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FOODBORNE DISEASES IN KENYA

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ABSTRACT

Objectives: To determine the occurrence of foodborne disease outbreaks in Kenya and the efforts employed to combat them.

Design: Cross-sectional survey.

Setting: Forty two districts in Kenya between 1970 and 1993.

Study subjects: Foodborne disease outbreak episodes due to *Staphylococcus aureus*, *Clostridium perfringens*, *Clostridium botulinum*, *Bacillus cereus*, *Escherichia coli*, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Listera monocytogenes*, chemicals, aflatoxin, plant and animal poisons.

Outcome measures: Number and aetiological causes of foodborne disease outbreaks reported in the study period.

Results: Thirty seven food poisoning outbreaks were reported to the Ministry of Health from various parts of the country in the study period 1970 to 1993, and only 13 of these involving a total of 926 people were confirmed to be due to particular aetiological agents. Foods that were involved included milk and milk products, meat and meat products, maize flour, bread, scones and other wheat products, vegetables and lemon pie pudding. A high number of food poisoning cases were treated as outpatients in various health facilities.

Conclusion: Under-reporting, inadequate investigation of outbreaks and inadequate diagnostic facilities suggest that foodborne disease outbreaks are more than is recorded by the Ministry of Health.

INTRODUCTION

Foodborne diseases are regarded as acute illnesses associated with the recent consumption of food, having normally a short incubation period and symptoms with gastrointestinal features, including vomiting, diarrhoea and abdominal cramps. In some cases, there may be neurological and other symptoms connected with the alimentary tract(1). These diseases are caused by a variety of aetiological agents including bacteria, parasites, viruses, fungi, chemicals, heavy metals, poisonous plants and animals. Bacteria are the most common cause of foodborne disease outbreaks. Those involved include *Salmonella* spp., *Bacillus cereus*, *Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens*, *Escherichia coli*, *Shigella* spp. *Campylobacter* spp. and *Vibrio cholerae*(2-4).

In Kenya, infections due to *Salmonella typhi*, *Salmonella paratyphi*, *Shigella* spp. and *Vibrio cholerae* are under constant surveillance by the Ministry of Health as they pose a serious public health hazard resulting in high morbidity and mortality. These diseases continue to be a problem with outbreaks being reported from various parts of the country. A number of other food poisoning agents have attracted little attention, although there are many newspaper reports of occurrence of foodborne illness

or deaths resulting from consumption of contaminated foods(5,6), uninspected meat(7) and some food crops such as cassava(8). This indicates the presence of a public health hazard that deserves more attention.

Mycotoxin food poisoning is important mainly due to aflatoxin involving cereals, pulses, nuts and other foods in Kenya. Fatal cases resulting from consumption of contaminated cereals with high levels of aflatoxin B₁ and B₂ have been reported(9). Muraguri *et al*(10) reported high levels of aflatoxin B₁, B₂, G₁ and G₂ in various foodstuffs including cereals, pulses and nuts meant for human consumption. This study investigated the occurrence of foodborne disease outbreaks in Kenya and efforts employed in combating the diseases.

MATERIALS AND METHODS

A cross-sectional survey was carried out using annual reports at the Ministry's Headquarters and medical and laboratory records available at various district hospitals. Records and reports were examined for specific outbreak episodes (symptoms, number of people involved, diagnosis and action taken), individual cases of poisoning and the diagnosis. Other sources of information included the Ministry's Health Information System (HIS) annual reports and the HIS statistical bulletins (1988-1993). Data were entered into a Microsoft excel computer package to perform descriptive statistics.

