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Causative agents and chemotherapy for food poisoning

Moke Emuesiri Goodies ^{1,*}, Edje Kesiena Emmanuel ¹, Toloyai Pere-Ebi Yabrade ², Anachuna Kenneth Kelechi ³ and Ifezue Chiamaka Rachael ¹

¹ Department of Pharmacology and Therapeutics, Delta State University, Abraka, Delta State, Nigeria.

² Department of Medical Biochemistry, Delta State University, Abraka, Delta State, Nigeria.

³ Department of Human Physiology, Delta State University, Abraka, Delta State, Nigeria.

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Abstract

Food-borne diseases remain a major public health problem across the globe. This challenge is more severe in developing countries because of lack of proper personal hygiene and food safety measures. It is as a result of the intake of food or water contaminated with bacteria and/or their toxins, or with parasites, viruses, or chemicals. One way of avoiding food-borne illness is to practice proper personal hygiene and safe steps in food handling, cooking, and storage. Treatment of food poisoning includes use of antidiarrhoea, anti-emetic and antimicrobial therapy. Electrolyte replacement is also important to ensure dehydration does not occur. This review intends to explore information on the causative agents of food poisoning, as well as how drug therapy could be applied.

Keywords: Food poisoning; Causative agents; Hygiene; Toxins

1. Introduction

Food-borne diseases are still a major public health concern across the globe. This problem is very severe in developing countries because of lack of personal hygiene and food safety measures [1]. It was estimated that globally 600 million people (almost 1 in 10) fell ill in 2010 from eating food contaminated by these agents, resulting in 420,000 deaths. Thirty percent (30%) of all deaths from food-borne diseases are children under 5 years of age [2]. The outcomes of food poisoning in Africa are not adequately documented and the actual burden of food poisoning is unknown due to a deficiency of surveillance systems and population-based studies

Food poisoning is defined as an illness caused by the consumption of food or water contaminated with bacteria and/or their toxins, or with parasites, viruses, or chemicals [3]. It is usually confused with food allergy and food adverse effects, which are, respectively, an immune-mediated reaction and a clinically abnormal response, ascribed to an exposure to a food or food additive [4]. It is a fallout from exposures to toxic agents present in the food which may lead to delirious effects following the reaction of the body to these agents or the food itself [5]. Contamination usually arises from improper handling, preparation, or storage of food or drinks. The routes by which these toxins gain entry to the body may be through ingestion, contact or transdermal, or inhalation.

Most common microorganisms involved in food poisoning include bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Clostridium botulinum*, *Bacillus cereus*, *Vibrio cholerae*, and *Shigella* species amongst others. Other microorganisms may also include *Norovirus* and *Rotavirus* as well as parasites such as *Giardia* spp. and *Cyclospidium* spp. [6]. Some foods are more predisposed to in being potential carriers of food-poisoning microorganisms; they include milk, raw meat, seafood, poultry, and raw vegetables. Furthermore, substances released in foods by insects, bacteria or other living microorganisms, hence called “toxins”, may also cause food poisoning [7, 8].

* Corresponding author: Moke Emuesiri Goodies

The symptoms caused by food poisoning are varied from mild to severe or even fatal one such as death. General symptoms are nausea, vomiting, diarrhoea and abdominal pain, headache and sometimes fever may also occur [9]. If these symptoms continued, it would cause dehydration and electrolyte imbalance. Fatality of food poisoning increases in patients with chronic illness, dehydration and electrolyte disorders [10].

2. Causative agents of food poisoning

2.1. Bacterial toxin poisoning

Bacterial toxins are virulence elements that manipulate host cell functions and take over the control of vital processes of living organisms to favor microbial infection [11].

- *Clostridium botulinum* [12]
- *Clostridium perfringens* [13, 14]
- *Staphylococcus aureus* [15, 16]
- *Bacillus cereus* [17, 18].

