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Review paper

Food Poisoning in Africa: A Silent Epidemic in Recent Era of Global Food Traffic

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ABSTRACT: Food poisoning is caused by consuming food contaminated with microbial or non-microbial contaminants. These contaminants can cause disease symptoms such as acute gastroenteritis, and in the worst-case scenario, death due to consumption of contaminated food or drink. Living bacteria, their toxins, or toxic chemical substances derived from plants and animals can all cause contamination. Africa is densely populated, but it is the poorest continent, with a high rate of resource mismanagement and slow development. Population growth, policy changes, weak institutions, poor infrastructure, and climatic factors all contribute to insufficient food production and food insecurity in many African countries. Food imports to the African continent are necessary, but they are poorly regulated. Food poisoning can occur as a result of the risks associated with food import. In South Africa, outbreaks of listeriosis occurred in three provinces: Gauteng (581 cases, 59%), Western Cape (118 cases, 12%), and KwaZulu-Natal (70 cases, 7%). Diseases were discovered in 674 patients, with 183 (27%) of them dying. Food poisoning outbreaks caused by Vibrio cholera, Shigella flexneri, Bacillus anthracis, and E. coli O157 H7 occur in several African countries. Food poisoning caused by food import is one of the reasons for the region's low economic growth. The costs of illness and death are high for individuals, families, and countries' health-care systems. Government policy should be regulated to protect the public from the importation of low-quality products and to prevent food poisoning.

Keywords: Food poisoning, food poisoning agents, food traffic and economic factor

INTRODUCTION

Food poisoning is characterized by the consumption of contaminated food, which attacks many people who consumed the food at the same time with similar signs and symptoms in most cases (Park, 2017). According to the World Health Organization, there are more than 1000 million cases of acute diarrhea in developing countries each year, with 3-4 million deaths (WHO, 2015).

Additionally, according to the Food Standards Agency (FSA), there are an estimated 900,000 incidents of food poisoning each year. Over the past century, changes in human behavior have led to an increased reliance on prepared foods. Nowadays, dining out, at work, or while traveling is more frequent than cooking at home. We lead busy lives and as a result, we spend less time preparing food. Regularly, some people prepare large quantities of food to improperly freeze them in advance for a longer period of time or buy food that will only be heated in a microwave, which is the main cause of the current rise in food poisoning cases. Ehiri *et al*. (2001) found that all food products reached temperatures capable of destroying vegetative spp.

Understanding the origin of the food and the criteria for safety precaution will help to reduce the occurrences of food poisoning. According to the data currently available, food poisoning cases are more prevalent in impoverished and emerging nations; yet, it also happens in industrialized

nations. For precautions to be taken, it is important to raise public awareness of food poisoning and its causes (Zyoud *et al*., 2019). This review focuses on the agents that cause food poisoning, the movement of food, and the socioeconomic effects of food poisoning in the African region.

Food poisoning agents

There are four types of contaminants in food: microbial, chemical, physical and allergenic agents. Microbial agents include bacteria, fungi, and viruses, and chemical agent contamination can occur from kitchen cleaning and disinfection products. Furthermore, fertilizers and pesticides can contaminate food, and some high concentrations of harmful chemicals are used as food preservatives or additives (Kumar, 2020).

Allergen is a substance found in both plant and animal foods that, when consumed in small amounts, activate allergic mechanisms in the person's body, and the substance is known as allergen for such people and phenomena as allergy. Some foods, such as fish, nuts, milk, cereals, and eggs, can cause allergic reactions in some people. Skin rashes are the most common allergic symptoms. Some people have difficulty breathing, cardiovascular issues, and severe abdominal cramps (Kumar, 2019).