RESULTS

Thirty seven food poisoning outbreaks were reported to the Ministry of Health between 1970-1993, and only 13 of these involving a total of 926 people were confirmed (Table 1). The confirmed aetiological agents were *Staphylococcus aureus* (five outbreaks), *Clostridium perfringens* (one outbreak), *Clostridium botulinum* (two outbreaks), plant poisoning (three outbreaks) and chemical poisoning (two outbreaks). Twenty outbreaks involving 518 people were tentatively diagnosed to be due to *Staphylococcus aureus*, *Bacillus cereus*, salmonellae, anthrax, chemical poisoning, aflatoxin, plant poisoning and heavy metal poisoning (Table 2). Foods involved in the outbreaks included milk and milk products, meat and meat products, maize flour, bread scones and other wheat products, vegetables, and lemon pie pudding. Four outbreaks of unknown aetiology involving 29 people who had consumed maize flour, uninspected meat and other unknown foodstuffs were reported.

Table 1

Confirmed food poisoning outbreaks that were reported to the Ministry of Health between 1970-1993

Aetiological agent	No. of confirmed outbreaks	Total number of people involved
<i>Staphylococcus aureus</i>	5	883
<i>Clostridium perfringens</i>	1	7
Plant poisoning	3	16
Chemical poisoning	2	5
Botulism	2	15
Total	13	926

Table 2

Tentative diagnoses of twenty unconfirmed food poisoning outbreaks in Kenya between 1970 and 1993

Tentative diagnosis	No. of unconfirmed outbreaks	Total number of people involved
<i>Staphylococcus aureus</i>	2	192
<i>Bacillus cereus</i>	1	3
Salmonellosis	3	46
Anthrax	5	230
Chemical poisoning	2	5
Aflatoxicosis	2	24
Plant poisoning	1	11
Heavy metal poisoning	4	7
Total	20	518

Laboratory diagnosis relied mainly on bacterial culture of suspected food samples, vomitus and stool samples from outbreak victims. Anthrax was suspected in cases of consumption of uninspected meat. There was no analysis for bacterial toxins in food or patient samples. Chemical poisoning was suspected after consumption of maize flour products contaminated with diazinon and other organophosphorus insecticides. These chemicals were

being transported in the same vehicle with maize flour during which time there was spillage and contamination of bags containing maize flour. Plant poisoning involved consumption of vegetables (e.g "managu"), poisonous cassava variety and wheat flour that was contaminated with *Datura stramonium*. A total of 40630, 31647, 207941 and 28973 food poisoning cases were treated as out patients throughout the country in 1988, 1989, 1990 and 1991 respectively (Table 3). During the same period, 24 individual cases of plant poisoning were reported in Isiolo District, while 298, 142, 91 and 111 cases of chemical poisoning were reported in Nyeri, Nyandarua, Meru and Isiolo districts respectively. Six cases of heavy metal (mercury, lead and copper) poisoning were also reported in Muranga, two in Meru and two in Isiolo districts.

Table 3

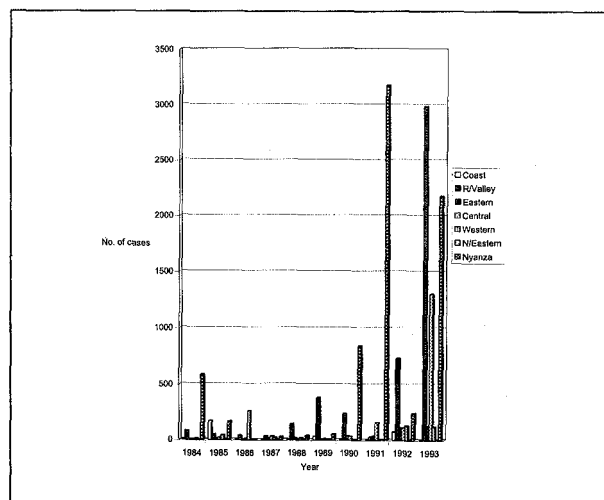
Outpatient poisoning cases treated between 1988-1991 by province

Province	1988	1989	1990	1991
Central	29,426	13,850	195,269	19,254
Coast	2,251	1,539	1,256	770
Eastern	651	5,011	3,263	316
N/Eastern	616	396	1,005	30
Nyanza	460	4,317	2,461	1,043
Western	151	452	809	1,697
R/Valley	7,075	6,005	3,289	5,300
Nairobi	-	77	586	563
Total	40,630	31,647	207,941	28,973

Nyanza Province led in the number of reported cases of typhoid fever (7317) in the period 1984 to 1993 followed by Rift Valley (4708) and Central Provinces (1683), respectively. The annual number of reported cases between 1985 and 1989 (inclusive) was relatively low but the picture suddenly changed with a sharp increase from 1990 (Figure 1).

