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Environmental health hazards against bacterial contamination of cutlery on the small island of Makassar

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Abstract. Bacterial contamination can occur in the cutlery. Poor hygiene of cutlery has an important role in the growth and spread of bacteria. The research is aimed to provide an overview of food handler hygiene and the bacteria on cutlery at Elementary School of Barrang Lompo. It uses an observational method with a descriptive approach. The sample of research consisted of 2 (two) types, namely food handlers, and cutleries. Respondent data was obtained by using questionnaire instruments and observation sheets. Bacteria in cutleries are examined using the swab method. It found 46.7% and 53.3% gram-positive and gram-negative bacteria, respectively. The types of identified bacteria were *Bacillus* sp, *Enterobacter hafniae*, *Enterobacter cloacea*, *Enterobacter aerogenes*, *Acinobacter calcoaceticus*, *Alcaligenes faecalis*, and *Klebsiella* sp. Based on observations on food handlers, personal hygiene has not been done well, especially on hand hygiene aspects.

1. Introduction

Ten thousand peoples in developing countries have health problems to death as a result of poor sanitation problems [1,2]. One interesting about sanitation is food sanitation. For students aged 7-15 years, the eating needs [3]. The existence of a canteen, in addition to facilitating the fulfillment of food and beverage needs, also ensures the health of the canteen user. Therefore, basic sanitation is needed that meets health requirements to prevent the disease vectors [4].

In essence, the practice of food hygiene and sanitation is a way to control 4 (four) food sanitation factors that can cause health problems or food poisoning, i.e., through places or buildings, people, food and equipment [5]. Food and beverage hygiene conditions are influenced by the hygiene of cooking ware and cutleries used in the process of preparing food and beverages [6]. Cutlery is one of the factors that play an important role in transmitting the disease because of the dirty cutlery and contains microorganisms can transmit food-borne disease. Cutleries that are in direct contact with ready-to-serve foods should not contain germ numbers that exceed 100 colonies/cm² [7].

Based on the result of research conducted by Rahayu, it was found that 8 respondents who had a habit after washing had never drained by using swab, 2 respondents who did not maintain the cleanliness of the swab, 5 respondents did not have a special rack, 12 respondents have open equipment storage, so it can contribute to cross-contamination of bacteria in food. Also, inappropriate equipment washing has a significant vulnerability to bacterial contamination *Escherichia coli* in food processing equipment [8].



Personal hygiene is something that can be done to prevent bacterial contamination. It can be influenced by the knowledge, attitudes, and behavior of food handlers when cooking [9]. If personal hygiene is disturbed or not good, the food will be easily contaminated by pathogenic bacteria. There are various types of pathogenic bacteria including *Salmonella*, *Shigella*, *Staphylococcus* and *E. coli* which are still a serious problem in various countries including Indonesia [10]. Bacterial contamination of cutlery can be seen from the result of research conducted by Rifhandita *et al.*, regarding the description of hygiene of food preparing sanitation and the presence of *E. coli* bacteria on cutleries in the canteen of North Sumatera University, it showed that there are 8 (eight) canteens with a 50% percentage of *E. coli* on cutlery as cause of diarrheal disease [4].

In 2014, South Sulawesi estimates of diarrhea were 180.570 cases, while diarrhea treated was 240.381 cases (133.12%). With the largest incidence in Makassar, amount treated as many 26.485 cases from total population 1.429.242 peoples [11]. While, specifically in Barrang Lompo Island in 2013 the number of diarrheal diseases was 199 peoples, in 2014 (187 peoples), and 2015 (199 peoples) [7]. Barrang Lompo Island is a coastal area and a densely populated settlement with a population of 4.421 peoples with 1.127 households with a low socio-economic level can facilitate the development of environment-based diseases, especially on school canteens.

By looking at the potential of snacks for children in Barrang Lompo Island Elementary School canteens are increasingly and high food insecurity level and the results of observation found that there are still many traders in containers that do not use draining water to wash cutlery and food equipment stored in open rack. It can cause contamination of cutleries.

2. Materials and Methods

The research uses an observational method with a descriptive approach. The research site on Barrang Lompo Island and sampling was conducted at the canteen in 2 (two) Elementary Schools on the island. It was conducted in July until August 2018. The samples were 15 cutleries, consisting of five plates, five spoons, and five glasses. Sampling was done by *purposive sampling* technique. Observes 5 (five) food handlers using *checklist* to get hygiene description. A sampling of bacteria on cutlery is done by using a swab method.