Microbial agents are the most dangerous contaminants, with a large number of pathogenic bacteria known, but only a few bacteria contaminant food cause food poisoning (Mayounga, 2018). Food processing can take many forms, beginning with sowing and ending when the food is ready to eat at home or in a restaurant. The stages of processing are referred to collectively as the food chain production. Despite precautions taken during the food preparation process, pathogenic microorganisms have the potential to contaminate food (Kumar, 2019). The nature and level of microbial contamination in food are determined by its origin, which includes both plants and animals. The common bacteria pathogens contaminating food are among others *Escherichia coli, Staphylococcus aureus, Clostridium botulinum, Salmonellatyphimurium, Vibrio parahaemolyticus* and *Campylobacterjejuni* which enter into human body through ingestion of contaminated food and water (Kumar, 2019). *Escherichia coli* and *Salmonellatyphimuriuma* have been found in manure: strains of *E.coli* are resistant to acids, allowing them to survive in the colon and stomach of animals and humans, particularly those that survive on grains feed. According to Fonseca *et al*., (2011), the pathogenic strain of *E. coli* 0157:H7 that reaches lettuce via water irrigation, which is also present in veges, fruits, and animal food, contaminates the body of water if fecal substances are present in its surroundings. *E.coli* 0157:H7 is dangerous and can be fatal because it causes diarrhea, abdominal cramps, vomiting, colitis, and kidney failure (Kumar, 2020). Particularly in infants and children. *Campylobacter* spp. is another bacterial species that causes food poisoning in contaminated food. Wild animals in farm environments have been reported as carriers of *Campylobacter* spp., and food products can be contaminated during harvest. According to one source, the major sources of food contamination during harvest are equipment, instruments and vehicles such as choppers, knives, boxes trailers, and truck beds (Kumar, 2019). The symptom for these pathogenic bacteria includes diarrhea, vomiting, fever and abdominal cramp etc. When poultry is fed with feed contaminated by bacteria, such poultry eggs and meat can be poisonous and contaminated surrounding environment can poison poultry animals and their feeds too. Contaminated material used for packaging of foods can result in food contamination. Certain species of pathogenic bacteria are reported as food contaminants in food chain production. Examples of such microorganisms that contaminate foods and can lead to food poisoning includes *Staphylococcus aureus, Listeria monocytogenes, Shigella* spp*., Clostridium* spp*., Bacillus cereus, Clostridium perfringens, Toxoplasma gondii* and *Entamoebahistolytica* (Kumar, 2019) and status of microbial contamination of food substance was discus as reported by Bintsis, (2018).

Bacillus cereus is responsible for global food contamination as reported by Zeighami *et al*., (2020). Samples of 200 various meats were collected from retailers' factories and eateries' in Zanjan and Iran to examine the occurrence of hemolysin BL(B, L1 and L2 together possess cytotoxic, dermonecrotic and vascular permeability activities) and non-hemolytic enterotoxin genes. It was discovered that uncooked meat samples 14.1% and raw meat samples 15% carried the pathogenic bacteria *Bacillus cereus*, and 89.6% of the isolates had one or more enterotoxin genes.

It have also been reported by Kumar, (2020) that number of virus enter human body through contaminated food to cause diseases. The common virus responsible for food poisoning cases is norovirus, other viruses species reported to enter human body through contaminated food include *Rotavirus, Astrovirus* and *Hepatitis* virus by (Kumar, 2019).

Chemical contaminants and toxins

Food poisoning occurs when certain poisonous substances are present in food, either naturally or through the addition of other substances. Food preservatives such as nitrite in cure meat, benzoic acid in fruit juice, sodium benzoate in fatty foods, and others are frequently added to foods and, when consumed in large

quantities, act as a poison. Poisonous substances in the environment can enter the human body via absorption, ingestion, and breathing and cause adverse effects. Food poisoning can result in disability and other diseases as a result of toxins produced by bacteria or present in food, and diseases caused can include toxic shock syndrome, diarrhea, and debilitating infections such as meningitis, which can also result in death (Kumar, 2019).

Presence of bacteria in food substances can develop virulence factors responsible for infection of food, certain bacteria species produced poisons on food substances directly while some produced poisons after they are colonized in the intestine of humans. Examples of pathogenic bacteria include *Clostridium perfringens, Vibrio parahaemolyticus, Bacillus cereus and Listeria monocytogenes* (Kumar, 2020).The way to avoid food poisoning isto consume a properly cooked diet. Raw foods like fruits and veges are consumed without cooking, and can be sources of microbial contamination that can cause food poisoning (Kassahun and Wongiel, 2019). Therefore, it is advisable to wash the raw foods with clean water before consumption to remove microbial contamination. To destroy contaminants, veges can be boiled or steamed before consumption. Hand washing is recommended before handling any food products for consumption, especially after using the toilet, because microbes present in fecal material can contaminate food. Eggs and meat, milks and other dairy products have been reported to be frequently contaminated with microbes, so it is critical to properly cook these products before eating. For food preparation, good sources of drinking water should be used; however, when a water-pipeline is closed to fecal matters or dirty water, such water can contaminate the food prepared with it.