Figure 1

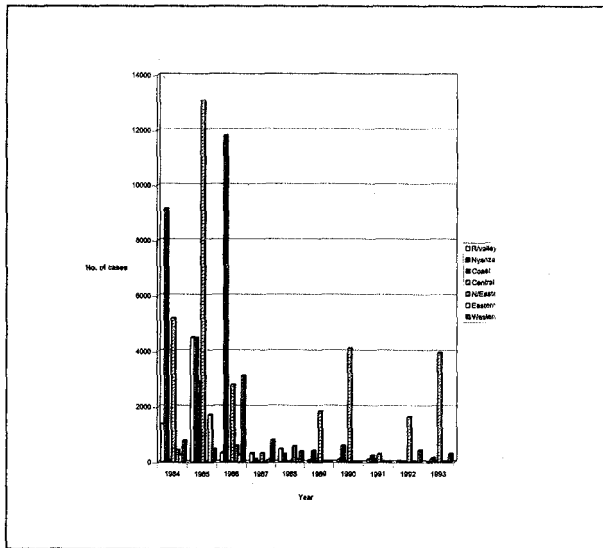
Prevalence of typhoid fever in the period 1984-1993 by province



The prevalence of dysentery/shigellosis in the period between 1984 and 1993 by province is shown in Figure 2. The bulk of the cases were reported between 1984 and 1986. The highest number came from Central Province (33189) mostly Kiambu (14904), Nyeri (9983) and Nyandarua (5757) districts. Nyanza Province followed with 27192 cases, majority of which came from Kisumu (18681) and Siaya (6976) Districts. Ninety seven per cent of the reported cases in the Coast province were from Mombasa district and these were only in 1984 and 1985.

Figure 2

Prevalence of dysentery/shigellosis in the period 1984-1993 by province



In Western Province, dysentery/shigellosis was reported from all the three districts, and mainly between 1984 and 1988. Few cases were reported in 1992 and 1993 in Busia District. Ninety per cent of the cases of dysentery/shigellosis recorded in Eastern Province were from Marsabit District between 1984 and 1986.

Figure 3

Prevalence of cholera in the period 1984-1993 by province

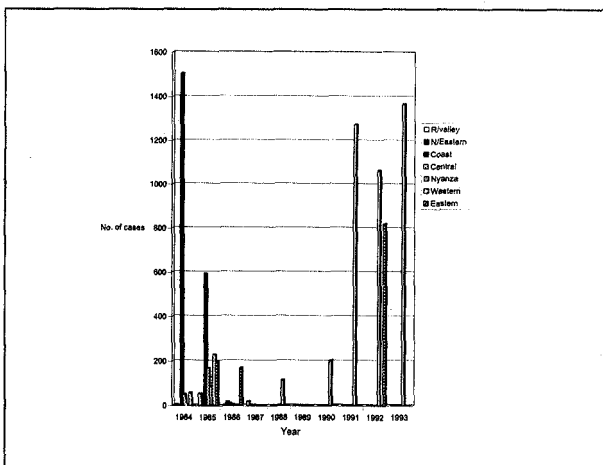


Figure 3 shows the prevalence of cholera from 1984-1993. Nyanza Province led in the number of cases followed by Coast and Eastern Provinces, respectively. Seventy five per cent of the cases reported in Nyanza province occurred in Kisumu District, 17 % in South Nyanza and 7.4 % in Siaya District. Ninety five per cent of the cases were reported between 1984 and 1987 (Figure 4). Cases of human anthrax showed a decreasing trend over the years with 1984 recording the highest number (Figure 5). The disease was reported sporadically from a number of districts in the country, but most of the cases were from Narok and Kajiado districts.

