Presence of Bacillus cereus in Packaged Some Spices and Herbs Sold in Istanbul

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Abstract: Ninety-three samples of packaged spices and herbs were collected from different retail shops in Istanbul, Turkey. They were examined for the presence and number of Bacillus cereus. It was determined that fifty-nine samples (63.44%) contained more 100 cfu/g of B. cereus, with counts ranging from 10² to 3.2x10⁵ cfu/g. In the 34 samples (36.56%), B. cereus were less 10² cfu/g. Only 5 samples (5.38%) had counts between 10³-10⁴ cfu/g. The results suggest that incidence of B. cereus was very high in spices and herbs, and therefore should not be ignored in food industry, especially in the meat industry and mass catering establishments.

Key words: Spices and herbs, Bacillus cereus, microbiological quality

Introduction

Bacillus cereus is an aerobic, gram-positive and endospore forming rod-shaped bacteria. It is widely distributed in soils and waters. From these sources, cereals-especially rice and rice dishes, spices, vegetables, meat and meat products, dessert dishes and other foods become contaminated (Aksu, 1994; Banwart, 1989; Cliver, 1990; Eley, 1992; Hobbs and Robert, 1987; Sooltan et al., 1987).

Since the 1950’s, B. cereus has been associated with several food poisoning outbreaks. It causes two distinct food poisoning syndromes, characterised respectively by diarrhoea and emesis (Banwart, 1989; Cliver, 1990; Eley, 1992). These syndromes result from the intake of foods containing B. cereus. The diarrhoeal type illness characterised by abdominal pain and diarrhoea 8 to 12 hours after the ingestion of suspected food, with a syndrome similar to that provoked by Clostridium perfringens. The emetic type illness characterised by nausea and vomiting that develops in <1 to 5 hours and resembles Staphylococcus aureus gastroenteritis (Banwart, 1989; Cliver, 1990; Eley, 1992; Lund, 1991). A variety of foods have been involved in the diarrhoeal type illness, including cooked meat and poultry, soups, sauces and dessert dishes which are rich of protein. In contrast, the vomiting type illness has been associated with the consumption of rice dishes, which are rich of starch (Cliver, 1990; Eley, 1992; Frazier and Westhoff, 1988; Lund, 1991).

A large number of viable cells of B. cereus is required to cause illness; numbers in excess 10²-10⁴ have been encountered in food suspected of causing illness (Banwart, 1989; Cliver, 1990; Hobbs and Robert, 1987). At the same time, B. cereus yields enterotoxins, cytotoxin, dernal and intestinal necrotic toxins and haemolysin (Banwart, 1989; Cliver, 1990). It is also responsible for a number of non-gastrointestinal infections involving wound, central nervous system infections, respiratory tract infections, etc. It also has been implicated the bovine mastitis (Hassan and Nabbut, 1996; Parry et al., 1983).

The purpose of this study was to determine the incidence and the levels of B. cereus contamination in processed spices and herbs currently available at retail shops in Istanbul, Turkey.

Materials and Methods

Totally 93 spice and herb samples were collected from different shops in Istanbul and examined for incidence and level of contamination by B. cereus. For microbiological examination, 5 g of each sample were homogenised in 45 ml of 0.1% peptone water, using a Stomacher. Decimal dilutions of the homogenisate were prepared in 0.1% peptoned water and 0.1 ml. amounts of each appropriate dilution were surface-plated on duplicate plates of Oxoid Bacillus cereus Selective Agar which is the Polymyxin-Egg yolk-Mannitol-Bromothymol blue Agar (PEMBA) of Holbrook and Anderson (1980). The plates were incubated at 37°C for 24 hours with an additional 24 hours at room temperature to facilitate the development of turquois to peacock blue colonies typical of B. cereus. Any colonies regarded as presumptive B. cereus were dyed by Gram method. Gram positive colonies were confirmed using the following tests: Indole production; catalase; Voges-proskauer; fermentation of glucose, arabinose, xylose and mannitol; reduction of nitrate; hydrolysis of gelatin, casein and starch; growth in pH 5.7 and pH 6.8 (Buchanan and Gibson, 1984; Kramer et al., 1982; Parry et al., 1983).

Results and Discussion

B. cereus was found from 100 cfu/g to 3200 cfu/g in 63.44% (59/93) of the spices and herbs samples. In the 36.56% (34/93) of the samples, B. cereus count was less 10² cfu/g. Only 5 samples (5.38%) had counts more 1000 cfu/g. The results summarised in Table 1.

Spices and herbs are subject to microbial, parasiter and fungal contamination after harvesting (Gaurino and Peppier, 1976; Pruthi, 1980). The microbial flora is dominated by aerobe spore-forming bacilli including B. cereus (Karapirar and Tunnel, 1988; Karivanc and Bert, 1989; Tekinsen and Sangol, 1982).

