The identification of *Salmonella* sp. in “cilok” road food in campus area of Jember University

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**Abstract.** Snack is very broad with target consumers of school-age children from elementary school to tertiary level. Cilok is one of the favorite snacks for students in the campus area of Jember University, which is often a substitute food when it is not yet eating. Foodborne illness is a food-borne disease. Bacterial contamination of food causes plague and death in foodborne diseases. One that causes pathogens that cause foodborne diseases is *Salmonella typhi* bacteria. *Salmonella typhi* is a gram-negative bacteria that attacks the intestines and liver which causes typhus or typhoid fever. The purpose of this study was to determine the presence of *Salmonella typhi* bacteria in the sample. The research design carried out is descriptive. The research method begins with random sampling, making agar medium, enrichment of samples using Nutrient Borth, Salmonella Test with SSA (Salmonella-Shigella Agar) media. The results showed that *Salmonella typhi* was found in samples a, c, e, f, g, h, and i. The presence of *Salmonella typhi* is indicated by the growth of bacteria on SSA media as a selective medium for *Salmonella typhi*. In the results of the study there were seven samples from eleven samples found *Salmonella typhi*.

1. Introduction

At this time the production of snacks is very widespread with target consumers of school-age children from elementary to tertiary level even to all levels of society. Their needs in fulfilling consumptive tastes make producers innovate to produce snacks that are liked by the public. One very popular snack food is "cilok". Snack consumed by student must be a common concern between the community and the government, because the food consumed will affect the growth of children as the hope of the nation. The smart generation in the future will come from a healthy generation [1].

Foodborne disease is a health problem that is often encountered in the community. Bacterial contamination causes outbreaks and deaths in foodborne diseases, so knowledge and skills are needed to understand and manage food safety hazards for food producers to pay attention to health values in the process of making food for snacks [2]. One of the pathogenic bacteria that causes foodborne disease is *Salmonella typhi*. These bacteria enter the body through the mouth into the digestive tract along with food and drinks that are contaminated by these bacteria.

*Salmonella typhi* (*S. typhi*) is a gram-negative bacterium that attacks the intestines and liver causing typhoid or typhoid fever. Typhoid fever is a fever that lasts long enough with symptoms of high fever, constipation, abdominal pain, dizziness, itching and reddish spots [3] due to bacteremia accompanied by inflammation that damages the intestines and liver. Typhoid fever is an infectious disease that exists throughout the world and is the biggest health problem in developing countries such as Southeast Asia, Africa and Latin America. The incidence of typhoid fever is still very high, it is estimated that in 21 million cases, there are 200,000 of them die each year [2]. The case of typhoid
fever in Indonesia is an endemic public health problem which from the review of cases in major Indonesian hospitals tends to increase every year with an average pain of 500 / 100,000 population with deaths between 0.6 - 5% [4].

Snack is food that is sold in public places and produced by street vendors. The process of consuming snacks is usually without further processing or preparation. Food is not far from the term junk food, fast food and street food. Snack from school students from elementary school to tertiary level are a special focus because they are the future young generation of the nation. Therefore safety needs to be considered because it plays a role in its growth and development [5]. Food snacks often contain more carbohydrates and less protein, vitamins and minerals. One example of snacks is “cilok”. “Cilok” is an acronym for “aci dicolok”. Aci is a term for tapioca flour for Sundanese people. Because it is made from a mixture of tapioca flour and meat so it tastes nice and chewy when bitten which is a pleasure for children. “Cilok” is consumed with seasoning which is a mixture of peanut sauce, chili sauce, tomato sauce, and soy sauce.

Snack is a common thing for children to accompany their learning activities. In one aspect it could be a positive side for children. But the lack of knowledge about nutrition that causes negative effects for them. Consumption of snacks is often used as a substitute for breakfast to hold hunger before doing activities. A fairly long period of time between breakfast and lunch should be provided with good nutrition for their good development. The influencing factors are divided into three groups, consisting of related factors, personal factors in decision making and socioeconomic factors [6].