2.2. Mycotoxin poisoning

Mycotoxins are metabolites of fungi (molds), which cause both animal and human disease. Mycotoxins are toxic products of fungi, not mushrooms. The best known mycotoxins are aflatoxins, ergot derivatives, ochratoxin A, fumonisin, and deoxynivalenol [19].

2.3. Phytotoxin poisoning

Phytotoxins are toxins produced by plants. Phytotoxin poisoning occurs as a result of the intake of non-edible plants, to the consumption of insufficiently prepared plants or to plant toxins resistant to the food preparation process. Phytotoxin includes alkaloids, terpenes, glycosides, tannins, and phenols [20, 21].

2.4. Chemical food poisoning

Chemical food poisoning occurs owing to a pre-contamination of plants or animals by heavy metals (lead, cadmium, mercury) which are consumed by humans. A wide range of clinical manifestations is seen depending on the chemical substance involved in poisoning. These toxic chemical products may be added directly during the food preparation process as have been seen in some cases [22, 23].

3. Treatment of food poisoning

Treatment of food poisoning is divided into;

- Symptomatic treatment (medications)
- Supportive therapy (Oral Rehydration Therapy)

3.1. Symptomatic treatment

3.1.1. Anti-diarrhoeas

- Absorbents (e.g. attapulgite, aluminum hydroxide): Attapulgite is an oral, non-absorbed medication that is used in the management of diarrhoea. Its mechanism is by adsorbing (binding) large numbers of bacteria and toxins and reducing the diarrhoea. Attapulgite lessens the number of bowel movements, improves the consistency of loose or watery stools, and relieves the cramping which is associated with food poisoning [24].
- Antisecretory agents (e.g. bismuth subsalicylate): Bismuth adsorbs extra water in the bowel during diarrhoea. It also adsorbs toxins and forms a protective coating for the intestinal mucosa [25].
- Antiperistaltics (e.g. loperamide): Loperamide is useful in the treatment of diarrhoea and irritable bowel syndrome because it inhibits intestinal secretion and peristalsis, thereby reducing the intestinal transit time and permitting more fluids and electrolytes to be absorbed; at rest, it improves anal sphincter tone, hence, it has minimal effect on the pain associated with irritable bowel syndrome [26].

3.1.2. Anti-emetic: promethazine, metoclopramide

Promethazine is a first-generation antihistamine. It is an H₁-receptor antagonist with antiemetic and sedative properties [27]. Metoclopramide is a dopamine antagonist used to treat the symptoms of slow stomach emptying (gastroparesis). It increases the movement of the upper gastrointestinal tract without increasing secretion. It relieves symptoms such as nausea, vomiting, heartburn, a feeling of fullness after meals, and loss of appetite.

3.1.3. Antibiotics: (e.g. tetracycline, ciprofloxacin, norfloxacin, co-trimoxazole, doxycycline, rifaximin).

Ciprofloxacin (a fluoroquinolone) is a broad-spectrum antibiotic which is active against both Gram-positive and Gram-negative bacteria. It inhibits bacterial cell division by inhibiting DNA gyrase, and a type II topoisomerase, topoisomerase IV, necessary to separate bacterial DNA [28].

3.2. Supportive therapy

Oral rehydration therapy (ORT) is a form fluid replacement useful in the prevention and treatment of dehydration, particularly in diarrhoea. It involves drinking water with modest amounts of sugar and salts, specifically sodium and potassium and this is to make up the salt water deficits and to replenish lost nutrients [29]. The risk of death associated with diarrhoea has been estimated to decrease by about 93% with use of oral rehydration solution and recommended home fluids [30].

4. Conclusion

The occurrence of food-borne disease still maintain a high despite our society's advances in sanitation, food preservation, and hygiene. Hence, there is need to advocate continuous practice of proper personal hygiene and safe methods in handling, cooking, and storage of our food so as to prevent food poisoning. Also, appropriate drug therapy should be employed.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have declared that no competing interest exists.

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