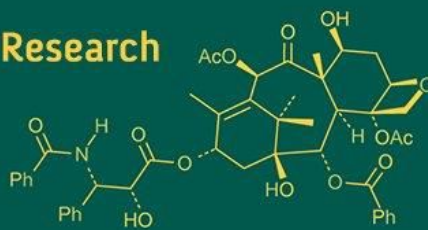
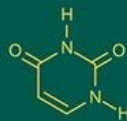


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2025; SP-9(4): 356-361
www.biochemjournal.com
Received: 18-01-2025
Accepted: 26-02-2025

Kosser S

Division of Veterinary Public Health & Epidemiology, FVSc & AH, SKUAST-Jammu, R.S. Pura, Jammu & Kashmir, India

Rashid M

Division of Veterinary Public Health & Epidemiology, FVSc & AH, SKUAST-Jammu, R.S. Pura, Jammu & Kashmir, India

Sharma HK

Division of Veterinary Public Health & Epidemiology, FVSc & AH, SKUAST-Jammu, R.S. Pura, Jammu & Kashmir, India

Ganai IA

Division of Animal Nutrition, FVSc & AH, SKUAST-Jammu, R.S. Pura, Jammu & Kashmir, India

Corresponding Author:**Rashid M**

Division of Veterinary Public Health & Epidemiology, FVSc & AH, SKUAST-Jammu, R.S. Pura, Jammu & Kashmir, India

Occurrence and associated risk factors of *Bacillus cereus* in fast foods in Jammu

Kosser S, Rashid M, Sharma HK and Ganai IA

DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i4Se.4166>

Abstract

In present study, 105 fast food samples were collected from vendors and retail market of Jammu and processed for isolation of *B. cereus*. Twenty seven isolates of *B. cereus* were obtained. So 25.71% fast food samples were positive for *B. cereus*. Highest occurrence was in fried rice 32%, followed by noodles 28.57%, momos 28%, pasta 18.75% and spring rolls 16.66% samples. During collection of samples randomly a semi structured questionnaire was used for collecting data regarding associated factors of transmission of pathogens from 20 food vendors across Jammu city. All the vendors were male mostly in age group of 18-30 years. 25% respondent acquired primary education, 20% acquired higher secondary level and 35% were illiterate. It revealed that mostly 18-30 years age group of unemployed youth were engaged in fast food service. Out of 20 food vendors, none of them received any training on food safety hygiene. Study revealed that 70% of food vendors had no knowledge about transmission of pathogenic microorganism through fast foods. 55% of food vendor had no knowledge about personal hygienic practices. Majority of vendors, 80% were always handling money during food service. Almost 75% of food vendors prepare food in open space.

Keywords: *Bacillus cereus*, fast foods, occurrence, hygienic practices, vendors

Introduction

Bacillus cereus is a motile, facultative anaerobic spore-forming, rod shaped bacterium that belongs to the genus *Bacillus* (Kamat *et al.*, 1989) [16]. Strains of *Bacillus cereus* are of great significance being ubiquitous in nature and with ability to occur in a wide range of foods (Ehling-schulz *et al.*, 2004; Oguntinyinbo and Reyes *et al.*, 2007) [7, 26]. *B. cereus* is the most prevalent pathogenic species found in food and other industrial processes (Prittijarvi *et al.*, 1999) [24]. Strains of this bacterium may cause food spoilage during production, storage and distribution, and food poisoning by gastrointestinal intoxication as well as local/systemic infections such as endophthalmitis, meningitis, periodontitis, osteomyelitis, wound infection and septicemia (Kortiranta *et al.*, 2000) [17]. *Bacillus cereus* is associated with two types of gastrointestinal disorders, the diarrheal and emetic syndromes. The diarrheal syndrome results in diarrhea and abdominal pain after 8-16 hrs of ingestion of contaminated foods, while the emetic syndrome is characterized by nausea and vomiting within 1-5 hour of ingestion (Beatti and Williams, 2000) [1]. In addition *B. cereus* can induce non-gastrointestinal tract infections (Bottone, 2010; Rishi *et al.*, 2013) [2, 27] and may even lead to death (Posfay-Barbe *et al.*, 2008) [23]. The infective dose of *B. cereus* in diarrheal food poisoning ranges from 10^5 - 10^7 cfu/g or ml (Granum and Lund, 1997) [12] and in emetic food poisoning from 10^3 to 10^{10} cfu/g or ml (Lund, 1990) [19]. It is generally considered that any food with a population exceeding 10^4 to 10^5 cells or spores per gram of *B. cereus* may not be safe for consumption (Beatti and williams, 2000; Granum, 2002) [1, 13]. The organism occurs in a wide range of habitat including air, water, dust and soil, from where spores get introduced to cereal crops, vegetables, animal hair, fresh water and sediments. Raw plant foods especially rice, potatoes, beans, peas, and spices are the most common sources of *Bacillus cereus* (Eglezos *et al.*, 2010) [5]. Wide spread occurrence of the organism in the environment facilitate the entry into food chain through raw materials and occurs a major problem in foods processing and mass catering (Beattie and William. 2000; Guinebreteiere *et al.*, 2006) [1, 6].

