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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 10^2 to $3.2x10^3$ cfu/g. In the 34 samples (36.56%), *B. cereus* were less 10^2 cfu/g. Only 5 samples (5.38%) had counts between 10^3-10^4 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; Hefnawy *et al.*, 1984; 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 10^5-10^6 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, dermal 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% peptoned 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 turquoise 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 10^2 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 (Guarino and Peppier, 1976; Pruthi, 1980). The microbial flora is dominated by aerobe spore-forming bacilli including *B. cereus* (Karapirar and Tunnel, 1986; Karivanc and Bert, 1989; Tekinşen 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 10^2 to 10^4 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 10^5 cfu/g. But, in general, samples contained low numbers (<10^2 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 the isolation rate of *B. cereus* in spices was 41.0%. They point out that 33.3% of samples gave *B. cereus* counts up to 10^6 cfu/g.

Table 1: Presence and incidence of *Bacillus cereus* on the spices and herbs samples

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

Powers *et al*. (1976) showed a high prevalence of *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 *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 10^3 to 10^4 cfu/g. These results is consistent with the observations of other researcher.

Many of the spices and herbs are grown in warm and humid areas, and they may contain high numbers of *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 *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, *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 *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 *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.

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