

## **Contamination of *Bacillus cereus* in Elementary School Snack Food**

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**Abstract:** Many food snacks have the advantage but still have health risks as evidenced by the many cases of food poisoning, one of the causes of food poisoning is *Bacillus cereus*. This study aims to determine the amount and percentage of *Bacillus cereus* pollution on snacks sold in elementary schools. This research is expected to provide information to the public about the presence or absence of bacteria *Bacillus cereus* contamination. This research uses purposive sampling technique. The sample used in this study was hawker food sold in Elementary School as many as 20 samples consisting of 10 samples that have not fried and ten samples that have cooked. The results of the questionnaire study showed 83% of sellers did not put snacks in closed containers and found *Bacillus cereus* in meals. Conclusion 9 (45%) of food samples contaminated with *Bacillus cereus* bacteria.

**Keywords:** snack food; *Bacillus cereus*

### **INTRODUCTION**

*Bacillus cereus* is a rod-shaped bacteria found in the soil. *Bacillus cereus* has long as a bacterium that causes food poisoning<sup>1</sup>. And the cause of foodborne outbreaks (19%) in 1998-2008 in the United States<sup>2</sup>. *Bacillus cereus* is very resistant and able to adapt to an adverse environment through its genetic mechanism<sup>3</sup>. These bacteria produce spores so that they can survive the heating process. Germination and bacterial propagation are influenced by pH and food composition<sup>4</sup>, although the administration of heat can damage spores, but with the CdnL gene that is owned by bacteria can survive and make improvements<sup>5</sup>.

This bacterium can cause two syndromes, namely emetic syndrome and diarrhea emetic syndromes due to heat-resistant toxin (cereulide) produced in food. Diarrhea syndrome occurs through the consumption of large amounts of spores or cells in a diet that produces diarrhea toxins<sup>6</sup>.

Diarrhea syndrome characterized by the occurrence of diarrhea, cramps, and vomiting. Which diarrhea starts after 6 to 15 hours after food consumption. An emetic syndrome characterized by vomiting, but diarrhea can also occur, and symptoms observed after 30 minutes to 6 hours after ingestion of poisoned food. Diarrhea toxin production is higher in psychrotrophic strains<sup>7</sup>. One of these strains of bacteria is capable of causing both syndromes<sup>8</sup>. Although this bacterial disease is usually mild, it can sometimes cause death. Dierick et al. (2005) reported deaths due to liver failure caused by cereulide<sup>9</sup>.

The results of epidemiological studies show that fruit salad, potatoes, ragout, venison, and pears are the food causes of three foodborne outbreaks caused by *Bacillus cereus*<sup>10</sup>. Other studies report a foodborne outbreak by these bacteria due to the consumption of fermented black beans (Douchi)<sup>11</sup>.

*Bacillus cereus* is the most common foodborne bacterium in raw milk in dairy farming environments<sup>12</sup> and can pollute honey<sup>13</sup>. *Bacillus cereus* is present in some dairy products and can withstand ultra-high temperature (UHT) processes<sup>14</sup>. This bacterium can cause decay and by reducing the shelf life of dairy products<sup>15,16</sup>. The contamination of these bacteria in dairy products in the illegal market is higher<sup>17</sup>.

Street food is more than 70% produced by home industry with traditional handling. Most enterprises still do not meet the health and food safety requirements in the production process. Testing of the Food and Drug Supervisory Agency in Indonesia for various snacks for children in primary school shows very alarming results. The test results showed, of 861 food samples as many as 344 types (39.95%) did not meet food safety requirements. Most microbial-contaminated food samples exceed the conditions<sup>18</sup>.

*Bacillus cereus* has found in food products such as potatoes, salads, pears, fermented black beans, but in food snacks in the Indonesian Banjarbaru Elementary School, this kind of research has never been done. Whereas from short observations, the sellers of snacks did not pay attention to cleanliness so that contamination of microorganisms originating from the environment could occur. The purpose of this study was to determine the presence of bacteria *Bacillus cereus* contamination in elementary school children's snacks.

## MATERIALS AND METHODS

This type of research used in this study is a descriptive survey, with cross sectional design, namely data collection is done at the same time at the same time at the time of the study. The sample in this study was hawker food in the Great Sungai Banjarbaru Indonesia basement environment. Samples were taken using purposive sampling technique that is food sold openly (without cover). Samples taken as many as 20 samples consisting of 10 raw samples and 10 samples that have been fried. Data obtained from questionnaires at hawker sellers as well as laboratory examination results to identify *Bacillus cereus* from examined samples.

Identification of bacteria using selective media by selecting the *Bacillus cereus* colony with the characteristics of large colonies, pieces, greenish color, uneven edges, anhemolysis. Colonies were inoculated on confectionery (glucose, lactose, mannitol, maltose and saccharose) (Merck), Simon Citrate Agar (Merck), SIM (Merck), and TSIA (Merck), then incubated for 18-24 hours at temperature 37°C.