3. Results

Observation is conducted for three days on 2 (two) elementary school canteens, namely SD Inpres and SD Negeri Barrang Lompo. It includes direct observation of how seller behavior on the practice of personal hygiene and cutleries sanitation (plates, spoons, glasses) used in the canteen (table 1).

Table 1. Observation result of cutleries and food handler on SD Inpres and SD Negeri Pulau Barrang Lompo, Sangkarrang Island Subdistrict, 2018

No	Day/Observation Date	Observation Time	Observation Result	
			SD Inpres	SD Negeri
1	Monday, 17 July 2018	08.00 – 12.00	1. Food handlers do not wash their hands properly before and after serving food.	1. Food handlers do not wash their hands properly before and after serving food.
2	Tuesday, 18 July 2018	08.00 – 12.00	2. There are only two food handlers who have clean nails.	2. There is only one food handler who has clean nails.
3	Wednesday, 19 July 2018	08.00 – 12.00	3. Food handlers do not use draining water to wash cutlery.	3. Food handlers do not use draining water to wash cutlery.
			4. Only 1 seller uses cloth or swab as a dryer for cutleries.	4. Only 1 seller uses cloth or swab as a dryer for cutleries.

As result of analysis for cutleries sanitation on SD Inpres and SD Negeri, Barrang Lompo was obtained frequency distribution about how to wash cutlery, the material for washing cutleries and cutlery storage. The data is presented in table 2. Whereas for the types of bacteria for cutleries in SD Inpres and SD Negeri Barrang Lompo, Sangkarrang Islands Sub-district was examined at the Laboratory of Microbiology, Faculty of Medicine, Hasanuddin University and the data is presented in tables 3 and 4.

Table 2. Frequency distribution of cutleries sanitation on SD Inpres and SD Negeri Pulau Barrang Lompo of Sangkarrang Subdistrict, 2018

No	Cutleries Sanitation	SD Inpres		SD Negeri		Total	
		n	%	n	%	N	%
1.	How to clean cutlery						
a.	Prepares water in a bucket/basin	2	100	3	100	5	100
2.	Material for cutlery washing						
a.	Water and specific soap	2	100	3	100	5	100
3.	Cutlery storage						
a.	Open rack	0	0	1	33,3	1	20
b.	Others	2	100	2	66,7	4	80

Table 3. Distribution frequency of types of bacteria in cutleries on SD Inpres Pulau Barrang Lompo, Sangkarrang Sub-district, 2018

No	Types of cutleries	SD Inpres
		Type of bacteria
1.	Plate 1	<i>Klebsiella</i> sp
2.	Plate 2	<i>Enterobacter hafniae</i>
3.	Spoon 1	<i>Enterobacter cloacea</i>
4.	Spoon 2	<i>Enterobacter aerogenes</i>
5.	Glasses 1	<i>Bacillus</i> sp dan <i>Alcaligenes faecalis</i>

Table 4. Distribution frequency of types of bacteria in cutleries on SD Negeri Pulau Barrang Lompo, Sangkarrang Sub-district, 2018

No	Types of cutleries	SD Negeri
		Type of Bacteria
1.	Plate 3	<i>Acinobacter Calcoaceticus</i>
2.	Plate 4	<i>Enterobacter hafniae</i>
3.	Plate 5	<i>Klebsiella</i>
4.	Spoon 3	<i>Enterobacter aerogenes</i>
5.	Spoon 4	<i>Enterobacter cloacea</i>
6.	Spoon 5	<i>Enterobacter cloacea</i>
7.	Glasses 3	<i>Alcaligenes faecalis</i>
8.	Glasses 4	<i>Klebsiella</i> sp
9.	Glasses 5	<i>Bacillus</i> sp

Based on the table, it found 7 types of bacteria namely *Klebsiella* sp, *Enterobacter hafniae*, *Acinobacter calcoaceticus*, *Bacillus* sp, *Enterobacter cloacea*, *Enterobacter aerogenes*, and *Alcaligenes faecalis* sp. The most common type of bacteria found is *Enterobacter cloacea*, it found in 4 samples, namely spoon 1, spoon 4, spoon 5 and glass 2. While the least type of bacteria is *Acinobacter calcoaceticus* sp, it found only in sample plates 3.

4. Discussion

The hygiene of cutlery is a very important part and influences the quality of food and drinks. Cutlery that are not washed can cause the disease organisms or seeds that are left behind will proliferate and contaminate the food that will be placed on it [7]. The way to wash the cutlery in the school canteen of SD Inpres and SD Negeri is still lacking in sanitation because based on observations and interviews for all sellers when they are washing the cutlery is not washed with draining water and only stored in the basin. In addition, the sellers do not pay attention to changes in rinse water. It causes the water source is far from the canteen, making it difficult to get draining water easily. However, the use of soap when washing dishes has been fulfilled because all sellers use specific soap that can kill bacteria.

