STUDY OF AN EPISODE OF FOOD- BORNE INFECTION PRODUCED BY *BACILLUS CEREUS*

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RESEARCH ARTICLE

Abstract

Food safety is a major area of interest in the current context, marked by the industrialization of food production and the growing demands of consumers for safe, quality products. In this context, the prevention and control of foodborne infections become essential, especially given the fact that numerous pathogenic microorganisms can contaminate food throughout the production, processing, transport and storage chain.

Foodborne infections caused by Bacillus cereus are frequently underdiagnosed, mainly due to the relatively mild and self-limited clinical manifestations. However, they constitute a significant public health hazard, especially in the context of inappropriate food handling, storage or reheating practices, which may favor the proliferation of the bacterium and the synthesis of toxins.

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INTRODUCTION

Food safety is a major area of interest in the current context, marked by the industrialization of food production, market globalization and increasing consumer demands for safe, quality products. In this context, the prevention and control of foodborne infections become essential, especially given the fact that numerous pathogenic microorganisms can contaminate food throughout the production, processing, transport and storage chain.

Among the etiological agents involved in such diseases, the species Bacillus cereus occupies a significant place, being a Gram-positive, sporulating bacterium, widely distributed in the environment, capable of contaminating a wide range of food products. Its frequent presence in cereals, dairy products, meat, vegetables or ready-to-eat products, together with the ability of the spores to resist common heat treatments, makes this bacterium a real risk to public health.

Foodborne infections caused by Bacillus cereus are frequently underdiagnosed, mainly due to the relatively mild and self-limited clinical manifestations. However, they constitute a significant public health hazard, especially in the context of inappropriate food handling, storage or reheating practices, which may favor the proliferation of the bacterium and the synthesis of toxins.

Foodborne infections caused by Bacillus cereus manifest themselves in two distinct clinical forms, representative both in terms of pathogenic mechanisms and symptomatology: the emetic form and the diarrheal form. These two variants differ in the duration of the incubation period, the type of toxins involved and the clinical characteristics, thus reflecting the biological and pathogenic diversity of the species.

Continuous monitoring of the presence of Bacillus cereus in the food chain, along with the implementation of effective alert and control systems, are fundamental elements in preventing the spread of this bacterium and reducing the associated epidemiological risk.

Also, prompt diagnosis and accurate reporting of cases are crucial for containing outbreaks and adopting appropriate corrective measures in a timely manner.

MATERIAL AND METHOD

The study was conducted in the spring of 2025 and included the investigation of an outbreak of food poisoning with Bacillus cereus, which broke out during a private event in Bihor County.

The purpose of the study was to conduct an investigation aimed at identifying the source of the disease, collecting epidemiological data from participants, data on food consumed, confirming the etiology, and proposing control and prevention measures.

Objectives: - identification and description of cases

- determination of the offending food

- evaluation of the factors that allowed bacterial multiplication and contamination
- emphasising the importance of respecting prevention measures

The private event under investigation was attended by 100 people, of whom 86 experienced gastrointestinal symptoms after consuming the dishes on the menu, with 60 people experiencing nausea and vomiting.

The menu included a cheese appetizer, vegetable soup, and a main course consisting of vegetable risotto and baked beef tenderloin, as well as a dessert consisting of a slice of cake with jam**.**

Epidemiological investigation

The investigation began by collecting clinical and epidemiological data from all reported cases. Face-to-face or telephone interviews were conducted with all participants. A form was completed for each patient, in which the following were noted: the duration of the incubation period, the symptoms that appeared, the order and frequency with which they appeared, the duration of the illness, the sex and age of the patients, the foods consumed, the evolution and results of the investigations, the treatment instituted.

Food and environmental survey

Regarding the food and environmental survey, information was collected on the type of food served (food list and time of consumption), preparation method, cooking time and temperature, cooling, storage, reheating, serving, source of raw materials from which the food was prepared. Inspections were carried out in the kitchen of the respective premises, monitoring hygiene conditions, food handling, equipment, compliance with workplace protection measures.

Sampling

Laboratory samples were collected both from patients who presented to the doctor, as well as from people who handled and served the food consumed.

Mainly vomit samples were collected from the patients. The samples from the patients were processed at the laboratories of the units where they presented.

Nasopharyngeal and skin swabs were collected from the staff who cooked, handled and served the food. These samples were processed at the Laboratory of the Public Health Directorate, Bihor.

Samples were collected from the food served, food scraps, and ingredients. These were properly packaged and transported under refrigeration to the Laboratory of the Bihor Sanitary and Veterinary Directorate, where they were processed.