Since people are adapting fast foods practices now a day and the processing practices of fast foods are of low standards that may lead to contamination which in turn can predispose people to food borne pathogens including *B. cereus*. Food-borne illnesses that are caused by consumption of contaminated food with toxic substances or infectious agents pose significant morbidity, mortality and economic losses, (Havelaar *et al.* 2015) [15].

Food poisoning caused by *B. cereus* is primarily diagnosed by isolating the pathogen from the samples of fast foods, from hands and utensils of vendors, faeces, vomitus etc. Foods sold in markets are often prepared in unsanitary environments, and with the use of contaminated containers that expose the food to multiple potential contaminants raises serious concerns in respect of safety of the food. In the UT of Jammu and Kashmir infectious agents are of paramount concern in the changing scenario of life style of common people. More to understand India is adjusting to these ready to eat foods just like other developed and developing nations. Few studies have been conducted on the incidence of food-borne pathogens with emphasis on *Bacillus cereus* (Yusuf *et al.*, 1992; Desai and Varadaraj, 2009) [36, 4]. When the food hygiene practices are not followed and food vendors are not fully trained in adoption of hygienic principles during food processing and serving, food borne disease outbreaks cannot be neglected (Sahota *et al.*, 2008) [28].

Keeping in view the role of *B. cereus* in food borne infection and intoxication as an emerging pathogen it was realized to assess the safety and quality of fast foods served in and around Jammu city.

Materials and Methods

A total of 105 samples comprising, Momos (25), Fried rice (25), Spring roll (18), Pasta (16), and Noodles (21), were collected randomly from Jammu city. The samples were transported to the laboratory in sample containers with ice packs and were processed immediately within 4 hours for isolation and identification of *B. cereus*. The reference strain of *B. cereus* (ATCC 14579) used in the current study was procured from Hi-media (Mumbai). The pure strain was maintained on nutrient agar slants by sub-culturing fortnightly.

Isolation and identification of *B. cereus*

For the selective isolation of *B. cereus*, Polymyxin-Pyruvate-egg yolk-Mannitol-Bromothymol blue agar (PEMBA) media was used. The samples were processed as per the protocol described by Shinagawa (1990) [30] and Tallent *et al.* (2012) [32] with suitable modifications. Briefly, 25 gm of sample was homogenized in 225 ml of brain heart infusion broth (BHIB) containing polymyxin B (10,000 U per 100 ml). The samples were then enriched at 35 °C for 16-18 hours. Following enrichment, a loopful was streaked onto PEMBA plates and then incubated at 37 °C for 24 hours. The plates showing crenate to fimbriate peacock blue-colored colonies of approximately 3-5 mm size, surrounded by a blue zone of egg yolk hydrolysis against a green background were purified and taken on nutrient agar slants and characterized further for identification of *B. cereus*).

Identification and confirmation of *B. cereus*

All the presumptive colonies of *B. cereus* and closely related species were collected and subjected to morphological and biochemical tests for identification. The morphological and biochemical tests conducted include Gram's staining, cell morphology, spore production, motility, reduction of nitrate, Christensen's citrate utilization, tyrosine decomposition, Voges-proskauer reaction, aerobic and anaerobic utilization of glucose, mannitol fermentation, and hemolysis. The tests and identification of species were carried out as described in the Bacteriological Analytical Manual of the United States Food and Drug Administration (Rhodehamel and Harmon 2001) and Bergey's Manual of Systemic Bacteriology (Clause and Berkeley 1986) [3].

