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ORIGINAL ARTICLES

Foodborne Toxicity in the Pediatric Population: Etiology, Diagnosis, and Prevention Strategies

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Abstract

Introduction: Foodborne intoxications persist as a significant and urgent public health concern globally, impacting both developing and developed nations. The incidence, particularly among children, escalates notably during the summer months, underscoring the severity of the issue.

This study aims to present our clinical experience in managing foodborne intoxications in pediatric patients aged between 12 months and 6 years.

Materials and Methods: This retrospective study included 96 children diagnosed with foodborne intoxication, all of whom were treated by the most recent World Health Organization (WHO) guidelines for the management of foodborne illnesses.

Results: Among the 96 children treated between June and August 2024, 56 were female and 40 were male. The mean age of the patients was 3.8 years. The most commonly reported symptoms upon admission were colicky abdominal pain, vomiting, diarrhea, and—in a subset of patients—high-grade fever and chills.

Conclusion: The management of foodborne infections remains a critical global health issue. The unique vulnerability of younger children and the potential for rapid clinical deterioration underscore the need for improved management strategies, highlighting the crucial role of the medical community in addressing this issue.

Keywords: Foodborne intoxications, children, risk factors, rehydration

Introduction

Diarrhea remains one of the most common illnesses in children, accounting for approximately 10% of all hospital admissions in children under five years of age, even in developed countries such as the United States [1].

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The incidence of foodborne intoxications is significantly higher during the summer months. The main etiological factors are associated with poor hygienic and sanitary conditions, consumption of contaminated or spoiled food, polluted drinking water, improper wastewater and sewage management, inadequate hygiene in kindergartens and schools, and non-compliance with hygiene standards [2, 3, 4, 5].

The most frequent causes of bacterial infections are pathogenic bacteria, which are responsible for approximately 60–80% of all cases. Other etiological agents include viruses (10–30%), parasites (1–5%), and fungi (less than 1%) [6, 7, 8]. Foodborne illnesses may also be caused by toxins secreted by various pathogenic microorganisms or by chemical additives used in food for preservation, flavoring, coloring, and texturing purposes [7, 8].

The most effective treatment for foodborne intoxications is correcting the electrolyte imbalance using fluids and oral rehydration solutions (ORS). In more severe cases, parenteral treatment with solutions such as 0.9% NaCl or Ringer's lactate is necessary [9, 10, 11].

Oral rehydration solutions (ORS) are among the most effective and standardized interventions for managing acute diarrhea caused by foodborne intoxications. Their use is recommended regardless of the patient's age, the cause of the diarrhea, or the initial blood sodium levels, as they help restore electrolyte balance and prevent dehydration [12, 13, 14].

The addition of glucose to physiological solutions enhances sodium absorption in the digestive tract, making treatment more efficient and practical for patients suffering from severe dehydration and at risk of developing hypovolemic shock [12, 14].

Treating foodborne intoxications remains a considerable challenge for both pediatricians and critical care specialists due to the high risk of severe metabolic and hemodynamic complications. These may lead to increased morbidity and, in rare cases, mortality in children [15].

The primary aim of this study is to investigate the incidence of foodborne intoxications among patients presenting to our healthcare facility. Our focus is on identifying the most common etiological agents, analyzing the clinical presentation and symptomatology, and evaluating the effectiveness of current treatment protocols. By providing evidence-based insights, this study aims to shape future interventions and contribute to a more informed response to foodborne illness within the clinical setting.

Materials and Methods

Between June and August 2024, a total of 96 pediatric patients presenting with foodborne intoxications were admitted to our clinical service. The children's ages ranged from 12 months to 6 years. Of the 96 patients included in the study, 56 were female and 40 were male.

Upon admission, all patients underwent a thorough clinical evaluation, which included physical examination, a detailed medical history focused on identifying potential sources of foodborne exposure, and relevant laboratory investigations. Based on the degree of dehydration and the general clinical condition of each patient, individualized treatment protocols were applied accordingly. These protocols included [specific treatments or interventions], which were found to be effective in managing the symptoms and complications of foodborne intoxications.

The data used for this study were collected retrospectively from the official medical records and patient registries maintained by our healthcare service.

Results

A total of 96 pediatric patients, aged between 1 and 15 years, were included in the study, all of whom were diagnosed and treated in our clinical service due to foodborne intoxications. (Tab. 1)

Among these, 56 were female and 40 were male. The most commonly reported symptoms upon presentation included colicky abdominal pain, diarrhea, vomiting, and high-grade fever.