Samples were also collected from kitchen surfaces, used utensils and water samples.

These were also processed at the Laboratory of the Bihor Sanitary and Veterinary Directorate.

RESULTS AND DISCUSSIONS

Following laboratory investigations, which involved culture by seeding on selective isolation and identification agar with mannitol, egg yolk and polymyxin (MYP agar) of samples collected from patients presenting to the doctor, Bacillus cereus was isolated.

Regarding the food samples collected, an increased load of Bacillus cereus was detected, exceeding 10^7 CFU/g in the vegetable risotto samples, the other food samples being free of microorganisms causing food poisoning.

The results of the food investigation showed that the offending vegetable risotto was cooked in the morning of that day, was insufficiently cooled immediately after cooking, at thermal levels unfavorable for the multiplication of the Bacillus cereus species. The risotto was kept for 8 hours at room temperature before being reheated for serving. Incomplete temperature logs and an uncalibrated thermometer were found at the unit level.

Clinical data and the isolation of Bacillus cereus from both food and biological samples confirm it as the etiological agent of food poisoning.

The food findings (cooked rice, kept at room temperature and reheated) are highly suggestive of the emetic syndrome related to the preformed toxin.

Handling conditions (slow cooling, storage at ambient temperature) favored the multiplication of Bacillus cereus and the production of toxin.

Following the centralization and analysis of the epidemiological survey data, the following results were obtained:

Of the 100 people participating in the event, 60 people became ill, recording a morbidity rate of 60%.

Regarding the consumption of food served during the event, the quantity of food consumed (partially/fully) was evaluated, as well as the number of patients who consumed a specific dish served. (Table 1, Figure 1)

Table 1

Evaluarea consumului alimentelor servite în cadrul evenimentului

The type of preparation	Total number of people who consumed the preparation	Total number of people who partially consumed the dish	Total number of people who consumed the entire preparation
Appetizer	80	60	20
Vegetable soup	70	45	25
Risotto with vegetables	90	40	50
Cake with jam	50	20	30

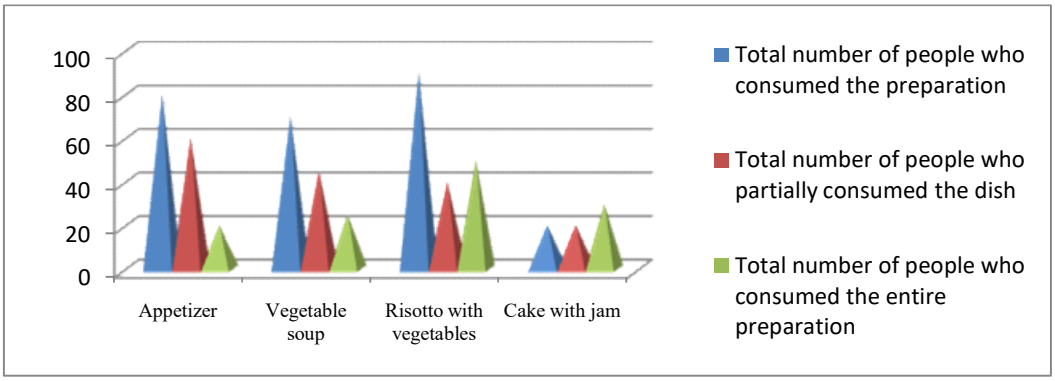

Figure 1 **Evaluation of the consumption of food served at the event**

Analyzing the types of dishes served, it was found that the most frequently consumed food by the cases was vegetable risotto; 50 people out of the 60 who had food poisoning consumed the entire dish.

Regarding the incubation period, in the 60 people who had food poisoning, its duration was between 1 and 5 hours, with a peak at 2-4 hours after the meal and a rapid decrease thereafter, typical of exposure to the preformed toxin in food. (Table 2, Figure 2). The duration of the incubation period depends on the individual sensitivity of the victims and also on the amount of toxin ingested.

Thus, of the 60 cases, 6 had an incubation period of 1 hour, 15 had an incubation period of 2 hours, 20 had an incubation period of 3 hours, 15 had an incubation period of 4 hours and 4 people had an incubation period of 5 hours.