Study of Associated Risk Factors of *Bacillus cereus*

Questionnaire survey for Street vendors/hawkers (Section-I)

At the time of sample collection, street vendors were interviewed randomly using a semi-structured questionnaire to collect data for assess the knowledge, attitude and practices related to food processing and services to consumers, to identify the factors associated with occurrence of *B. cereus*. The information collected is based on four modules comprising of four sections. Sections-I, deals with general questions and socio-demographic characteristics of food vendors, Sections-II, explains knowledge of vendors about food safety issues, Sections-III, explains, attitude of food vendors towards ensuring food safety and Sections-IV, is related to the food safety practices of food vendors.

Descriptive Statistics

Descriptive statistics were calculated for each variable of interest, in term of percentage to simply the understanding of every one.

Results and Discussion

Overall Occurrence of *B. cereus* in fast food products

A total of 105 fast foods samples were collected and processed to isolate the *Bacillus cereus* and 27 samples were found positive showing an overall occurrence of 25.71%. of *B. cereus*

The present study revealed maximum contamination of rice (32%), noodles (28.57%), momos (28%) followed by pasta (18.75%) and spring roll (16.66%). The finding of this study was in agreement with similar incidence reported by Gdoura Ben Amor *et al.* (2018) [11], who reported an incidence of 27.8% in different food stuffs (cereals, pastry, cooked poultry meat, fresh cut vegetables, spices and dairy products). These finding were lower than those mentioned by Yu *et al.* (2020) [35], who isolated *B. cereus* 35% from the retail ready to eat food samples from different regions of china. But our results were higher than Mostafa *et al.* (2022) [20] who observed 11.1% *B. cereus* strain from meat products (luncheon, kofta, minced meat, beef burger and sausage).

Study of Associated Factors of *Bacillus cereus*

A Questionnaire based survey was conducted among 20 food vendors to study the factors associated with occurrence of *Bacillus cereus*. The results obtained were presented under the following heads:

Social characteristics of respondents

Age and sex distribution of respondent

Twenty males' respondents were interviewed by selecting randomly during study. The average age of all the respondents was 31-45 years and maximum of respondent (9) were in age of 18-30 years, eight were in age of 31-45 years, followed by (2) in the age group of less than 18. However, only one candidate was found in the category of greater than 45 years of age.

Distribution according to Education status

The educational attainment of respondents was evaluated in terms of different level of education, 35% were illiterate, 25% of the respondents had acquired primary education. 20% were matriculate, whereas, 20% of the respondents had acquired education up to higher secondary school level. It revealed that mostly 18-30 years age group of unemployed youth having primary educations were engaged in fast food services. They may not be practicing hygienic practices as a consequence there are chances of contamination of food items.

Distribution of respondents according to work experience

Majority of respondent (45%) were having 5-9 years of experience in this job. 30% were having less than 5 years, whereas, 15% were having 10-14 years of experience.

Others details of food vendors

Some of the food vendors surveyed were having their own small shops and some were having moveable street cabins for food processing and selling. Selling fast food was the only source of income of majority of respondents. Majority of the food vendors got training from their friend and relatives followed by their parents. None of the food vendors had received any formal training from any specialized source. Out of the 20 food vendors surveyed no one had additional job. None of the food vendors knew about *Bacillus cereus* infection or other food borne pathogens. So lack of knowledge was one contributory factor in spread of food borne pathogens.

The finding of this study reveals the comparable results with the study of Loukieh *et al.* (2018) [18].

Awareness level of food vendors regarding food safety and transmission of food borne pathogens

The survey conducted revealed that 70% of vendors had no knowledge about the food borne pathogens transmitted through contaminated food. However, 30% believed that unhygienic practices contaminate the food.

Regarding personal hygiene 55% respondents had no knowledge about personal hygienic practices, whereas, 45% agreed that personal hygiene is important.

Almost all food vendors agreed that use of whole some water for all purposes in processing and serving food is essential. The other parameters of assessing the level of awareness are tabulated in table-1.

