating/drinking equipment. Data were obtained by observing and examining 139 households with infants aged 1-11 months who were randomly selected. The variables studied are clean water pollution (construction of water sources and distance with latrines); hand hygiene (hand washing behavior and hand washing

method); cleaning of cutlery (washing and storage of cutlery).

### Results

Table 1 shows the general condition of research objects.

**Table 1** The general condition of research objects

Variables	n	%
Diarrhea events		
a. Diarrhea	31	22.3
b. No Diarrhea	108	77.7
Microbiological Quality of Clean Water		
a. Polluted	87	62.6
b. Not Polluted	52	37.4
Construction of clean water facility		
a. Does not meet the requirements	73	52.5
b. Meet the requirements	66	47.5
The distance of a clean water facility		
a. Does not meet the requirements	70	50.4
b. Meet the requirements	69	49.6
Hand Hygiene		
a. Contaminated	114	82.0
b. Clean	25	18
Handwashing Behavior		
a. Less Good	46	33.1
b. Good	93	66.9
How to Wash Hands		
a. Less Good	126	90.6
b. Good	13	9.4
Cleanliness of cutlery		
a. Contaminated	46	59.7
b. Clean	31	40.3
Washing Tableware		
a. Less Good	55	71.4
b. Good	22	28.6
Tableware Storage		
a. Less Good	20	26.0
b. Good	57	74.0

The results of the study found that 22.3% of babies experienced diarrhea in the Simpur Health Center work area.

Coli bacteria have contaminated as many as 62.6% of water sources. Based on the requirements of the clean water source, 52.5% had the construction that did not meet health requirements, and 50.4% had less than 10 meters from the toilet.

The results of the examination of the number of bacteria on the hands showed that as many as 82.0% of the mother's hands were contaminated with coli group bacteria. As many as 33.1% of mothers have poor behavior at hand washing, and as many as 90.6% have not washed their hands properly.

The results of the examination of the number of germs on the cutlery showed that 51.9% of baby eating utensils were contaminated with coli group bacteria. As many as 71.4% of mothers have not

washed the baby eating utensils properly, and as many as 26.0% still keep cutlery in the open.

**Table 2.** The relationship between variables

Variables	Polluted		Not		p	Oddity Ratio	95% Confidence Interval
	n	%	n	%			
<b>Latrine distance</b>							
Does not meet the requirements	63	90.0	7	10.0	0.0001	16.87	6.69 - 42.55
Qualifies	24	34.8	45	65.2			
<b>Construction</b>							
Does not meet Conditions	64	87.7	9	12.3	0.0001	13.29	5.61 - 31.48
Qualified	23	34.8	43	65.2			
<b>Hand washing behavior</b>							
Poor	45	97.8	1	2.2	0.001	15.65	2.05 - 119.81
Good	69	74.2	24	25.8			
<b>How to wash hands</b>							
Less well	110	87.3	16	12.7	0.0001	15.47	4.26 - 56.15
Good	4	30.8	9	69.2			
<b>Storage</b>							
Not good	18	90.0	2	10.0	0.003	9.32	1.98- 43.94
Good	28	49.1	29	50.9			
<b>How to wash the appliance</b>							
Poorly	41	74.5	14	25.5	0.0001	9.96	3.10 - 32.00
Good	5	22.7	17	77.3			

The results of the study found a significant relationship between the construction of water sources and pollution of clean water ( $p = 0.0001$ ). The risk of contamination of fresh water is 13.29 times (95% CI 5.61 – 31.48). The study also found a significant relationship between latrine distance and clean water pollution ( $p = 0.0001$ ). The risk of contamination of fresh water is 16.87 times (95% CI 6.69 - 42.55). The relationship between behavior and hand washing with hand hygiene

The results showed a significant correlation between the act of hand washing with soap and hand contamination ( $p = 0.001$ ). The risk of hand contamination is 15.65 times (95% CI 2.05 – 119.81). The results also found a significant relationship between the method of hand washing and hand contamination ( $p = 0.0001$ ). The risk of disease is 15.47 times (95% CI 4.26 to 56.15). The results showed a significant relationship between washing with contamination of eating utensils ( $p = 0.0001$ ). The risk of disease in cutlery is 9.96 times (95% CI 3.10 - 32.00). The study also found a significant relationship between storage and eating equipment contamination ( $p = 0.003$ ).

The risk of disease is 9.32 times (95% CI 1.98 - 43.94).

Risk of diarrhea in groups the source of polluted clean water (after controlling for hand hygiene factors) was 2.89 times compared to the uncontaminated (OR = 2.89; 95% CI = 1.07 – 7.84). The risk of diarrhea in the group whose source of contaminated clean water and contaminated hands was 3.74 times compared to the uncontaminated ones ( $p = 0.030$ ; OR = 3.74; 95% CI = 1.19 – 11.73). There was no risk of the incidence of diarrhea in the group of sources of polluted clean water and had poor hand washing behavior ( $p = 0.190$ ; OR = 3.05; 95% CI = 0.78 – 11.85). The risk of diarrhea in the group whose sources of clean water are contaminated and how to wash hands poorly is 3.33 times compared to those who are not polluted ( $p = 0.024$ ; OR = 3.30; 95% CI = 1.24 – 8.78).