Table 2

Number of cases of Bacillus cereus food poisoning recorded according to the duration of the incubation period

Incubation period duration (hours)	Number of registered cases
1	6
2	15
3	20
4	15

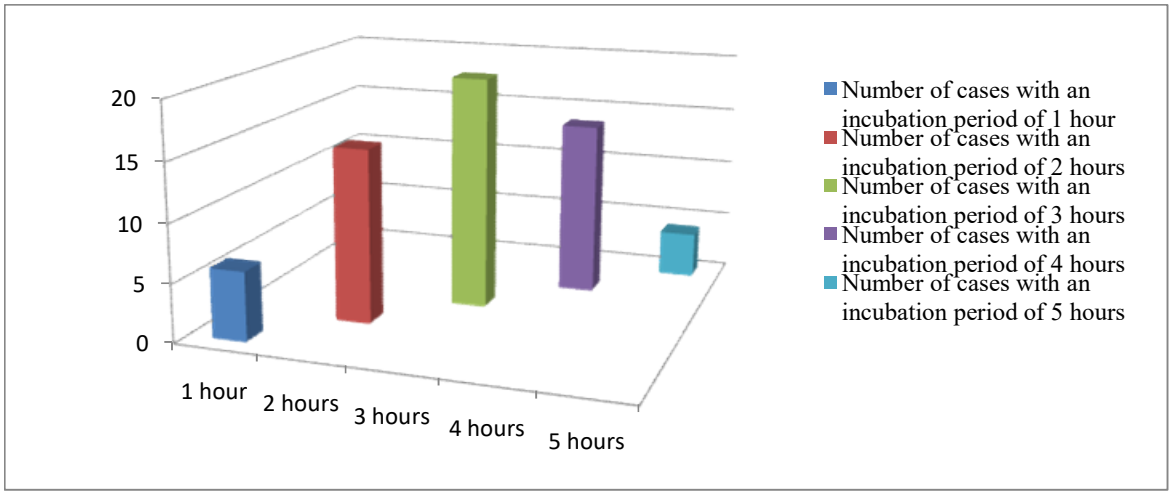

Figure 2 **Number of cases of Bacillus cereus food poisoning recorded according to the duration of the incubation period**

The clinical picture was dominated by nausea that occurred in 86.6% of patients and vomiting occurred in 78.3% of patients. Diarrhea was present in a minority affecting only 18.3% of cases. The clinical picture recorded is typical of emetic syndrome. (table 3, figure 3)

Table 3

Predominant symptomatology in the 60 patients investigated

Symptoms	Number of people affected
Nausea	52
Vomiting	47
Diarrhea	11

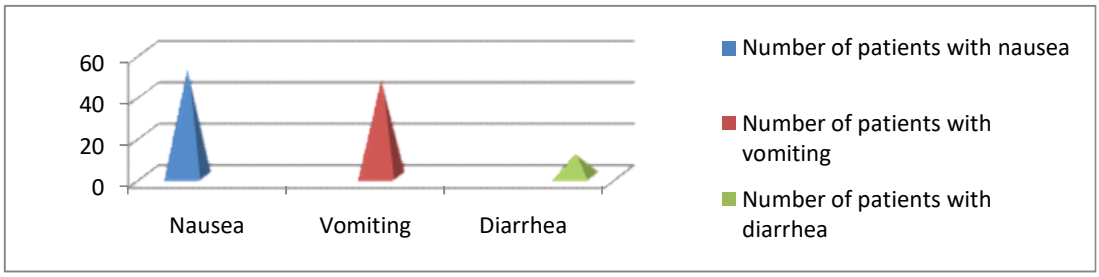

Figure 3 ***Predominant symptomatology in the 60 patients investigated***

Regarding the duration of the disease, it was on average 24 hours in 70% of patients and approximately 48 hours in the remaining 30%. (table 4, figure 4)

Table 4

Average duration of illness in investigated patients

Average duration of illness (days)	Number of cases
1	42
2	18

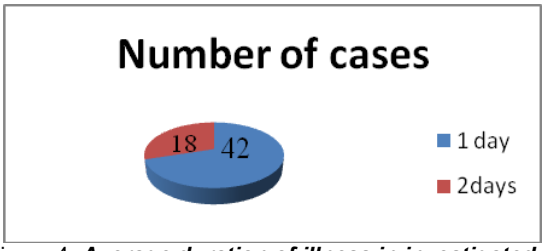

Figure 4 ***Average duration of illness in investigated patients***

CONCLUSIONS

The results obtained describe a common exposure event, characterized by a short incubation period and an emetic clinical picture, associated with the consumption of reheated rice. High levels of Bacillus cereus in the food, lack of thermal chain control and insufficient reheating (which does not destroy the heat-stable emetic toxin), facilitated the occurrence of the episode. The observations are consistent with the literature that identifies improperly cooked and stored rice as a typical vehicle.

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