Attitude of food vendors towards ensuring food safety

Regarding training on food hygiene 25% food vendors agreed that training is essential whereas, 50% had no idea about it and 25% vendors believe that training is not essential. Similarly, 25% of food vendors agree on the importance of personal hygiene. 45% have no idea whereas,

30% disagree the statement. The other parameter of attitude of food vendors are mentioned in the table-2 below.

Based on the results from this study, the vendors have positive attitude towards preparation of nutritious and healthy meals, majority of food vendors (90%) recognize the importance of providing safe food as a job of responsibility. This attitude is in the line with another study in the United Kingdom where, 97% of respondents thought that it was necessary to produce health food than tasty food (Worsfold *et al.* 2004) [38]. Regarding the importance of personnel hygiene practices such as washing of hands, touching of body parts, use of detergents after toilets, handling money and engaging in activities that may contaminate food etc for maintaining food safety, 50% agreed with the statement. Thus there is a strong linkage between positive attitudes of food vendors in preparing, and offering healthy street meals is in agreement with another study Tuglo *et al.* (2021) [34]. The hands are the most important vehicle for the transmission of organisms from sources to food (WHO, 1989; Rane, 2011) [37, 25]. Food handler should be trained supervised by government health agencies to ensure personnel hygienic practices and good sanitation procedures (Sneed *et al.*, 2004) [31]. The majority, of workers (85%) agree that properly cooked food is free of contamination, while 15% have no opinion on the matter. The other important parameters of attitude are as in Table-2.

Food safety practices of food vendors

Regarding personal habits 80% of food vendors always handle money, unwashed plates, glass etc during food service. It means they do not know the importance of personal hygiene and routs of disease transmission and 20% never handle money, unwashed utensils during food service time. During food serving majority of responded (40%) were not eating or drinking during serving, 20% usually eat while working. Whereas (25%) vendors responded that they sometime eat during working, 15% rarely eat while working. Similarly, 55% vendors responded that they always follow personal hygienic practices, 25% usually and 20% follow sometime. The other results related to the food safety practices of the food vendors are briefly enlisted in table-3.

In the present study, 90% of the vendors did not use any personal protective equipment/clothing as well as safety procedures. The poor socio-economic condition with lacking proper safety knowledge among the street vendors is one of the potential reason for their lower use of protective equipment (Gadaga *et al.* 2014) [10]. These finding were quite similar in Kenya (87.7%) and with the studies undertaken in Haiti and Uganda, where, 40% and 45% food vendor used personal hygiene (Muinde and Kuria, 2005; Muiyanga *et al.* 2011; Samapundo *et al.* 2015) [21, 22, 29].

Majority of the vendors had food that was already prepared when they set up shop to sell it. Food that has been cooked and left at room temperature has a higher potential to harbour dangerous bacteria. It was also found that very few of the vendors regularly cleaned the area where food was produced and only few of the vendors correctly covered their prepared food. Such set of practices were in agreement of the studies conducted on other parts of globe. Thus foods should ideally be handled with clean tongs, forks, spoons, or disposable gloves to lower the danger of cross-contamination, according to the WHO.

Section I: General questions and socio-demographic characteristics of food vendors

Name of food vendor	
Name of establishment	
Address	
Contact number	
Date	
Gender of Vendor	Male
Education	Educated Uneducated
Any Training on food safety-hygiene	Yes
Heard about food borne infections (<i>B. cereus</i>) or any other?	Yes

Section II: Knowledge of vendors about food safety

Knowledge	True	False	Don't Now
Pathogenic microorganism can be transmitting through food.			
Maintaining personal hygiene is essential for food processors and handlers.			
Use of wholesome water for all purposes in processing and serving food is essential			
Workers should avoid touching their hands with body parts during processing and service of food			
Covering food at all times improves the safety of food.			
Can microbes be commonly present in the skin, nose and mouth of healthy handlers			
Proper cleaning and sanitization of utensils decrease the risk of food contamination.			
Can exchanging of money by hand during service and processing of food causes contamination			
Dirt of street can seriously contaminate the open food			
Re-selling and use of leftover food from the previous day is not safe			