Figure 4

Prevalence of cholera in Nyanza Province in the period 1984-1993 by district

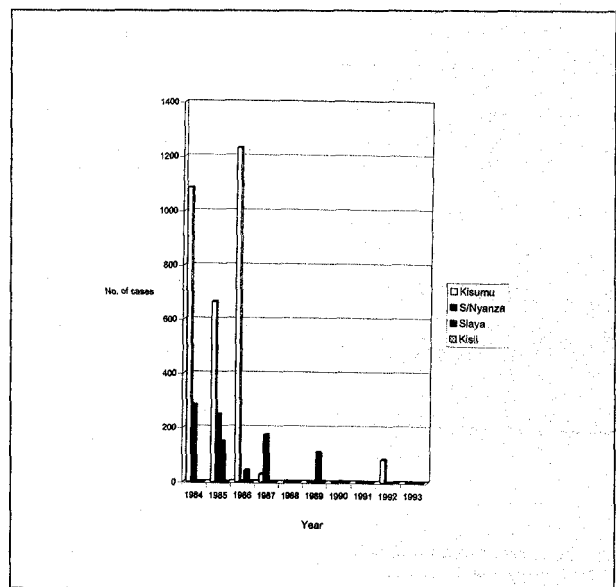


Figure 5

Number of human anthrax cases in the period 1984 to 1992

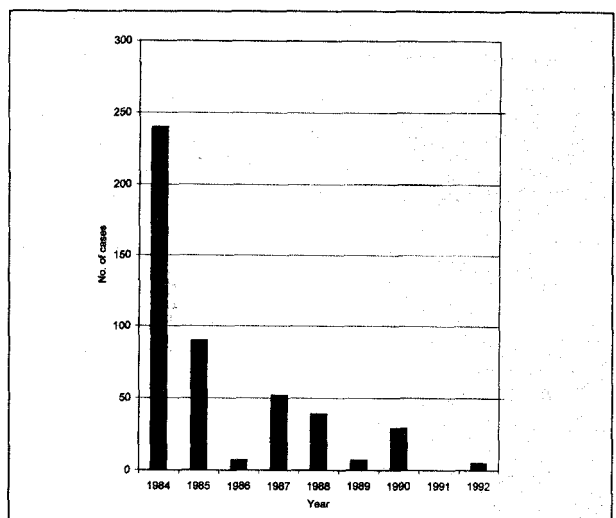


Figure 6

Prevalence of taeniasis in the period 1984-1993

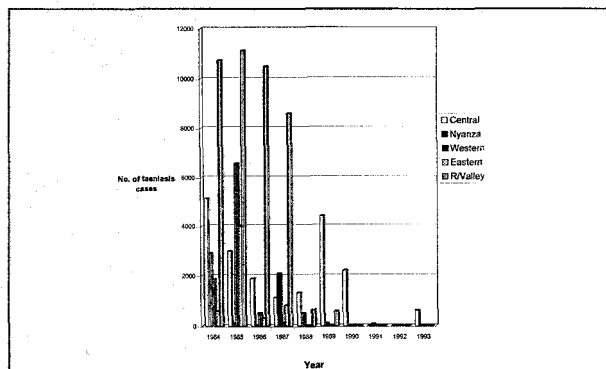


Table 4

Total number of various groups of parasites diagnosed at various health facilities in Kenya in the period 1989-1990

Parasite	Number of cases diagnosed	
	1989	1990
Tapeworms	5,100	2,256
Hookworms	15,262	14,825
Roundworms	18,667	18,274
Amoeba	43,023	37,086
others	8,941	7,536