Variable	**Number of Patients (n = 96)**	**Percentage (%)**
Age range	1 – 6 years	–
Mean age (approximate)	3.8 year	–
Female	56	58.3%
Male	40	41.7%

Table 1. Demographic Characteristics of the Study Population

Based on parental reporting, 48 of the children had consumed food outside the home at various local establishments shortly before symptom onset. In 40 cases, parents reported the possible ingestion of unwashed fruits or food that was consumed with unwashed hands. In 8 children, drinking water from uncontrolled or unregulated sources was considered the likely cause of intoxication. (Tab. 2)

Suspected Source	**Number of Cases**	**Percentage (%)**
Food consumed outside the home	48	50%
Unwashed fruits / contaminated hands	40	41.7%
Untreated water sources	8	8.3%

Table 2. Reported Sources of Foodborne Intoxication

The onset of symptoms ranged from 3 to 5 hours after ingestion of contaminated food in the majority of cases, although in some specific instances, symptoms began up to 24 hours post-ingestion. Diarrhea was the predominant symptom and was observed in 40 children.

Vomiting alone was reported in 24 cases, while 32 children experienced both diarrhea and vomiting simultaneously. Fever exceeding 38°C was recorded in 64 children.

Signs of dehydration, such as dry mucous membranes and increased thirst, were observed in nearly all patients. Notably, no child reported the presence of visible blood in their stools. (Tab. 3)

Symptom	**Number of Cases**	**Percentage (%)**
Diarrhea	40	41.7%
Vomiting	24	25%
Both diarrhea and vomiting	32	33.3%
Fever > 38°C	64	66.7%
Dehydration signs	~96	~100%
Blood in stool	0	0%

Table 3. Clinical Symptoms Observed on Admission

Laboratory investigations revealed leukocytosis in 48 patients and elevated C-reactive protein (CRP) levels in 32 cases. Electrolyte imbalances—including hyponatremia, hypokalemia, and hypochloremia—were identified in 56 children. Elevated blood urea nitrogen and serum creatinine levels were recorded in 32 cases, consistent with dehydration. Additionally, 16 children presented with elevated liver transaminases (AST and ALT). (Tab. 4)

Finding	**Number of Patients**	**Percentage (%)**
Leukocytosis	48	50%
Elevated CRP	32	33.3%
Electrolyte disturbances (Na/K/Cl)	56	58.3%
Elevated urea and creatinine	32	33.3%
Elevated liver enzymes (AST/ALT)	16	16.7%

Table 4. Laboratory Findings

Stool cultures (coprocultures) were performed in 32 patients. Pathogenic microorganisms were isolated in 8 of these cases: *Staphylococcus aureus* (6 cases), *Campylobacter jejuni* (2 cases), *Salmonella spp.* (1 case), and *Escherichia coli* (1 case). (Tab. 5)

Pathogen Isolated	**Number of Positive Cases**
Staphylococcus aureus	6
Campylobacter jejuni	2
Salmonella spp.	1
Escherichia coli	1
No growth / negative	22

Table 5. Coproculture Results (n = 32 tested)

Of the 96 children, 24 required intravenous rehydration with isotonic saline and glucose-based solutions, with the volumes adjusted according to the degree of dehydration and clinical status. Children presenting with a high fever were treated with antipyretics, including paracetamol or ibuprofen, depending on the severity of the fever. In four cases, antibiotic therapy with azithromycin (10 mg/kg/day for 3 days) was administered due to clinical indications.

The remaining 72 children were managed using oral rehydration therapy (ORS) with pre-prepared electrolyte solutions to correct fluid and electrolyte imbalances. Parents were advised to temporarily avoid giving children high-fat foods and dairy products, and were instructed to administer probiotics (e.g., *Linex*, three times daily, or *Lactobacillus GG*) to support intestinal microbiota restoration. The reintroduction of a regular diet was recommended as early as tolerated, using small, frequent feedings.

Four of the children included in the study were exclusively breastfed at the time of intoxication. Their mothers were advised to continue breastfeeding without interruption, as breast milk provides both hydration and immunological protection. (Tab. 6)

Treatment Modality	**Number of Patients**	**Percentage (%)**
IV fluids (NaCl + glucose)	24	25%
Antipyretics (paracetamol/ ibuprofen)	Most febrile cases	–
Antibiotics (Azithromycin)	4	4.2%
Oral Rehydration Solution (ORS)	72	75%
Probiotics (e.g., Linex, Lactobacillus GG)	Majority	–
Continued breastfeeding	4	4.2%

Table 6. Treatment Approaches

Educational guidance was provided to all parents regarding the importance of improved hygiene at home, including the prevention of insect presence in food storage areas, as insects can act as vectors for foodborne pathogens. Parents were also encouraged to teach and reinforce proper handwashing practices among children, particularly before meals.