B. cereus ranked as one of the most common cause of food poisoning in some countries (Konuma et al., 1988; Todd, 1996). In some studies, investigators were found B. cereus in spices and herbs in different levels (Bhat et al., 1987; Deambrosis and Da Silva, 1992; Kenifel and Berger, 1994; Konuma et al., 1988; Powers et al., 1976; Rosenberger and Weber, 1993). In our study, the highest contamination levels were obtained from chopped red pepper, powdered black paper, cumin powder and chopped mint samples. Powdered coriander and powdered ginger samples had the lowest contamination levels. Konuma et al. (1988) reported that the incidence of B. cereus in spices was 39.7%. B. cereus counts generally ranged between 10² to 10⁴ cfu/g. Kenifel and Berger (1994) were detected that 49.37% of spices and herbs gave positive results for B. cereus and some samples such as ginger and curry had B. cereus counts as high as 10⁶ cfu/g. But, in general, samples contained low numbers (<10³ cfu/g.) of B. cereus. According to Bhat et al. (1987), the isolation rate of B. cereus was high in chilli powder. In the cumin seed samples, however, B. cereus incidence was lower than chilli powder samples. Deambrosis and Da Silva (1992) were found that isolation rate of B. cereus in spices was 41.0%. They point out that 33.3% of samples gave B. cereus counts up to 10⁴ cfu/g.
Powers et al. (1976) showed a high prevalence of \textit{B. cereus} (53.0%), which confirms the role played by these ingredients as one of the main source of contamination of some food products. Rosenberger and Weber (1993) found that \textit{B. cereus} levels were not exceed limit level of $10^4$ cfu/g. Our data show that the contamination levels for most samples (94.7%) were less $10^3$ cfu/g; only five samples (5.3%) gave values between $10^2$ to $10^4$ cfu/g. These results is consistent with the observations of other researchers.

Many of the spices and herbs are grown in warm and humid areas, and they may contain high numbers of \textit{B. cereus} and other microorganisms (Guarino and Peppier, 1976; Kenifel and Berger, 1994; Powers et al., 1976; Pruthi, 1980). After commercial utilisation of such contaminated spices and herbs in foods, there is the risk of early spoilage or food-borne infections and intoxications. Especially in meat industry and mass catering establishments, the risk is high. Meat dishes are frequently well seasoned with spices that often contain large numbers of \textit{B. cereus}. Spores survived because of inadequate heat treatment of food, can germinate when proper conditions is available (Aksu, 1994; Hefnawy et al., 1984; Konuma et al., 1988; Mosso et al., 1989; Pafumi, 1986; Powers et al., 1975).

Microbiological safety of spices and herbs may be provided by several fumigation practices (ethylene oxide, propylene oxide), filtration, microwave treatment, ultra-violet irradiation, infra-red irradiation and gamma irradiation (Powers et al., 1975; Pruthi, 1980; Sharma et al., 1989). Heat treatment of raw spices is not recommended, because it often alters the aromatic and flavour components and colour characteristics (Pafumi, 1986). Ethylene oxide fumigation treatments are common, but residue is an important problem. And, after the ethylene oxide fumigation procedure, \textit{B. cereus} may be found in low numbers. Because the effect of Ethylene oxide on spore is not as big as for vegetable cells (Pafumi, 1986). Studies have suggested that gamma irradiation is the most effective and safe method for decontamination of spices and herbs (Pafumi, 1986; Sharma et al., 1989).

Since the toxigenity of \textit{B. cereus} has been proven, potential health hazards of foods containing spices and herbs contaminated with this bacterium should not be ignored. It is important that food workers be aware of the source of \textit{B. cereus}. So that they should avoid from mistakes such as improper refrigeration, cross contamination, inadequate heat treatment and warm storage of foods. Use of sterilised spices and herbs in the food establishments will be useful to minimise of the hygiene risks.

### Table 1: Presence and incidence of \textit{Bacillus cereus} on the spices and herbs samples

<table>
<thead>
<tr>
<th>Spices and herbs</th>
<th>No. samples</th>
<th>$&lt;10^2$ No.</th>
<th>$&lt;10^2$ %</th>
<th>$10^2$-$10^3$ No.</th>
<th>$10^2$-$10^3$ %</th>
<th>$10^3$-$10^4$ No.</th>
<th>$10^3$-$10^4$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red pepper, powdered, sweet</td>
<td>22</td>
<td>12</td>
<td>54.5</td>
<td>10</td>
<td>45.5</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Red pepper, powdered, hot</td>
<td>7</td>
<td>0</td>
<td>0.0</td>
<td>7</td>
<td>100.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Red pepper, chopped</td>
<td>6</td>
<td>2</td>
<td>33.3</td>
<td>3</td>
<td>50.0</td>
<td>1</td>
<td>16.7</td>
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<tr>
<td>Black pepper, powdered</td>
<td>17</td>
<td>5</td>
<td>29.4</td>
<td>10</td>
<td>58.8</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Cumin powder</td>
<td>6</td>
<td>3</td>
<td>50.0</td>
<td>2</td>
<td>33.3</td>
<td>1</td>
<td>16.7</td>
</tr>
<tr>
<td>Ginger, powdered</td>
<td>5</td>
<td>3</td>
<td>60.0</td>
<td>2</td>
<td>40.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Coriander, powdered</td>
<td>6</td>
<td>4</td>
<td>66.7</td>
<td>2</td>
<td>33.3</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Curry powder</td>
<td>4</td>
<td>1</td>
<td>25.0</td>
<td>3</td>
<td>75.0</td>
<td>0</td>
<td>0.0</td>
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<tr>
<td>Mint, chopped</td>
<td>8</td>
<td>0</td>
<td>0.0</td>
<td>7</td>
<td>87.5</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>Parsley, chopped</td>
<td>7</td>
<td>2</td>
<td>28.6</td>
<td>5</td>
<td>71.4</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Dill, chopped</td>
<td>5</td>
<td>2</td>
<td>40.0</td>
<td>3</td>
<td>60.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>34</td>
<td>36.56</td>
<td>54</td>
<td>58.08</td>
<td>5</td>
<td>5.38</td>
</tr>
</tbody>
</table>

### References

Aksu, H., 1994. Presence and importance of \textit{Bacillus caraus} in some ready-to-eat and ready-to-cook foods consumed in Turkey. Ph.D. Thesis, Department of Food Hygiene and Technology, Institute of Health Sciences, Faculty of Veterinary Medicine, University of Istanbul, Istanbul.


Aksu et al.: Spices and herbs, Bacillus cereus, microbiological quality


