

ORIGINAL ARTICLE

Salmonella sp. Detection in Elementary School Street Foods in Surabaya

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ARTICLE INFO

Article history:

Received 31 August 2018

Received in revised form 22

September 2018

Accepted 3 October 2018

Keywords:

Street food Drinks,

Salmonella sp.,

Bacterial Contamination,

Pathogen Bacteria,

Elementary School.

ABSTRACT

Introduction: Street foods are food and drink which are processed on the selling spot and/or served as ready-to-consume foods by food vendors to sell to people. Foods and drinks which are rested for too long in the environment will make it possible to get contaminated by pathogen microbes and then results in disease. One of the microbes that is considerably contaminating street foods is *Salmonella*. We aim to identify *Salmonella* on drink which are offered in the canteens of Public Elementary School.

Methods: This research is design as a descriptive observational, including incubation in Selenite broth, streak in MacConkey agar, and species identification using biochemical tests.

Results: There were no *Salmonella* sp. in drinks sample of street foods which are offered both inside and outside the canteens of Public Elementary School 1 Surabaya, but other gram-negative bacteria contaminated foods.

Conclusion: The street foods in elementary school, both the main ingredients and tools used during food processing and serving, still have contamination from pathogen, especially gram-negative bacteria. The vendors and sellers need to be taught how to process and serve foods in better hygiene.

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Introduction

Indonesia is a developing country with high incidence of infectious diseases. Infectious diseases vary including respiratory infections and digestive infections. Diarrhea is the most common digestive disease and a health problem in Indonesia. In 2000, diarrhea Incident Rate (IR) was 301/1000 population, in 2003 was 374/1000 population, in 2006 was 423/1000 population and in 2010 was 411/1000 population. In 2008, an outbreak occurred in 69 districts with 8133 cases and 239 deaths (CFR 2.94%). In 2009, an outbreak occurred in 24 sub-districts with 5756 cases and 100 deaths (CFR 1.74%), whereas in 2010, outbreaks occurred in 33 sub-districts with 4204 cases and 73 deaths (CFR 1.74%).¹

Diarrhea is the top 10 most common diseases in Indonesia and main cause of malnutrition and death in

children.² Diarrhea can be classified into two: acute diarrhea when diarrhea occurs suddenly in less than 14 days and chronic diarrhea, which lasts more than 14 days. The etiology of diarrhea are infection and non-infection. Infectious diarrhea is the most common diarrhea which is caused by various organisms, such as *Salmonella*. *Salmonella* are causative agent of infection, ranging from gastroenteritis, septicemia to enteric fever.³

Salmonella bacteria live in the human intestinal tract and transmit through contaminated foods, although person to person transmission is possible.⁴ The contamination occurs in three ways, namely direct contamination, cross contamination and recontamination,⁵ and are related to food and beverage processing, materials and tools, personal hygiene, serving and storing. The food and beverages contamination are called foodborne illness.⁶

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Snacks is ready-to-eat foods and beverages processed by the vendors with the purpose of sale to the public other than those served by catering services, restaurants, and hotels. Snacks is needed, moreover it is relatively affordable. Although the price is low, the community need to consider its hygiene.² The activity of school-age children influences their snack selection. This is also influenced by the products packaging. As the street food snacks are susceptible to microbial contamination, low level of education and awareness about food hygiene and safety, as well as poor hygiene and sanitation practices, it is important to know the microbial contamination in street food snacks.⁷

Methods

This study was a descriptive observational using cross-sectional design. The sample were street food beverages that are sold inside and outside the canteen in one of the elementary schools in Surabaya. The samples were collected by buying from the chosen vendors. All of the samples were collected in the morning and immediately examined at Department of Microbiology, Faculty of Medicine, Universitas Airlangga.

Salmonella bacteriological examination were performed by using Selenite enrichment broth and MacConkey agar. One milliliter of each samples was cultured on Selenite Enrichment Broth media and then incubated at 37° C for 24 hours. The multiplications were cultured on MacConkey media and re-incubated at 37 ° C for 24 hours. Furthermore, the suspected colonies were tested biochemically by planting on a media

consisting of Indole, MR, VP, citrate, semi-solid, urea, TSIA and then incubated 24 hours.

As the samples were collected, the vendors were interviewed to find out more about the ingredients, location, and hygiene condition of the vendors.

Results

A total of 20 samples collected from inside and outside the school canteen. The samples were all beverages that were sold there (Table 1).

From 20 samples, 11 types of bacteria were identified. None of the samples with negative values of bacterial contamination. The absence of *Salmonella* sp. presumably because there was no *Salmonella* sp. in the ingredients, the bacteria were killed by the heat during food processing, or no *Salmonella* sp. on all equipment and workers (Table 2).

The *Escherichia coli* bacterial contamination in canteen (A) was identified in 2 out of 5 samples and 4 out of 6 samples in canteen (B), both of the canteens used refill mineral water as ingredient and tap water to wash the equipment. *Klebsiella* spp. found in grass jelly drinks from canteen (B), orange drinks form canteen (C) and soybean drinks from canteen (D). Most of the beverages from outside the school canteen had bacterial contamination. Zoonotic bacterial growth was found in the sample, namely *Edwardsiella tarda* which is an opportunistic pathogen found in areas with high consumption of raw fish (Table 3).

