

Short Communication

Presence of *Bacillus cereus* s.l. from ready-to-eat cereals (RTE) products in Sarawak

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Abstract

Bacillus cereus is a soil inhabitant gram positive bacterium, and is known to cause severe food poisoning. The objective of this study was to isolate and identify the presence of *Bacillus cereus* s.l. from selected ready to eat cereals purchased randomly from local supermarkets in Kuching and Kota Samarahan, Sarawak. The result showed that four of the 30 food samples were detected to be contaminated by *B. cereus* s.l. . Our findings suggested that it is important for the public to be aware of the safety of RTE cereals consumption, as it is possible that *B. cereus* s.l. may be present in high count number and pose hazardous health effects to the consumers.

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Keywords

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ready-to-eat (RTE) cereals

Introduction

Bacillus cereus is a gram positive bacterium that causes severe food poisoning. As its name suggests, the bacterium is rod shaped and forms spores under stress. The spores are able to survive in hot and dry conditions, and remain dormant for many years (Sagripanti *et al.*, 2006; Henriques and Moran, 2007). The bacterium is commonly present in soil, but can be found in foods, such as dairy products, rice, cereals and cereals derivatives, dried foods, spices, eggs, vegetables (salads) and meats (Kramer and Gilbert, 1989; Granum, 2005). It was only recognized as a bacterial cause of food poisoning in 1955 and accounts for about 2% of all food-borne illness in the industrialized world.

Foods with *B. cereus* contamination will usually trigger emetic (vomiting) reactions and diarrhea. This is due to the emetic toxin and enterotoxins (Drobniewski, 1993) produced by the bacterium and their spores during foods processing (Sagripanti *et al.*, 2006; Henriques and Moran, 2007). Several food poisoning outbreaks in cereal products showed that the presence of *B. cereus* s.l. as the main cause (CDC, 1994; Diereck *et al.*, 2005; Reyes *et al.*, 2006; Kennedy, 2008).

Ready-to-eat (RTE) cereals have been receiving

popularity among Malaysian as their breakfast diet. Ready-to-eat (RTE) cereals in Malaysian market come under a variety of brands, and are either locally produced or imported. These cereals offer several benefits, such as, to provide important vitamins and minerals, low in calories, less fat and cholesterol as well as more fiber. Although there are many advantages in consuming RTE cereals, yet there are still needs to evaluate the food safety of the product in Sarawak, Malaysia, as there are rare reports on the spore-forming bacterium in local foods, both processed and raw items. Therefore, this research was embarked with the aim to isolate and identify the presence of *B. cereus* s.l. from selected RTE cereals through a series of biochemical tests and confirmation by using BBL Crystal™ Identification Systems Gram - Positive ID Kit.

Materials and Methods*Sample collection and bacteria identification*

A total of 30 commercial cereal products (raw cereals, pre-mixed cereal drinks and breakfast cereals) were randomly purchased from different sale points in local supermarkets at Kuching and Kota Samarahan, Sarawak, Malaysia (Table 1). The sampling was carried out from December 2009 until February 2010. Twenty grams of the food samples

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Table 1. The total number of *Bacillus cereus* detected from the various types of RTE cereals samples

RTE cereal types	Number of samples collected	Positive <i>B. cereus</i>	Negative <i>B. cereus</i>
Breakfast cereals	19	3	16
Cereal drinks	4	0	4
Original cereals	3	0	3
Corn flakes	2	0	2
Oat	1	0	1
Instant oatmeal	1	1	0
Total	30	4	26

were weighed under sterile condition, homogenized by a Stomacher in 180 ml pre-enrichment medium (Tryptic Soy Broth). Then, the samples were enriched in Tryptic Soy Broth for 20 hours at 35°C. Next, a loopful of the overnight culture was streaked on *Bacillus cereus* Selective Agar (Base) and incubated for 24 hours at 35°C. Plates were examined for the presence of pinkish white colonies. Subsequently, colonies that exhibited this characteristic were stored in Tryptic Soy Agar (Oxoid, England) and were tested using gram-staining and a series of biochemical tests as recommended by FDA Bacteriological Analytical Manual (Rhodehamel and Harmon, 1998). The biochemical tests included catalase test, motility test, glucose fermentation test, VP test, Tyrosine decompose test and indole test. The isolates were further confirmed by using commercial identification kit, BBL Crystal™ Identification Systems Gram - Positive ID kit.