Discussion

Foodborne intoxications in children represent the most common cause of pediatric illness and doctor visits, especially during summer months, both in developing and developed countries, including the USA. Although all pediatric age groups can be affected, morbidity is much higher in children under 5 years old [16].

Several factors can explain this increased vulnerability: the decline of maternal passive immunity; the introduction of complementary foods after weaning, which may be contaminated or insufficiently heat-processed; and young children's tendency to put foreign objects in their mouths. These behaviors facilitate the ingestion of pathogens or toxins, leading to digestive infections or foreign-body contamination during the crawling stages. [17]

In this age group, the incidence is higher in boys than in girls, likely because boys are generally more active and tend to play outdoors more frequently.

Two main types of foodborne contamination cause gastrointestinal intoxications: microbiological agents and food toxins. Microbial contamination often stems from improper heat treatment, prolonged time between cooking and consumption, and vector contamination (e.g., insects, rodents, pets). It can also arise from the use of unclean utensils (such as plates, glasses, and spoons) or inadequate hygiene during transport, especially when cold-chain standards are not followed [18, 19, 20].

Toxins may be produced by pathogenic microorganisms (e.g., preformed toxins from *S. aureus*, *C. perfringens*) or they may be chemical additives and preservatives [21, 22].

A key preventive measure is the disinfection of surfaces in contact with food, not only in kitchens but also in eating areas, especially in preschools and schools. [23]

The most frequently implicated bacteria in foodborne contamination include *Salmonella, Escherichia coli, Listeria monocytogenes, Campylobacter,* and *Vibrio vulnificus* (MDPI, 2020). Studies have shown that some *E. coli* strains can contaminate both animal and plant-based foods, often through the use of contaminated water during rinsing (Fonseca et al., 2011). Infections from *E. coli* can be severe, leading to high morbidity, treatment challenges, renal failure, and rare fatalities in children [23, 24, 25]

Other pathogens include *C. perfringens, S. aureus, L. monocytogenes, B. cereus, Toxoplasma, Shigella,* and *Entamoeba histolytica*. *Campylobacter* stands out for its severe clinical presentation, characterized by intense abdominal pain, diarrhea, vomiting, and fever [27, 28, 29].

Although viruses do not produce toxins in the classic sense, they often cause clinically similar foodborne illnesses. Transmission occurs via contaminated food, water, or unclean hands. Noroviruses are the most common, highly contagious, and frequently cause outbreaks in communal settings, such as canteens, schools, and daycare centers [30, 31, 32, 33, 34, 35].

Toxins may originate from microbial growth, food spoilage, or the addition of chemicals such as additives and preservatives. Primary toxin producers include *Salmonella spp., S. aureus, V. parahaemolyticus, C. botulinum, C. perfringens, V. cholerae,* and *Listeria monocytogenes* [36, 37, 38, 39].

There are many measures to prevent food poisoning, the most important of which are: proper heat treatment of all foods, thorough washing of fresh produce (fruits and vegetables) with clean water, regular hand washing before eating, especially in young children—it is crucial.

Multiple controlled trials show that teaching caregivers to wash their hands at key times significantly reduces diarrheal incidence in children under five by 35–50%. Socioeconomic status, family hygiene, and access to a regular clean water supply are strongly correlated with a reduction in foodborne illnesses in children [40, 41, 42, 43, 44].

Management of foodborne infections focuses on correction of fluid and electrolyte imbalances. Mild cases are effectively treated with oral rehydration solutions (ORS) and increased fluid intake. Fatty foods or food suspected to be contaminated should be avoided.

For severe dehydration, intravenous fluids (0.9% NaCl or Ringer's) may be necessary. Antibiotics are typically not recommended unless a severe illness or comorbidities are present. For severe cases, stool cultures guide antibiotic use, preferably with ciprofloxacin or azithromycin.

Antibiotics can prolong bacterial carriage and increase the risk of complications, especially in *E. coli* infections. In viral gastroenteritis, antibiotics play no role, and in cases involving preformed bacterial toxins (e.g., *S. aureus*, *C. perfringens*), they are also ineffective [45, 46, 47, 48, 49, 50].

Conclusion

Our study, consistent with numerous investigations conducted both in developing and developed countries, demonstrates that foodborne intoxications are among the most common disorders during the summer season, particularly in children. Our clinical experience suggests that bacterial pathogens and their associated toxins are the most frequent causes of foodborne intoxications, while viral pathogens are less commonly implicated.

Management is primarily supportive and involves the administration of fluids and electrolyte solutions, such as Tresol or Oral Rehydration Solution (ORS), typically administered orally; however, in more severe cases, intravenous rehydration is required. The use of antibiotics is generally not indicated in foodborne intoxications, except in cases where symptoms persist for several days and the child's condition deteriorates.

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