Section III: Attitude of food vendors towards ensuring food safety

Attitudes	Agree	No idea	Disagree
Training of workers is essential to reduce the food borne diseases			
Personal hygiene of workers is important to prevent food borne pathogens			
Providing the safe food is an important part of job responsibility			
Food should be kept covered before serving			
Well cooked foods are safe for human consumption.			
Workers should not rub hand on body parts while processing or distribution of food			
Hand washing before handling food will reduces the risk of food borne infections.			
Vendors should not touch the money or dirty utensils during food processing or distribution			
The uses of paper/polythene packs for food packaging are not safe.			
Use of masks and gloves is important in reducing risk of food borne pathogens			

Section IV: Food safety practices of food vendors

Practices	Always	Usually	Sometimes	Rarely	Never
Handling of dirty utensils and money while processing & serving food					
Eating/drinking while working					
Proper maintenance of personal hygiene					
Preparation of food in open place					
Use of safe water for cooking and drinking					
Separate storage of raw and cooked food items.					
Avoiding cooking when sick					
Washing hands before food processing.					
Washing of hands with soap after using toilet					
Cleaning of utensils after usage with detergent					

Table 1: Awareness level of food vendors regarding food safety and transmission of food borne pathogens

Knowledge	True	False	Don't Now
Pathogenic microorganism can transmit through contaminated food.	6(30%)		14(70%)
Maintaining personal hygiene is essential for food processors and handlers.	9(45%)		11(55%)
Use of whole some water for all purposes in processing and serving food is essential	20(100%)		
Workers should avoid touching their hands with body parts during processing and serving of food	10(50%)		10(50%)
Covering food at all times improves the safety of food.	15(75%)		5(25%)
Microbes are commonly present in the skin, nose and mouth of healthy handlers	5(25%)		15(75%)
Proper cleaning and sanitization of utensils decrease the risk of food contamination.	9(45%)		11(55%)
Exchanging of money by hand is a source of contamination	5(25%)		15(75%)
Dirt of street can seriously contaminate the open food	9(45%)		11(55%)
Re-selling and use of leftover food from the previous day is not safe	6(30%)		14(70%)

Table 2: Attitude of food vendors towards ensuring food safety

Attitudes	Agree	No idea	Disagree
Training of workers is essential to reduce the food borne disease	5(25%)	(10)50%	5(25%)
Personal hygiene of workers is important to prevent food borne pathogens	5(25%)	9(45%)	6(30%)
Providing the safe food is an important part of job responsibility	18(90%)	2(10%)	—
Food should be kept covered before serving	20(100%)	—	—
Well cooked foods are safe for human consumption.	(17)85%	(3)15%	—
Workers should not rub hand on body parts while processing or distribution of food	(10)50%	(6)30%	(4)20%
Hand washing before handling food reduces the risk of food borne infections.	(8)40%	(3)15%	(9)45%
Vendors should not touch the money or dirty utensils during food processing or distribution	—	(8)40%	(12)60%
The uses of paper/polythene packs for food packaging are not safe.	(1)5%	(16)80%	(3)15%
Use of masks and gloves is important in reducing risk of food borne pathogens	(1)5%	(9)45%	(10)50%

Table 3: Food safety practices of food vendors

Practices	Always	Usually	Some times	Rarely	Never
	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Handling of unwashed, utensils money during service	16(80%)		4(20%)		
Eating drinking while working		4(20%)	5(25%)	3(15%)	8(40%)
Proper maintenance of personal hygiene	11(55%)	5(25%)	4(20%)		
Preparation of food in open space	15(75%)			2(10%)	3(15%)
Use of safe water for cooking and drinking	4(20%)	5(25%)	7(35%)	4(20%)	
Separate storage of raw and cooked food items,	5(25%)	5(25%)	8(40%)	2(10%)	
Avoiding cooking when sick	8(40%)	6(30%)	4(20%)	2(10%)	
Washing hand before processing	18(90%)		2(10%)		
Wearing gloves, mask, apron while cooking				2(10%)	18(90%)
Washing hand with soap after using toilet	6(30%)	3(15%)	6(30%)	5(25%)	
Cleaning of utensils and premises after usage with detergent	5(25%)	7(35%)	4(20%)	4(20%)	

Conflict of Interest

The authors declare that there is no conflict of interest.