Results and Discussion

In this study, four RTE cereals were found to be positive for the presence of *B. cereus* s.l as shown by the biochemical tests and the commercial identification kit, BBL Crystal™ Identification Systems Gram - Positive ID Kit (Becton - Dickinson, USA).

Contaminated food is a real threat to the public health and welfare. The prevalence of toxigenic strains of *B. cereus* has been extensively documented in various starchy foods, such as vegetables, puddings, sauces, milk, dairy products, cereals, infant cereal formulas, fried and cooked rice, salads, meat products, salmon, meatballs, pork entrails, pasteurized eggs, ready-to-serve dishes, and cakes (Agata et al., 2002; Schneider et al., 2004; Duc et al., 2005; Pinto et al., 2005; Shaheen et al., 2006; King et al., 2007; Svensson et al., 2007; US FDA/CFSAN 2007). Though no official information is

available on the incidence of *B. cereus* poisoning in Malaysia (Nor Nadiyah et al., 2011), nevertheless a local report has documented the presence of the bacterium in food (Lee et al., 2009). Thus, it is important to determine the distribution of *B. cereus* in food products, particularly RTE cereals distributed and sold in Sarawak, Malaysia.

From the microbiological analysis done on the 30 RTE cereals samples purchased from Kuching and Kota Samarahan, Sarawak only four samples were contaminated with *Bacillus cereus* s.l. The result of this study is in agreement with similar studies conducted previously (Fang et al., 1997; Reyes et al., 2006 and Lee et al., 2009). In a local study, their findings indicated that from 111 RTE cereals assessed, 95 % were contaminated by *Bacillus* spp. while *Bacillus cereus* s.l. was recorded as 76 % in the foods. Generally, ready-to-eat foods are considered as highly hygienic and safe to be consumed since the foods are manufactured under strict processing conditions such as cooked time and temperature (Fang et al., 2003), and strict continuous surveillance from the authorities (Wei et al., 2006). Nonetheless, *Bacillus cereus* s.l. can cross-contaminate the RTE cereals in various way during the processing line in the factories. Among the factors are the abilities of the bacterium to survive under high temperature and dried conditions (Claus and Berkeley, 1986). In favorable environment, these spores will later germinate. Besides, cross-contamination from human to the prepared food during preparation can occur especially in the process of adding flavoring agents, sweeteners, salt and water (Lee et al., 2009). The packaging process is another factor that contributes to the contamination of RTE cereals during the processing line (Väisänen et al., 1991).

Similarly, Reyes et al. (2006) has successfully isolated *B. cereus* from dried milk products. The isolation rate was at 45.9%. The dried milk products especially with supplemented ingredients (whole rice, cereals, pulses extruded and food additives) had a higher number of *B. cereus* counts, which were up to 10⁴ spores g⁻¹ products. In another report, Fang et al. (1997) reported that in 155 instant cereals examined, the occurrence of *Bacillus cereus* s.l. was at 26% for regular instant cereals and 81% for cereal mix.

Although originally *B. cereus* s.l. is a soil bacterium (Sofos, 2008), it can cross – contaminate the food product by forming spores on the raw cereals plants (such as corn and rice) (Vissers et al., 2007). These raw cereals plant materials are later processed to become RTE cereals, carrying along the spores even under the harsh processing environments only to germinate when conditions become more favourable

(Sagripanti *et al.*, 2006; Henriques and Moran, 2007). Although there has not been any significant studies or recorded reports on the specific types of ready-to-eat cereal which are susceptible to the presence of *Bacillus cereus* in Malaysia, precautionary awareness are highly recommended before consuming.

Conclusion

Overall, this study provides an overview of distribution and presence of *B. cereus* s.l. in RTE cereals. RTE cereals are very common, and usually the largest consumers are children and teenagers. Hence, it is indeed very crucial for the food industries and the local public health authorities to pay attention on the safety of RTE cereals, since there is a possibility that *Bacillus cereus* s.l. can exist in high count number, and potentially causes food-borne poisoning to the consumers.

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