

A review on food safety and food hygiene studies in Ghana

- Patricia Foriwaa Ababio^{a, b, , ,},
- Pauline Lovatt^a.

doi:10.1016/j.foodcont.2014.06.041

Highlights

-

Food hygiene and safety research in Ghana focussed on commercial catering in Accra.

-

Institutional catering hygiene practices and effect on food safety was unavailable.

-

Food allergens and physical hazards in food in the country were not identified.

-

Food hygiene training and other PRP required legalisation in support of the Food Law.

-

Agents in charge of food handlers monitoring and surveillance required improvement.

Abstract

Food safety and hygiene in Ghana was studied using desk top literature review. Food research was highly concentrated in the capital city of the country and most research focus were on commercial food operations specifically street foods and microbiological safety with limited information from institutional catering and other forms of food hazards. The media currently serves as the main source for reporting of food borne diseases. Food establishments and other sources contributing to food borne diseases included restaurants, food joints, food vendors, schools and individual homes. Limited use of prerequisites measures and food safety management systems was identified. Recommendations on regulating the General Hygiene Principles, implementation of HACCP to strengthen the food sector, regular food safety and hygiene workshops and training for food handlers that commensurate with their roles were made. Government support for SMEs and food handler's health screening were made.

Keywords

- Food safety;
 - Review;
 - Ghana
-

1. Introduction

Ghana is a West African country with a land area of 238,527 km² and a population of 24,658,823 ([Ghana Statistical Service, 2010](#) est.). The country is divided into 10 main regions with Accra as the capital city. The food sector includes

primary producers, food manufacturers and processors which predominantly are of Small and Medium Size enterprises, retailers and food vendors. The Food Laws in Ghana include the Food and Drugs Act PNDCL 305B of [1992](#) which covers food safety and handling requirements and penalties for breaching the Law. The existing Hygiene Principles are not legally binding ([Ghana Standard Authority, 2013](#)) but are guidelines which the food industry can use to ensure food safety. The Food and Drugs Authority (FDA) is the national regulatory body under the Ministry of Health with the responsibility of implementing food policies and ensuring the safety and wholesomeness of food for consumers. FDA roles include food manufacturing and processing site inspections, licensing, product registration and monitoring. They also provide good hygiene practices training for food handlers. The Ghana Standard Authority develops and promotes international and locally acceptable standards for the industry. Other supporting agencies include the Ministry of Health, Ministry of Agriculture, Ghana Tourist Board and the Environmental agency. The government of Ghana has also given directives to the local authorities including metropolitan assemblies and their districts to actively control and monitor food safety practices of food vendors who are individuals or group of people who sell ready to eat foods at readily accessible areas including caterers, nightclubs, beer bars, chop bars, cold stores, hotels and restaurant operators and bagged water processors. The Water and Food Hygiene unit of the Environmental Health Department of the districts is responsible for the health monitoring and certification of food vendors which is subject to renewal on a yearly basis. Food preparation traditionally in this country is a woman's place and this has reflected in most demographic reports of workers in this field. Level of education (formal) which is considered to have direct positive effect on Good Hygiene Practices is low among food handlers in Ghana ([Ababio et al., 2012](#), [Ackah et al., 2011](#) and [Tomlins et al., 2002](#)). World Health Organisation reports of high levels of Diarrhoeal cases of which a higher percentage are due to food and water borne infections ([Table 1](#)).

Table 1.

General food and water borne disease status in the country.

Author	Year	Case
Opore et al.	2010	9000 Cholera cases with 250 deaths recorded
MOFA/World Bank	2007	1 in every 40 Ghanaian experience serious Food Borne Disease annually
Food and Drugs Board –	2008	90,692 deaths related to food and personal hygiene with 297,104 cases reported at various outpatient

Author	Year	Case
Ghana		departments of clinics and hospitals
Ghana Health Service,	2012	6000 cholera outbreaks with 69 deaths
Food and Drugs Authority – Ghana	2013	77% of all traceable food borne diseases result from improper handling in food establishments