Table 1. The Types and Locations of the Samples

No.	Locations	Types
1.	Canteen inside the school (A)	Tea
		Orange drinks
		Chocolate milk "Milo"
		Ice cream "cap jempol"
		Ice cubes
2.	Canteen inside the school (B)	Tea
		Chocolate milk "Milo"
		Milk
		Syrup drinks
		Grass jelly drinks
3.	Outside the school canteen (C)	Green bean drinks
		Sticky rice drinks
		Orange drinks
		Fruit juice
		Ice cubes
4.	Outside the school canteen (D)	Instant drinks
		Soybean drinks
5.	Outside the school canteen (E)	Ice cubes
		Es kertas

Table 2. Bacteriological Identification

No	Types of Beverages	Bacteriological Identification
1.	Tea (A)	<i>Enterobacter agglomerans</i>
2.	Orange drinks (A)	<i>Escherichia coli</i>
3.	Chocolate milk "Milo" (A)	<i>Escherichia fergusonii</i>
4.	Ice cream "cap jempol" (A)	<i>Escherichia coli</i>
5.	Ice cubes (A)	<i>Yersinia intermedia</i>
6.	Tea (B)	<i>Escherichia coli</i>
7.	Chocolate milk "Milo" (B)	<i>Escherichia coli</i>
8.	Milk (B)	<i>Enterobacter gergoviae</i>
9.	Syrup drinks (B)	<i>Escherichia coli</i>
10.	Grass jelly drinks (B)	<i>Klebsiella pneumoniae</i> & <i>Escherichia coli</i>
11.	Ice cubes (B)	<i>Yersinia intermedia</i>
12.	Green bean drinks (C)	<i>Enterobacter agglomerans</i>
13.	Sticky rice drinks (C)	<i>Escherichia vulneris</i>
14.	Orange drinks (C)	<i>Klebsiella pneumoniae</i>
15.	Fruit juices (C)	<i>Escherichia coli</i>
16.	Ice cubes (C)	<i>Escherichia coli</i> & <i>Shigella</i> spp.
17.	Instant drinks (C)	<i>Klebsiella oxytoca</i> & <i>Yersinia intermedia</i>
18.	Ice cubes (D)	<i>Morganella morgani</i>
19.	Soybean drinks (D)	<i>Klebsiella oxytoca</i>
20.	Es Kertas (E)	<i>Escherichia coli</i> & <i>Edwardsiella tarda</i>

Table 3. The Distribution of the Bacteria

Bacteria	Percentage
<i>Escherichia coli</i>	37,5% (9/24)
<i>Yersinia intermedia</i>	12,5% (3/24)
<i>Enterobacter agglomerans</i>	8,3% (2/24)
<i>Klebsiella oxytoca</i>	8,3% (2/24)
<i>Klebsiella pneumoniae</i>	8,3% (2/24)
<i>Escherichia fergusonii</i>	4,1% (1/24)
<i>Enterobacter gergoviae</i>	4,1% (1/24)
<i>Escherichia vulneris</i>	4,1% (1/24)
<i>Edwardsiella tarda</i>	4,1% (1/24)
<i>Morganella morgani</i>	4,1% (1/24)
<i>Shigella</i> spp.	4,1% (1/24)

The highest percentage of bacterial contamination was *Escherichia coli* and *Yersinia intermedia*, both are groups of gram-negative bacteria. This result showed poor quality of beverages, and potential in foodborne transmission (Table 3).⁸

Discussion

There was no *Salmonella* sp. found in all samples in this study. A study showed that *Salmonella* sp. cannot compete with other bacteria, its growth will be severely inhibited.⁹ In addition, the samples were collected in the morning when the equipment was still clean, few flies and dust attached to equipment and beverages. This result was similar with a study showed 35 Panganan Jajanan Anak Sekolah (PJAS) samples without *Salmonella* contamination.¹⁰

In beverages, *Escherichia coli* contamination can be an indicator that the water used is contaminated by feces. *Yersinia intermedia* was found in ice cubes from canteen (A) and (B), which had similarities using ice cubes in packs. These bacteria can be found in the environment, such as fresh water and wastewater, but these bacteria do not cause gastrointestinal diseases.¹¹ A study showed that the main source of contamination are water and ice that are not cooked properly.¹² *Klebsiella* spp. contamination in beverages was caused by the contaminated water and aerosol bacteria which was spread by sneezing or coughing.¹³ *Edwardsiella tarda* contamination was found only in "es kertas" sold outside the school canteen, this is caused by the contaminated water and unwashed hands.

The bacterial contamination mentioned above can be caused by several factors, including ingredients and

equipment, hand use without gloves or unwashed hands, inappropriate cooking process and serving, and the environment of the school.^{14, 15} In addition, the vendors low awareness about personal hygiene can be a source of contamination in beverages.

From the observations, no vendors wore aprons during the cooking process and serving in the school. The results of this study were similar to study showed that 85% of food vendors do not wear aprons while selling the food and beverages.⁶ An apron is a cloth cover and used as a protector to keep clothes clean. Clean clothes will improve sanitation and hygiene of snacks because there is no dust or dirt attached to clothing that can indirectly contaminate the snacks. The equipment used to sell the beverages can be a source of contamination, such as unsterilized or unwashed equipment and its storage. The use of unwashed hands or without gloves can also be a source of contamination, from the cooking process to serving process, therefore gloves are needed.²

Conclusion

No *Salmonella* sp bacteria were found in this study. However, the contamination by *Enterobacter agglomerans*, *Enterobacter gergoviae*, *Escherichia coli*, *Escherichia fergusonii*, *Escherichia vulneris*, *Edwardsiella tarda*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Morganella morganii*, *Shigella* spp., and *Yersinia intermedia* were found in some samples.

Conflict of Interest

The author stated there is no conflict of interest.

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