Acknowledgement

Authors wish to thank the Dean, faculty of Veterinary Science and Animal Husbandry, R.S. Pura, SKUAST-Jammu for the facilities provided.

References

- Beattie SH, Williams AG. Detection of toxigenic strains of *Bacillus cereus* and other *Bacillus* species with an improved cytotoxicity assay. *Letters in Applied Microbiology*. 2000;28:221-225.
- Bottone EJ. *Bacillus cereus*: a volatile human pathogen. *Clinical Microbiology Reviews*. 2010;23:382-398.
- Claus D, Berkeley RCW. Genus *Bacillus* Cohn, 1872. In: Sneath PHA, Mair NS, Sharpe ME, Holt JG, editors. *Bergey's Manual of Systematic Bacteriology*. Baltimore: The Williams & Wilkins Co.; 1986. Vol. 2, p. 1105-1139.
- Desai SV, Varadaraj MC. Prevalence of toxigenic traits in native food isolates of *Bacillus cereus* in the city of Mysore, Southern India. *Journal of Microbiology and Antimicrobials*. 2009;1(2):27-34.
- Eglezos S, Huang B, Dykes GA, Fegan N. The prevalence and concentration of *Bacillus cereus* in retail food products in Brisbane, Australia. *Foodborne Pathogens and Disease*. 2010;7(7):867-870.
- Ehling-Schulz M, Guinebretiere MH, Monahan A, Berge O, Fricker M, Swenson B. Toxin gene profiling of enterotoxigenic and emetic *Bacillus cereus*. *FEMS Microbiology Letters*. 2006;260:232-240.
- Ehling-Schulz M, Fricker M, Scherer S. *Bacillus cereus*, the causative agent of food-borne illness. *Molecular Nutrition and Food Research*. 2004;48:479-487.
- Ehling-Schulz M, Frenzel E, Gohar M. Food-bacteria interplay: pathometabolism of emetic *Bacillus cereus*. *Frontiers in Microbiology*. 2015;6:704.
- Fagerlund A, Ween O, Lund T, Hardy SP, Granum PE. Genetic and functional analysis of the CytK family of genes in *Bacillus cereus*. *Microbiology*. 2004;150:2689-2697.
- Gadaga T, Ntsike M, Ntuli V. Socio-economic and hygienic aspects of street food vending in Maseru City, Lesotho. *USWA Research Journal of Agriculture, Science and Technology*. 2014;5:28-39.
- Gdoura-Ben Amor M, Siata M, Zayani M, Grosset N, Smaoui S, et al. Isolation, identification, prevalence, and genetic diversity of *Bacillus cereus* group bacteria from different foodstuffs in Tunisia. *Frontiers in Microbiology*. 2018;9:447.
- Granum PE, Lund T. *Bacillus cereus* and its food poisoning toxins. *FEMS Microbiology Letters*. 1997;157(2):223-228.
- Granum PE. *Bacillus cereus* food poisoning. In: *Food Associated Pathogens*. 1st ed. Boca Raton: CRC Press; 2002. p. 13.
- Guinebretiere MH, Fagerlund A, Granum PE, Nguyen C. Rapid discrimination of cytK-1 and cytK-2 genes in *Bacillus cereus* strains by a novel duplex PCR system. *FEMS Microbiology Letters*. 2006;259:74-80.
- Havelaar AH, Kirk MD, Torgerson PR, Gibb HJ, Hald T, Lake RJ, et al. World Health Organization global estimates and regional comparisons of the burden of foodborne disease in 2010. *PLoS Medicine*. 2015;12(12):e1001923.
- Kamat AS, Nerkar DP, Naif PM. *Bacillus cereus* in some Indian foods: incidence and antibiotic, heat and radiation resistance. *Journal of Food Safety*. 1989;10:31-41.