Based on the results of laboratory tests as conducted on the cutlery sample, it founds that all samples contained bacteria. This condition is caused because the cutlery is washed using water that does not drain and its storage is open and does not use storage racks. It caused by several factors that cause the presence of germs (bacteria) in the cutlery, namely the quality of washing water, washing method by the food handler, the source of pollution from the wind direction, the condition of the storage room and the condition of the storage rack so that it can trigger the presence of bacteria in the food.

It is in line with the research conducted by Yulia [13] in Pontianak which showed that all samples of cutlery tested were positive contains bacteria. It because the possibility of washing methods that do not use disinfectants or the water used has not been changed as well as the use of sanitation facilities, especially the cutlery tub is still minimal because the place is not permanent so that the water used is less in quantity. Disinfecting at the last rinse needs to be used to address this.

Research conducted by Tumelap [7] seen cutlery used by food stalls namely plates, glasses, bowls, spoons and forks. Shows the number of germs on plates, glasses, bowls, spoons, and forks, with an average of 2.010 colonies/cm², it does not fulfill the requirements according to the regulation of the Ministry of Health RI No. 1096/menkes/per/ VI/2011 concerning the requirements of Culinary Sanitation Hygiene, namely 0 colonies/cm².

As a result of gram-bacterial staining in the laboratory, it obtained bacteria in the sample consisted of gram-positive bacteria and grams when staining. Research conducted by Maori and De [14] shows that to determine the bacteriological quality of cutlery on 7 (seven) restaurants at the Federal University of Technology, the Yola (FUTY) stall of 147 samples examined were all positive contains bacteria. These bacteria are *Staphylococcus aureus*, *Proteus vulgaris*, *Salmonella typhi*, *E. coli*, *Shigella*, *Klebsiella sp*, and *Bacillus sp*. The number of bacteria found was caused by cutlery storage in open rack and poor personal hygiene of the chef.

Gram-negative bacteria found in cutlery samples were *Enterobacter h₂niae*, *Enterobacter cloacea*, *Enterobacter aerogenes*, and *Klebsiella sp* were included in *Enterobacteriaceae* family. *Enterobacteriaceae* is a large and heterogeneous of gram-negative rods, with their natural habitat in the human and animal digestive tract. Most *Enterobacteriaceae* are normal flora in the digestive tract even though some are widely distributed in the surrounding environment [15]. These bacteria live in the large intestine of humans and are found in dry feces and then fly through the air. Most of these bacteria do not cause diseases such as bladder tract infections, wound infection, respiratory tract infections, inflammation of brain membrane and septicemia [16].

Gram-negative bacteria that were also found in samples of cutlery were *Acinobacter calcoaceticus* and *Alcaligenes faecalis*. *Acinobacter calcoaceticus* comes from *Moraxecellaceae* family. These bacteria play a role in causing acute disease infections such as meningitis, pneumonia, and bacteremia. These bacteria are also known to be resistant to conventional soaps and antiseptics so that bacterial contamination in human hands is easy to arise [17].

Alcaligenes faecalis is a psychrophilic bacteria that can survive in a low temperature range so that it can survive in contaminated food products such as fish, milk, meat, and eggs. Such contamination can cause decay in cold temperatures and also cause disease in humans. The best way of handling and prevention of such bacteria is proper sanitation and physical handling based on the characteristic of the bacteria, i.e., heating (pasteurization/sterilization). Such bacteria can be found in various locations including the soil and water environment [18].

5. Conclusion

Based on the result of research, it can be concluded that 1) types of bacteria in cutlery on SD Negeri and SD Inpres are *Bacillus sp.*, *Enterobacter hafniae*, *Enterobacter cloacea*, *Enterobacter aerogenes*, *Acinobacter calcoaceticus*, *Alcaligenes faecalis* and *Klebsiella sp.* Personal hygiene of sellers in SD Inpres and SD Negeri is still less regarding maintaining hand hygiene. Cutlery sanitation in SD Inpres and SD Negeri are all washed using specific soap. However, it does not use draining water and largely storing the cutleries in open rack. It is suggested for sellers in SD Inpres and SD Negeri to improve the hygiene of sellers and cutlery sanitation, and give attention to the health of the canteen. For the next researcher, it is expected to study further other variables that have not studied related to the occurrence of bacterial contamination that is likely to occur in the aspects of food sanitation and cutleries.

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