The records also showed a high prevalence of intestinal parasites. Various specific groups of parasites diagnosed at various health facilities in 1989 and 1990 are shown in Table 4. Amoeba was the leading cause of intestinal parasites followed by roundworms, hookworms and tapeworms, respectively. The absolute number of cases of intestinal worms treated nationally in 1988, 1989, 1990 and 1991 were 788455, 997866, 762630 and 713045, respectively. The number of cases of tapeworm infestation treated in the various provinces are shown in Figure 6. Most of these cases were reported between 1984 and 1990 with few (613) reported later in 1993 from Nyandarua District alone. Nyeri reported over 70% and Nyandarua over 24 % of all the cases in Central Province. Kakamega District accounted for 79.6 % and Bungoma 20.4% of the cases reported from Western Province. In Eastern Province, Marsabit District accounted for 94.6 % of all the cases with the rest being reported from Isiolo (4.2 %) and Meru (1.2%) Districts. Kisumu and Siaya Districts accounted for 53.3% and 44.9 % of tapeworm cases reported from Nyanza Province respectively. In the Rift Valley Province, Narok District accounted for 66%, West Pokot 13.6% and Samburu 11.0% of the cases reported.

DISCUSSION

Foodborne diseases occur worldwide and are possibly 300-350 times more frequent than what is reported(11). In Kenya, few cases of food poisoning outbreaks were reported to the Ministry of Health between 1970 and 1994. In most of the outbreaks where diagnosis was confirmed, the cause was recorded as *Staphylococcus aureus*. Other bacterial causes included *E. coli*, *Clostridium perfringens* and

Clostridium botulinum. Individual cases of bacterial food poisoning pathogens were also diagnosed in various districts. For example, between 1984 and 1993, 420, 181, 29 and 41 cases of foodborne bacterial pathogens were diagnosed in Embu, Meru, Isiolo, and Machakos Districts, respectively. Nyeri district diagnosed 24 individual cases, while 50 cases were diagnosed in Nyandarua District.

The number of reported outbreaks was thought to be a gross underestimate of the actual situation in the country especially when compared with the number of individuals treated for poisoning at out-patients clinics in various health facilities. For example, the national figures for poisoning cases treated at outpatients clinics in various health facilities countrywide between 1988 and 1991 ranged between 28,973 and 207,941 per year with Central Province reporting the highest number followed by Rift Valley. These poisoning cases were due to a variety of causes including food poisoning, herbal medicine, drug poisoning, petrol and kerosene poisoning, battery poisoning, chemical poisoning, and alcohol poisoning among other causes.

The low rate of food poisoning outbreaks was attributed to under-reporting and inadequate investigation of outbreaks. Diagnosis of reported foodborne outbreaks was hampered by lack of adequate laboratory facilities and reagents. Confirmation of bacterial food poisoning mainly relied on the isolation of pure organisms from the suspected food or patient stool. No attempts were made to analyse for enterotoxins which are important causes of food poisoning by some bacterial agents such as *Staphylococcus aureus*, *Bacillus cereus* and *Clostridium botulinum* and *Clostridium perfringens* (Ministry of Health, Personal Communication). Plant poisoning was only suspected mainly on the knowledge of consumption of the toxic food plant/vegetable without analysis for toxic components. Heavy metal poisoning was diagnosed after detection of high levels of mercury, copper, or lead in serum of patients and was thought to have resulted from contamination of food by agro-chemicals. Unintentional contamination of food with agricultural chemicals used for crop protection and food preservation is the most common type of chemical food poisoning reported in Kenya(12). The most common contaminating chemicals that have been found include organophosphates and organochlorine pesticides, cyanide and heavy metals(12). Contamination may occur during transportation and storage of the chemicals together with foodstuffs or use of chemical containers to store foodstuffs. Outbreaks of chemical food poisoning referred to in this study were due to consumption of maize flour that was contaminated with diazinon and organophosphate insecticides during transportation.