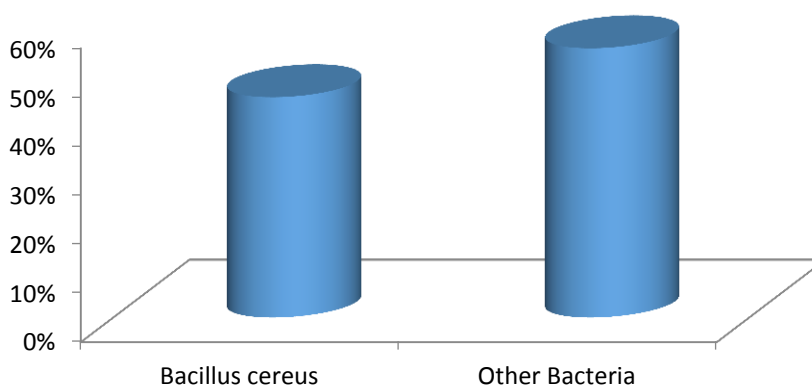
## RESULTS AND DISCUSSION

Based on the results of examinations on food snacks conducted at the Microbiology Laboratory, majoring in Health Analyst get the results that can see in table 1.

Table 1. Examination Results Identification of *Bacillus cereus* in Snack Foods

No	Sample Code	Results Identification
1	1 TM	<i>Bacillus cereus</i>
2	2 SM	<i>Bacillus cereus</i>
3	3 NM	<i>Bacillus cereus</i>
4	4 TM	Other bacteria
5	5 PM	Other bacteria
6	6 KM	Other bacteria
7	7 PM	Other bacteria
8	8 PWM	Other bacteria
9	9 MM	Other bacteria
10	10 CM	<i>Bacillus cereus</i>
11	1 TG	<i>Bacillus cereus</i>
12	2 SG	<i>Bacillus cereus</i>
13	3 NG	<i>Bacillus cereus</i>
14	4 TG	Other bacteria
15	5 PG	Other bacteria
16	6 KG	Other bacteria
17	7 PG	Other bacteria
18	8 PWG	Other bacteria
19	9 MG	<i>Bacillus cereus</i>
20	10 CG	<i>Bacillus cereus</i>

Based on the data obtained, snacks that were contaminated by *Bacillus cereus* bacteria as many as 9 samples (45%) and 11 samples (55%) infected with other bacteria.

Figure 1. Percentage of *Bacillus cereus* and Other Bacteria in Snack Foods

Based on the data above, it found that snacks that are contaminated by *Bacillus cereus* bacteria are 45%, and other bacteria infect 55%. The results of the questionnaire

showed that hawker food sellers still did not pay much attention to hygiene when selling. The results can see in table 2.

Table 2. Results of Questionnaires at Street Food Snacks

No.	Question	Yes	No
1	Have cookware washed before use before processing food	6	-
2	Do food transportation use tightly closed containers	6	-
3	Do you wash your hands first before selling	6	-
4	When you sell, you use tools to take food (gloves, food tongs)	6	-
5	Is when selling food snacks placed in a closed container	1	5
6	Are the snacks you sell always sold out in a day	4	2
7	If it is not sold out, do you store the food in the refrigerator for resale the next day	6	-

As many as 45% of *Bacillus cereus* contaminated food samples (Figure 1.) found in 5 out of 6 sellers (83%) who when selling laid uncovered snacks that were covered (Table 2). Some street food vendors use carts in the sale, made of wood around them using a cover made of glass, but when selling is not closed tightly, and some snacks are still placed outside not inside the glass. Even though the selling location is on the side of the road that might be will be polluted from the dust coming from the ground when selling.

The results of the questionnaire showed that as many as 2 out of 6 snacks were not always sold out. If not sold out, food snacks will be stored in the refrigerator for sale the next day. Cold temperatures for storage turned out to support the formation of cereulide. Dommel et al. (2011) and Kranzler et al. (2016) proved that cereulide production was higher at low temperatures, and the optimum temperature for bacterial growth actually inhibited product toxins<sup>19,20</sup>.

Toxin formation that occurs when bacterial sporulation in food can cause emetic syndrome<sup>21</sup>. This toxin codified by the ces gene located in the plasmid, which is heat-resistant and low in pH<sup>22</sup>.

Things that can be done to avoid contamination of these bacteria in food include avoiding long food storage, rapid cooling of food at temperatures below 10°C or maintaining diet at temperatures higher than 55°C<sup>7</sup>. Other ways can do, such as the use of light-emitting diode (LED) (460 nm)<sup>23</sup>, use of autolysin<sup>24</sup>, the addition of peptide<sup>25</sup> or citrate extract (Citrox ©)<sup>26</sup>. Also, the application of programs such as Good Manufacturing Practices (GMP) is useful for reducing risk<sup>16</sup>.

## CONCLUSION

The number of snacks contaminated by *Bacillus cereus* bacteria was 9 (45%) samples.

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