This research was conducted in the campus area of the University of Jember because the campus is one of the educational facilities that helps realize students as young people who are great at their respective expertise. A student is expected to be able to have the responsibility and a big role in solving problems in society [7]. Dense student activities often override nutritional intake in food. Living conditions alone and far from parents are a separate reason for consuming junk food or foodborne disease such as snacks such as “cilok”. Researchers chose “cilok” as a research sample because “cilok” is a hawker that is widely sold in the campus area, the price is cheap, filling and liked by almost most students. Researchers took “cilok” samples, which at five points were taken to eleven research samples.

The purpose of this research is to identify Salmonella Typhi on "cilok" food which is sold in the campus area of Jember University, which is a place that many students enjoy doing. So the results of the research are expected to be as information for those who like to consume cilok to be more vigilant in maintaining a healthy body.

2. Methodology

The research design carried out is descriptive. Descriptive research is a form of research that is intended to describe the phenomena that exist, both natural phenomena and man-made phenomena. That phenomenon can be in the form of activities, characteristics, forms, changes, relationships, influences, and differences between one phenomenon and another [8]. The research flowchart is contained in Figure 1.

2.1 Samples

The research sample was taken in the campus area of Jember University. The sampling technique used was simple random sampling method. Samples were taken at five taking points: two taking points on the Jawa street, two taking points on Kalimantan street and one taking point on the Mastrip street. Samples taken from five points were 11 samples consisting of “cilok”, chili sauce, and peanut.
sauce. One gram of each sample “cilok” is taken to be mashed using a mortar and added in *Nutrient Broth* (NB) enrichment medium. Peanut sauce and chili sauce have a liquid form so that 1 gram is taken immediately to be added to the NB medium. The enrichment process with NB media is intended to increase the number of bacterial colonies contained and then the presence of *Salmonella* sp. using *Salmonella and Shigella Agar* (SSA) media.

![Flowchart](image)

**Figure 1.** Flowchart the research

### 2.2 Making the media

#### 2.2.1 Nutrient Broth (NB)

The equipment used is certain to be sterile. Sterilization can be done by autoclaving. NB liquid medium is made in Erlenmeyer glass. NB media for one sample used 1 glass Erlenmeyer containing 50 mL. NB media is made by mixing 8 grams of NB powder for every 1 liter of water. The mixture is cooked on the stove then sterilized by autoclaving for 2 hours. NB cold media is ready to use.

#### 2.2.2 Salmonella and Shigella Agar (SSA)

The equipment used is certain to be sterile. Sterilisasi can be done by autoclaving. SSA medium is made by dissolving 63.03 grams of SSA powder for 1 liter of water. The mixture is cooked and sterilized for 2 hours using an autoclave. Liquid SSA media that have been made are poured into a petri dish. The pouring is done immediately before the media cools and solids. Each petri dish was added as much as 15 mL of SSA media. SSA media that has been compacted in a petri dish is ready to be used for testing the content of *Salmonella* sp and *Shigella* sp.
2.3 Enrichment bacteria

Enrichment of bacteria was carried out using NB media that had been made. Samples that have been crushed “cilok”, put into the media as much as 1 gram for each sample. Samples of peanut sauce and chili sauce were added directly by as much as 1 gram without the smoothing process because it was already in liquid form. NB medium containing samples were shaken using a shaker. Shaking is done for 24 hours at a speed of 100 rpm. NB media is used as bacterial enrichment because of the high nutrient content that supports the growth of bacteria. The composition of the NB medium itself is 8 grams of NB per 1 liter of Aquades. Each Erlenmeyer containing 50 mL of NB solution for one sample. The results of the enrichment process will be used in the salmonella testing process using SSA medium.