After controlling for the cleanliness of cutlery, there was no risk of diarrhea in the group whose water source was polluted (OR = 2.34; 95% CI = 0.47 – 11.76). There was no risk of the incidence of diarrhea in the group of sources of contaminated clean water and contaminated

cutlery ( $p = 0.590$ ;  $OR = 1.74$ ;  $95\% CI = 0.26 - 11.51$ ). The risk of diarrhea in the group with sources of polluted clean water and poor washing was 7.37 times compared to good ( $p = 0.018$ ;  $OR = 7.37$ ;  $95\% CI = 1.37 - 36.83$ ). A good cutlery storage is a protective factor for the incidence of diarrhea in infants ( $p = 0.005$ ;  $OR = 0.58$ ;  $95\% CI = 0.39 - 0.84$ ).

## Discussion

The results of the study showed a significant relationship between the distance of the restroom to the pollution of water sources ( $p = 0.0001$ ). The study also found a meaningful relationship between the construction of clean water sources and freshwater pollution ( $p = 0.0001$ ).

According to the Ministry of Health of Republic Indonesia (Kemenkes, 2014), transmission of infectious germs that cause diarrhea is transmitted through fecal-oral. These germs can be spread when entering into the mouth through food, drinks or objects that are contaminated with feces, such as fingers, food that is a container or place to eat and drink that is washed with polluted water.

To prevent diarrhea, according to Rosmaini (2011), clean water must be taken from a safe or uncontaminated source. Sources of fresh water must be far from livestock pens and latrines at least ten meters from water sources. Water must be stored in a clean container and taking water in a bowl using a clean dipper, and to drink water must be cooked. Communities that are affordable by the provision of clean water have a smaller risk of suffering from diarrhea when compared to people who do not get clean water.

Statistical test results showed a significant relationship between hand washing with soap behavior and hand contamination by coli group bacteria ( $p = 0.001$ ). The results of statistical tests also found a significant correlation between how to wash hands with soap and the contamination of hands by coli bacteria ( $p = 0.0001$ ).

In this study calculated the magnitude of the relationship of water pollution with the incidence of diarrhea in infants and the association of water

pollution with the prevalence of diarrhea in infants through maternal hand hygiene. These results indicate an increased risk of diarrhea in infants by 31.02%, through maternal hand hygiene contribution.

In this study also sought from sub-variables of hand washing which contributed to the relationship of water pollution with the incidence of diarrhea in infants. The results of the analysis found that the sub-variables that contribute to the prevalence of diarrhea in infants are ways of washing hands. The results of this study are following Rohmah and Syahrul, (2017) which mentions a significant relationship between hand washing habits and the incidence of diarrhea in children under five.

The Indonesian Ministry of Health (Kemenkes, 2014) explained that one prevention of correct and useful diarrhea is to wash hands using water and soap before eating and after defecating. Rohmah and Syahrul (2017) further explained that someone who has hygiene goodwill behavior reduces the risk of contracting the diarrheal disease. Mothers play an important role in preparing food for children. The results of statistical tests showed a significant relationship between washing utensils with contamination of cutlery by coli group bacteria ( $p = 0.0001$ ). The results of statistical analyses also found a substantial correlation between the storage of cutlery with contamination of cutlery by coli group bacteria ( $p = 0.003$ ).

This study is per Kusumadewi and Hermawati (2014) who stated that as much as 72.2% of the eating utensils under investigation were contaminated with E. coli bacteria. The hygiene of the hands of people who usually prepare baby food (including handling washing utensils) is a risk factor for contamination E. coli on baby eating equipment ( $p\text{-value} = 0.002$ ). Hands contaminated with E. coli have a 3.7 times greater risk of contamination in tableware.

The results also found the risk of diarrhea in the group of sources of polluted clean water and poor washing was 7.37 times compared to good ( $p =$

0.018; OR = 7.37; 95% CI = 1.37 - 36.83). While good storage of cutlery is a protective factor for the incidence of diarrhea in infants ( $p = 0.005$ ; OR = 0.58; 95% CI = 0.39 - 0.84).

Rosidi, et al. (2010) stated that the incidence of diarrhea is not only caused by personal hygiene but can also be caused by food sanitation factors. WHO also said, in addition to using clean water and proper latrines, an essential element in the incidence of diarrhea is the behavior of hand washing with soap and food sanitation.

How to wash all cooking utensils and cutlery with clean water and in the right way, namely 1) Using running water; 2) Using detergent; 3) Rinse with boiling water or disinfectant; 4) Dry without using a napkin, while proper food storage methods are: 1) Store cutlery in a closed place; 2) A place to store cutlery, free of dust, insects, and rats; 3) Place for storing cutlery is always cleaned regularly.

### Conclusion

The risk of contamination of clean water which is not eligible is 16.87 times whereas the construction that does not meet the requirements is 13.29 times. The risk of hand contamination due to poor hand washing behavior is 15.65 times and due to poor hand washing method is 15.47 times. The risk of eating contamination due to inadequate washing was 9.32 times and due to poor storage 9.96 times. The risk of diarrhea in the group whose source of contaminated clean water (after controlling for hand hygiene factors) was 2.89 times. The risk of diarrhea in the group whose source of contaminated clean water and contaminated hands was 3.74 times. The risk of diarrhea in the group whose source of fresh water is polluted and how to wash hands poorly is 3.33 times. The risk of diarrhea in the group whose source of polluted clean water and poor washing was 7.37 times. Finally, proper cutlery storage is a protective factor for the incidence of diarrhea in infants.

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