Zyoud *et al*. (2019) conducted a study with socio-demographic characteristics on food security information, approaches and preparation, in the Nablus district of Palestine. The families of four hundred and twelve were cross-examined, in which 92.7% were parents. The data was collected between May to July 2015, and conclusion was made based on knowledge, attitudes and practices measures to avoid food poisoning among their children and influenced by variables of socio-economic. Based on data collected health education and general awareness programs was recommended to teach mothers to practice food safety measures in a strict manner to increase their knowledge level on avoiding food poisoning.

Food imported into Africa countries

Food handling and transportation methods without proper safety precautions exposed the food to hazards, which disproportionately affect African countries by causing food poisoning to consumers of such hazardous food products. Certain malnutrition, food insecurity, and comorbidity conditions can increase the vulnerability of an unsafe product.

The structural level of a number of social factors like trade, migration, education, gender, ethnicity, Urbanization, demographic factors and poverty indicate unfairness in relation to safety of food products imported into Africa countries which result into outbreak of food poisoning like *Vibrio cholera, Shigellaflexneri, Anthrax and E.coli O157* continue to occur in several countries (Mensah *et al*., 2012). Outbreak of *Listeria monocytogenes* sequence Type 6 occur in Africa region as a result of consumption of ready to eat meat products processed called Polony (WHO, 2018).

Factors responsible for food traffic into Africa from developed countries

Low Agriculture yield and productivity

The low agricultural yield is not a perfect measure of agricultural productivity, but it does raise awareness about the low levels of agricultural productivity in Africa. As a result, agricultural production in African countries is low in comparison to the rest of the world, particularly in staple foods such as vege oils, dairy, cereals, and meat. Agriculture production in African countries has grown slowly, resulting in an increase in food imports into several African countries, both good quality food products and lower quality products that can cause food poisoning. Agriculture yields are a major reason for low growth in food productivity in the African region. It is necessary to comprehend why agricultural productivity is generally low. The three main technical causes of low agricultural productivity in Africa are: limited access to essential inputs and equipment (Malley *et al*., 2009); slow transfer and adoption of technology (Maitima *et al*., 2010); and negative supply shocks such as natural disasters and diseases (Sultan and Janicot, 2006).

Lack of physical infrastructure, service and low investment

Low agricultural yield is a major cause of weak domestic supply in Africa, while in some cases the local manufacturer is elevated but does not reach the buyers due to a lack of substructures such as streets, transportation, laboratory capacity, safe storage, sanitary facilities, electric power, and effective processing equipment within their country region.

According to Ndulu and O' Connell (2008), Africa's skill and development have been hampered by its isolation. The African region is not well connected to the rest of the world, and even within the African region, towns, metropolises, and communities are inaccessible to each

other. This isolation is due to a lack of infrastructure, which acts as an impediment to trade and lower food supply to rising food demands by African Wanmali and Islam (1997).Finance and capital reduce domestic food production in Africa countries, resulting in a lack of investment, while the estimated levels and development of both public and private farming investment in Africa countries remain low in comparison to the rest of the world. Although wealthy individuals are increasingly interested in agriculture investment, agricultural resources have hampered them (Von cramon Cramon-Taubadel *et al*., 2009).

Institutional deficiencies, insecurity and conflicts

The issue of institutional deficiencies, insecurity and conflicts in Africa countries disturb not only the food production; but, even consumers' choices and favorites are also affected based on production side, Fulginiti *et al*., (2004) show that in Sub -Saharan Africa foreign culture, conflicts, absence of political and economic liberty and conflict have had major effect on agriculture production. While on the consumption side, a lack of organization that protects consumers' rights and controls the safety and quality of food distributed in the markets of several African countries, particularly the wealthier ones, has encouraged access to cheaper foreign products whose quality is occasionally questioned (Henson *et al*., 2000; FAO/WHO, 2003; Bagumire *et al*., 2009), which is depositing of expired food products in African countries. As a result, these factors contributed to food trade deficits and food poisoning in several African countries.