2.4 Salmonella sp. testing

The results of the enrichment process with NB media were used in testing for the presence of Salmonella sp. in each sample. One piece was taken from NB media to be streak on SSA media that had been previously made. The scratching is done by zig zag technique. This process is certainly carried out sterile, both from the equipment and how it works. This is because the Salmonella sp. quite dangerous if entered in the body or spread in the environment. The scratched SSA media was then incubated at room temperature for 48 hours. Positive samples containing Salmonella sp. characterized by the presence of bacterial colonies and also black spots on the media.

3. Results

Identification of the presence of Salmonella sp on SSA medium was seen after 48 hours of incubation. The test was carried out on 11 samples taken from 5 different places around the University of Jember. The results showed the presence of salmonella sp. Samples were marked by the growth of bacterial colonies and appeared black on SSA medium. The results of testing the presence of Salmonella sp. presented in a table that can be seen in Table 1.

Table 1. The result of Salmonella sp. test in the sample “cilok”, peanut sauce, and chilli sauce from sellers around campus

| Sample                  | Place               | Result |
|-------------------------|---------------------|--------|
| a. Chilli sauce cak edi | Semanggi Street     | +      |
| b. Peanut sauce cak edi | Semanggi Street     | -      |
| c. “cilok” cak edi     | Semanggi Street     | +      |
| d. Chilli sauce PKM     | Kalimantan Street   | -      |
| e. Peanut sauce PKM     | Kalimantan Street   | +      |
| f. Peanut sauce mama    | Jawa Street         | +      |
| g. Chili sauce mama     | Jawa Street         | +      |
| h. Peanut sauce cak wi  | Jawa Street         | +      |
| i. Chili sauce cak wi   | Jawa Street         | +      |
j. Chili sauce Bandung  Mastrip Street  -

k. Cilok Bandung  Mastrip Street  -

Note:

(+): Positive containing Salmonella sp.
(-): Not containing Salmonella sp.

Test results for salmonella sp bacteria in Table 1 show 7 samples containing salmonella sp. and 4 samples not containing or the result is negative from Salmonella sp. Samples that not containing Salmonella sp. are "cilok" Bandung, peanut sauce cakedi, and chili sauce PKM, and chilli sauce Bandung. Positive results are characterized by the growth of bacterial colonies on SSA medium with a black colony color. The appearance of petri dishes that had been scratched with each sample and incubated for 48 hours can be seen in the Figure 2.

Figure 2. SSA from sample: a. chilli sauce cakedi in Semanggi Street; b. Peanut sauce cakedi in Semanggi Street; c. "Cilok" cak Edi in Semanggi Street; d. chilli sauce PKM in Kalimantan Street; e. Peanut sauce PKM in Kalimantan Street; f. Peanut sauce mama in Jawa Street; g. chilli sauce mama in Jawa Street; h. Peanut sauce cakwi in Jawa Street; i. chilli sauce cakwi in Jawa Street; j. chilli sauce Bandung in Mastrip Street; k. "Cilok" Bandung in Mastrip Street.
The research data showed that 63.33% of samples were contaminated with *Salmonella* bacteria. This is a condition that needs to be more selective in choosing snacks to consume. The presence of *Salmonella* in “cilok” snacks can be caused by environmental conditions at the time of serving less hygienic. The results of observations show that selling places on the side of the road cause dust, dirt and germs, one of which is bacteria easily enter the food. Lack of cleanliness “cilok” seasoning container also affects the development of *Salmonella* bacteria.

Salmonella existence research has been conducted before on snacks sold inside and outside the elementary school canteen. The results of a study of 28 snacks samples found 10 samples (35.7%) contaminated with salmonella. A total of 4 samples (26.7%) came from the canteen and 6 samples (46%) came from outside the canteen. The identification results show that there are 4 samples (40%) contaminated with *Salmonella typhi* and 6 samples (60%) contaminated with *Salmonella paratyphi* A. The presence of Salmonella can be caused by the influence of raw materials, water, serving, container and environmental cleanliness [9]

Previous research on Salmonella sp. Also done in Bangladesh against Broiler chickens. Research in Bangladesh was conducted on 50 samples of healthy broiler chickens and 30 samples of broiler diarrhea chickens. The results showed 48% or 24 of 50 samples of healthy chickens infected with *Salmonella* and 66.7% or 20 of 30 sick chickens infected with *Salmonella* [10]. Differences from research, in Bangladesh morphology, staining and biochemistry studies, while this study identified Salmonella in cilok snack samples in Jember University area.