17. Kortiranta A, Lounatmaa K, Haapasalo M. Epidemiology and pathogenicity of *Bacillus cereus* infection. *Microbes and Infection*. 2000;2:189-198.
18. Loukieh M, Mouannes E, Jaoudeh AC, Wakim HL, Fancello F, Zeidan BM. Street foods in Beirut city: an assessment of the food safety practices and of the microbiological quality. *Journal of Food Safety*. 2018;38(3):e12455.
19. Lund BM. Food-borne diseases due to *Bacillus* and *Clostridium* species. *Lancet*. 1990;336:982-986.
20. Mostafa NF, Elkenany RM, Younis G. Characterization of *Bacillus cereus* isolated from contaminated foods with sequencing of virulence genes in Egypt. *Brazilian Journal of Biology*. 2022;84:e257516.
21. Muinde OK, Kuria E. Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya. *African Journal of Food, Agriculture, Nutrition and Development*. 2005;5(1):1-14.
22. Muyanja C, Nayiga L, Brenda N, Nasinyama G. Practices, knowledge and risk factors of street food vendors in Uganda. *Food Control*. 2011;22(10):1551-1558.
23. Posay-Barbe K, Schrenzel J, Student R, Korff C, Belli D, Parvex P, *et al.* Food poisoning as a cause of acute liver failure. *Pediatric Infectious Disease Journal*. 2008;28:846-847.
24. Prittijarvi TSM, Andersson MA, Scoging AG, Salkinoja-Salonen MS. Evaluation of methods for recognizing strains of *Bacillus cereus* group with food poisoning potential among industrial and environmental contaminants. *Systematic and Applied Microbiology*. 1999;22:133-144.
25. Rane S. Street vended food in developing world: hazard analyses. *Indian Journal of Microbiology*. 2011;51(1):100-106.
26. Reyes JE, Bastias JM, Gutierrez MR, Rodriguez MO. Prevalence of *Bacillus cereus* in dried milk products used by Chilean school feeding program. *Food Microbiology*. 2007;24:1-6.
27. Rishi E, Rishi P, Sengupta S, Jambulingam M, Madhavan HN, Gopal L, *et al.* Acute postoperative *Bacillus cereus* endophthalmitis mimicking toxic anterior segment syndrome. *Ophthalmology*. 2013;120:180-185.
28. Sahota P, Jairath S, Pandove G, Krishan M. Emerging food-borne pathogens: a review. *Asian Journal of Microbiology, Biotechnology and Environmental Sciences*. 2008;10(4):921-926.
29. Samapundo S, Climat R, Xhaferi R, Devlieghere F. Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti. *Food Control*. 2015;50:457-466.
30. Shinagawa K. Analytical methods for *Bacillus cereus* and other *Bacillus* species. *International Journal of Food Microbiology*. 1990;10:125-142.
31. Sneed J, Strohbehn C, Gilmore SA, Mendonca A. Microbiological evaluation of foodservice contact surfaces in Iowa assisted living facilities. *Journal of the American Dietetic Association*. 2004;104(11):1722-1724.
32. Tallent SM, Kotewicz KM, Strain EA, Bennett RW. Efficient isolation and identification of *Bacillus cereus* group. *Journal of AOAC International*. 2012;95(2):446-451.
33. Tewari A, Singh SP, Singh R. Incidence and enterotoxigenic profile of *Bacillus cereus* in meat and meat products of Uttarakhand. *Journal of Food Science and Technology*. 2013;1155:253-270.
34. Tuglo LS, Agordoh PD, Tekpor D, Pan Z, Agbanyo G, Chu M. Food safety knowledge, attitude, and hygiene practices of street-cooked food handlers in North Dayi District, Ghana. *Environmental Health and Preventive Medicine*. 2021;26(1):54.
35. Yu S, Yu P, Wang J, Li C, Guo H, Liu C, *et al.* A study on prevalence and characterization of *Bacillus cereus* in ready-to-eat foods in China. *Frontiers in Microbiology*. 2020;10:3043.
<https://doi.org/10.3389/fmicb.2019.03043>
36. Yusuf Z, Umoh VJ, Ahmad AA. Occurrence and survival of enterotoxigenic *Bacillus cereus* in some Nigerian flour-based foods. *Food Control*. 1992;3:150-155.
37. World Health Organization (WHO). Health surveillance and management procedures for food handling personnel. WHO Technical Report Series. 1989;785.
38. Worsfold D, Worsfold PM, Griffith JC. An assessment of food hygiene and safety at farmers' markets. *International Journal of Environmental Health Research*. 2004;14(2):109-199.