Possible solution to Food Importation into African countries

The government should involve food safety in health plan policies for national development, to harmonize the national legislation that is directed by standard and international norms to reinforce national analytical capacity through capacity building, proper training and creation of quality assurance procedure and protocol which include food poisoning surveillance. Then national structure develop for research and work towards creation of WHO collaborating centers as centers of excellence, work with industry involving food vendors on the street to realize their responsibility in assuring the safety of the food products and also to encourage voluntary and application for correct method to food safety in terms of food importation, create variety of methods to improve consumer participation and consciousness in food safety activities with dedication to education of consumers.

Access to nutritious and safe food is a basic human right; it is critical to use the same standards for local food consumption and exports; and it is critical to ensure food safety for imports, exports, and locally produced food for consumers. This responsibility is shared by all relevant authorities, who must implement a farm-to-work method to reduce the burden of food poisoning-related incidents in Africa (Mensah *et al*., 2012).

OUTBREAK OF FOOD POISONING IN AFRICA COUNTRIES

WHO record of Africa region on food poisoning outbreak

A blood-stained diarrhea outbreak caused by Escherichia coli 0157 infections occurred in South Africa with a rate of 42% attack among 778 residents examined (WHO, 2015), and the main precipitating factors were consumption of beef and untreated water; in Swaziland and South Africa, E.coli O157: NM was recovered from seven foci affected, and the isolate from 27 patient out of 31 patient and environment samples had a distinct pulse filed gel of electrophoresis arrangement.

The outbreak is exacerbated by a major issue, which is drought, which causes increased carriage of E. coli O157 through heavy rains, cattle dung, and contaminated surface water (Effler *et al*., 2001). In Ghana in 2001, there were two outbreaks. The first affected forty-six Ghanaians who attended an interment and ate a saucer called appraisal made with roasted maize flour, palm soup, fish and crabs, and were hospitalized with vomiting and diarrhea. In the second occurrence, 20 people who ate rice balls with palm soup or maize dumplings with okra stew were hospitalized with vomiting and diarrhea, but the expected cause for both occurrences was not found (www.ghanaweb.com). Anthrax outbreaks caused by sick animals occurred in many African countries. In 1976, approximately 155 people in a Western Uganda village ate a dead zebu cow, which was later discovered to have died from anthrax septicemia. Mensah *et al*., (2012) and within 15-72 hours, approximately 143 people developed acute gastroenteritis, resulting in the death of nine children.

In 2005, the African regional office was informed that a total of 601 cases and 12 deaths from anthrax had occurred in Tanzania, with only one case and no disease, in Zimbabwe, with 470 cases and six deaths, and in Burkina Faso, with 130 cases and six deaths, but the source of infection was not reported.

The outbreak of cholera in Mali in 1984 resulted in 1,793 cases and the deaths of 406 people. Case studies identified two ways diseases can be transmitted: drinking unsanitary water from the village's largest well and consuming leftover millet food in drought-stricken areas (Mensah *et al*., 2012). Cholera is common in many countries. However, there is evidence to suggest that sick

Table 1: Selected cases of food borne diseases associated with food traffic.

Country/Region	Causative agents	Fatality/Mortality	References
South Africa	*E.coli O157*	778/0	Effler *et al*.,2001
West Uganda	*Anthrax septicemia*	155/0	WHO,2015
Zimbabwe	*Anthrax*	470/6	Mensal *et al*., 2012
Tanzania	*Anthrax*	1/0	Mensal *et al*., 2012
Mali	*Vibrio cholera*	1,793/406	WHO,2015
S/Africa	*Shigellaflexneri*	579/0	Vosloo *et al*.,2021
S/Africa	Aflatoxicosis	317/0	Ashiq, 2015
Uganda	*Vibrio cholera*	48/2,544	WHO, 2015
Mozambique	*Vibrio cholera*	7/647	WHO, 2012
Nigeria	Lassa fever	92/869	WHO,2012
Togo	Yellow fever	10/0	WHO, 2015
Zimbabwe	*S.typhi*	4,266/0	WHO,2012
Chad	Meningococcal meningitis	154/3636	WHO,2012
Zimbabwe	*Vibrio cholera*	0/16	WHO, 2015
Burkinafaso	*Anthrax*	6/130	WHO,2007-2015