4. Discussion

Data from this study were analyzed by discription based on observations on Shalmonella morphology. Observations were made after incubation for 2 x 24 hours at room temperature. From the observation of 11 samples on the SSA medium there was bacterial growth so that all samples were positive for *Salmonella*. SSA (Salmonella-Shigella Agar) is a selective medium which is a medium that is added by certain chemicals which are selective to prevent the growth of other microbes so that it can isolate *Salmonella* Sp. So that it is certain that what grows on that medium is *Salmonella* sp.

To ensure that colonies growing on the SSA medium are *Salmonella* colonies, the following are the characteristics of the colonies on the SSA medium compared to the images in the literature:

![Figure 3](image)

**Figure 3.** *Salmonella* bacterial colony, one of which has black spots on its colony, (a) *Salmonella* colony has spots on the SSA medium of research results, (b) *Salmonella* colony on the SSA medium literature picture, (x) the growth of black colony in the medium

SSA medium is used as a selective medium for *salmonella*sp bacteria by inhibiting the growth of bacteria other than *salmonella* sp. and *shigella* sp. This selective media is based on H$_2$S production.
and sugar fermentation by *salmonella* bacteria [11]. Samples containing salmonella sp. marked by the growth of a black colony in the middle. The black color in SSA media is the result of $\text{H}_2\text{S}$ production by *salmonella* sp. [12]. All the samples tested, 7 positive containing *salmonella* sp. and 4 others are negative. Samples that do not contain *Salmonella* sp. Are "cilok" bandung, peanut sauce cak edl, and chili sauce pkm, and chilli sauce bandung. Samples that do not contain *salmonella* bacteria are suspected to use good raw materials and are not contaminated with *salmonella* sp. Samples containing *salmonella*, can be caused by the influence of environmental contaminants and the raw material used is not good.

Sources of *salmonella* sp. the samples in this study can come from the environment in the form of water, air, and dust. The location of the sale which is located on the side of the road becomes a possibility of contamination. Peanut sauce containing salmonella sp. besides getting contamination from the environment, it might also be due to poor raw materials. Water used in the manufacture can also be a source of *salmonella* sp. besides peanut sauce, chili sauce is also positive to contain *salmonella* sp. this is also influenced by the raw materials used. Rotten chili can contribute to *salmonella* sp. [13]. *Salmonella* sp can enter the body through food. Consumption of foods containing *Salmonella* sp. be the way *Salmonella* can enter the body. The existence of salmonell sp. adverse health effects in the body. Salmonella sp. attacks the digestive organs in humans. Diseases that can be caused by these bacteria include typhoid fever, diarrhea, and dysentery [14]. The body that is often affected by disease will reduce the body's performance and affect human activities. Food consumed needs to be considered, especially at a young age in order to develop and grow properly. Smooth and productive activities will produce good performance as well.

5. Conclusion

Test Salmonella sp. as was done using SSA media. SSA as a selective medium for salmonella sp. which will inhibit the growth of bacteria other than salmonella sp. Positive results are considered by colony bacteria that grow in SSA and black colonies. The results of the study found 63.33% of the sample was contaminated with Salmonella. Bacterial activity tests were carried out on 11 samples, 7 samples were positive for Salmonella, namely samples a, c, e, f, g, h, and i. Salmonella's findings in a number of "cilok" samples in the Jember University area as information so that consumers prefer choosing snacks to consume, because this situation can occur anywhere in a bad environment.

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