Although not all the parasites referred to in the present study are foodborne, the high number of reported cases of intestinal worms gives a rough indication of the extent of the potential problem of foodborne parasitic infections, and particularly those which may be due to *Taenia saginata* and *Taenia solium*. Tapeworm infestation occur particularly where meat and fish are eaten raw or undercooked and its occurrence in man is due to such poor dietary habits. The high number of

cases of tapeworm infestation in some districts may reflect the prevailing dietary habits which should be discouraged. Education and regular de-worming programs will help reduce the infestation rates. The worldwide occurrence of foodborne diseases calls for an urgent need to improve food preparation processes and to educate those responsible for the provision of ready-to-eat foods particularly in mass catering situations. Microbial agents are the main cause of foodborne disease outbreaks associated with consumption of contaminated milk, meat and poultry. Contaminated cooked rice is also commonly implicated in *Bacillus cereus* food poisoning. Most incidents of food poisoning involve foods prepared in restaurants, hotels, clubs, hospitals, institutions, schools and canteens for mass catering, and few home prepared mainly for consumption and sometimes for external catering(3). Cross contamination between raw and cooked foods, undercooking use of left-overs and holding of food for long periods at ambient temperatures before consumption are some of the factors that contribute to microbial foodborne disease outbreaks.

Efforts to curb foodborne disease outbreaks involve measures taken by the Ministry of Health, Nairobi City Council and other allied bodies. The Ministry of Health through the National Public Health Laboratory Service (NPHLS) and Nairobi City Council (NCC) Public Health Department screens for *Salmonella spp*, *Staphylococcus aureus*, *Clostridium spp* and *E. coli* in all samples received for routine food quality assurance. In addition, the Public Health Department regularly carries out food quality control activities. These include inspection of general retail shops, butcheries, meat roasting premises, wholesale shops, food kiosks, food processing factories, cereals stores, hotels, supermarkets and bakeries. Premises are inspected for general cleanliness and quality of retail foodstuffs. All foods found unfit for human consumption for whatever reason are condemned and their disposal supervised by the public health personnel, while persons involved in handling food in various food establishments are required to be certified as medically fit. The Ministry of Agriculture and Livestock Development provide regular meat inspection service aimed at the prevention of zoonotic diseases (including anthrax and taeniasis) that can be acquired from consumption of contaminated meat. These efforts should be extended to include education of the public and especially training of mass catering personnel and street vendors on food safety measures to avoid occurrence of food poisoning outbreaks. These measures include: (i) choosing foods that are processed for safety; (ii) thorough cooking of food; (iii) serving and eating food immediately after cooking; (iv) reheating cooked foods thoroughly; (v) avoiding contact between raw foods and cooked foods; (vi) repeated hand washing; (vii) keeping all kitchen surfaces clean; (viii) protection of foods from insects, rodents and other animals, and; (ix) use of safe water.

The public should also be educated on the need to transport and store foodstuffs and chemical substances separately to avoid accidental contamination of foodstuffs, and the need to proper disposal of emptied chemical containers. Such containers should not be used to prepare, transport or store food or be used as utensils. The need to

properly dry cereals, pulses and nuts before storage to avoid fungal spoilage that may lead to fungal food poisoning should be emphasised. The public should also be warned of the dangers of consumption of some poisonous varieties of cassava and vegetables that are not traditionally considered as safe.

Tapeworm infection showed a declining trend over the years, and this was attributed to the increased awareness of the problem posed by consumption of raw and uninspected meat, use of toilets and latrines, and meat inspection. Meat inspection was reported to be responsible for 80% decline in the prevalence of *Cysticercus bovis* in bovine carcasses over the period 1976 to 1991(13). Education of the general public is still needed and especially among pastoralists where infection pressure of *Cysticercus bovis* is high in cattle.

The low reporting of food poisonings and poor diagnosis and confirmation of the causative agent of the few reported cases calls for improvement on reporting of the cases by encouraging the public to do so, and also revamping and improving diagnostic capability to include analysis and detection of microbial toxins, poisonous chemicals and emerging food pathogens such as *E. coli* 0157:H7(14,15), *Listeria monocytogenese*, *Yersinia enterocolitica* and *Campylobacter jejuni*(16,17). Surveillance and investigation of all food poisonings should be stepped up.

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