people handling and preparing food with physiochemical features of diet that support Vibrio growth, such as high moisture, alkali and/or neutral pH, and a lack of bacteria competition, contribute to the spread of *Vibrio cholera*. *Shigellaflexneri* outbreak in South Africa occurred in 2001, with 578 cases linked to maize meal contamination. Type A botulism occurred in 2002 as a result of spoiled tinned fish in tomato sauce, resulting in the deaths of two people (Vosloo *et al*., 2021). In 2004, a large outbreak of acute aflatoxicosis occurred due to the consumption of contaminated maize (Ashiq, 2015), affecting over 317 people and resulting in a 39% fatality rate.

An unprecedented number of diet-related outbreaks were reported to the African District Office in 2008, including those in Zimbabwe with anthrax, Uganda with typhoid fever and botulism, Kenya and Nigeria with chemically contaminated bean seed and maize, Senegal with pesticide-contaminated cabbage and other veges, Mauritius with salmonellosis caused by fish mice, Algeria with mushroom poisoning, Nigeria with diarrhea related to Gala dinner meal, Angola with bromide poisoning, and Zimbabwe with anthrax.

Outbreaks of diarrhea also occurred in Kenya, Congo, Madagascar, Comoros, Burundi, Uganda, Mozambique, and Botswana, though the major ones were Malawi with Shigellosis, Kenya with acute aflatoxicosis, and Konzo with DRC and Angola. Diarrhea outbreaks occurred in Kenya, the Democratic Republic of the Congo, Burundi, Uganda, Madagascar, the Comoros, Botswana, and Mozambique in 2009, with fewer cases of diet-related outbreaks occurring.

According to the WHO report from 2007 to 2015, the most important were Shigellosis in Malawi, acute aflatoxicosis in Kenya, and Konzo (acute paralysis) in the DRC and Angola (Table 1).

Socio-economic cost of food poisoning

Food poisoning costs are associated with illness and even death, resulting in a financial cost for a person's relationships and the country's health care system, as well as rejection by international trade.

The cost of human illness due to *Campylobacter jejuni, Clostridium perfringes, E.coli 0157:H7, Listeria monocytogenes, Staphylococcus aureus, Toxoplasma gondii*and *Salmonella* that cause 3.3-12.3 million cases estimated with up to 39,000 deaths which are USD 6.5-34.9million annually was estimated in 1995 (Aragrande and Canali, 2020). The outbreak-related with *Salmonella typhi*in Nauru in the South pacific cost was predict at USD 46,000 (Olsen *et al*., 2001). In the UK intestinal infectious diarrhea (IID) study by Rodrigues et al. (2000), the standard charge for each case of Salmonella is £606, Campylobacter is £315, and SRSV is £175. In England, the expected cost of IID was £743 million in 1994/1995 dollars. In Tanzania, there were approximately 40,000 cases of cholera in September and October 1997, representing a significant increase over the previous year's case count of 1,460 (273%). In 1997, approximately 2,200 people died, compared to 35 in 1996. The economic cost of the cholera epidemic was unexpected, amounting to USD 36 million during the outbreak period because Europe refused to accept fish imports from the region (WHO, 2010).In 1990, Food and Drug Administration destroyed food contaminated with *aflatoxin* that worth more than USD 200,000 in Nigeria (Bintsis, 2018).

Conclusion

In conclusion, the majority of food products imported into the African region from other nations are of lower quality

due to the use of lower quality, contaminated ingredients and/or an unsanitary environment to prepare the food product. This is leading to diseases outbreak and, in the worst cases, may cause more deaths among African region people than the epidemic occurring in their regions. In order to prevent food poisoning-related deaths and disease outbreaks in the African region, it is now advised that the government of Africa adopt regulations that will always permit inspecting the quality of food products imported into Africa regions.

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