According to the [Ministry of Food and Agriculture and the World Bank \(2007\)](#), 1 in every 40 Ghanaian suffer serious food borne illness per year, 420,000 cases are reported with an annual death rate of 65,000 which cost the government US \$ 69,000,000.00 annually. This report could be an under estimate as report rate is low and in the calculation of cost in developing countries only the cost borne by individuals through hospitalization and medication is considered whilst others in developed countries consider the cost to employers, institutional bodies like laboratories, surveillance, disability cost and cost from other family members who take care of the sick member and premature mortality ([Abelson, Forbes, & Hall, 2006](#)). According to FDA, the loss of productivity in Ghana in 2006 due to food borne diseases was approximately 594,279 days (19,809 months) this could be huge in terms of cost to the state. Studies from the commercial food sector have dominated research in the country with special focus on street foods although there are reported food poisoning cases on the media from institutional set ups specifically schools. [Saba and Gonzalez-Zorn \(2012\)](#) reported that studies on microbiological food safety is on the decline and highly centered in the capital city of the country. Although all food hazards are detrimental to the health of consumers and require monitoring and control in the country, currently microbiological hazards in ready to eat foods and chemical hazards mostly pesticides from agricultural products including fresh vegetables and fruits have been highlighted ([Amoah, Abaidoo, & Ntow, 2006](#); [Bempah et al., 2011](#), [Feglo and Sakyi, 2012](#) and [Mensah et al., 2002](#)). There is minimal information on physical contaminants/hazards, food allergy and injuries caused by these. This could be due to less awareness and or lack of public education of these hazards. The [FAO/WHO, 2005](#) regional report on food safety for Africa recorded microbiological hazards as the most eminent risk from street foods but also reported the danger of high levels of heavy metals including lead, cadmium, arsenic, mercury and copper and also pesticide residues from utensils, raw materials or transport methods used. This work looks at food safety and hygiene reports in Ghana.

2. Approach

A desk top review of literature was carried out. Search was conducted using mainly Google search engine with phrases including 'food safety in Ghana', 'food hygiene in Ghana', 'food hygiene training Ghana', and 'list of food poisoning in Ghana'. Journals used included Food control, Internet Journal of Food Safety, Food and Nutrition Science, Food and Public Health, Food Science and Technology, Journal of Infection in developing countries, Journal of Urban Health and African Journal of Food Agriculture Nutrition and Development. Professional sites included World Health Organisation (WHO), Ghana Health Services and TEPHINET library. Media sources were used for individual cases of food poisoning in homes, commercial and institutional set ups. Data used ranged from 1999 to 2013.

3. Report from media and scholarly research articles

3.1. Food poisoning cases from homes, commercial and institutional catering

Food poisoning occurs in individual homes, commercial and institutional catering in the country ([Table 2](#)). Commercial catering including hotels, restaurants, finished products from retailers and food vendors. Institutional catering includes schools, hospitals, day care centers, prisons and industry staff kitchens. Restaurants and individual food vendors were identified sources of food borne diseases. Schools stand out from the data to be another suspected source of food hygiene problems among Institutional catering services. Thus schools constitute a percentage of the food establishments which are reported to be responsible for 77% of all traceable food borne diseases in the country ([FDA, 2013](#)). Consumers in their homes equally practice poor hygiene which brings about food borne diseases. On the whole institutional catering stands out as the unit with huge number of consumers at a time due to communal feeding and these include school children, sick and vulnerable people from hospitals who equally require great care in terms of food safety.

Table 2.

Selected food poisoning cases from the media and other online sources.

Source	Date	Home/Private cases	Institutional kitchens/catering cases	Commercial catering cases
Citifm online	2013		Over 40 students hospitalised in Adonten Secondary School. in	

Source	Date	Home/Private cases	Institutional kitchens/catering cases	Commercial catering cases
			Eastern Region over food poisoning. case under investigation	
Daily guide Ghana web	2007 2011	17 out of 28 farmers die of chemical food poisoning in northern region a whole family dies of food poisoning		Dozens suffer food poisoning in Obuasi on Nov. 13th after eating fried rice from a fast food joint and 30 are hospitalised.
Anon Joy News Der et al.	2010 Joy News Ghana, 2008 , Joy news, 2010a and Joy News, 2010b , 2009	Outbreak of food poisoning at a Child Naming Ceremony Anyaa Ghana- locally made drink	Over 100 girls in Archbishop Porter Girls Hospitalised from food poisoning after eating in dining hall. Pupils reject insect infested meals supplied in school feeding programme	40 persons suffer food poisoning at a salad joint at Koforidua Causative agent <i>Clostridium perfringens</i>
Ghana Health Service Daily Guide	2007 2007		1, 348 children suffered food poisoning among schools in Madina, Accra from food served by contracted caterer. Dozens of pupils from two schools hospitalised from food poisoning from school meals	

Information sources and dates provided correspond with successive cases in the columns provided.

3.2. Research reports from food scientist in the country

3.2.1. Food hygiene practices

Hygiene practices among food handlers, mostly food vendors and catering services have been reported to be below standard ([Addo et al., 2007](#), [Afoakwa, 2005](#), [Feglo and Sakyi, 2012](#) and [Tomlins et al., 2002](#)). Research covering the hospitality industry has been around hotels, restaurants and street food vendors mostly in the capital city, Accra ([Ackah et al., 2011](#), [Addo et al., 2007](#) and [Donkor et al., 2009](#)). High levels of total bacterial counts in street vendored food beyond

the acceptable reference figures, $\leq 10^5$ Colony Forming Units (CFU) g^{-1} set by the Ghana Standards Authority for Ready to Eat Foods (RTE) have been reported by [Mensah et al. \(2002\)](#) and [Feglo and Sakyi \(2012\)](#)(Table 3).

Table 3.

Selected Food research articles and recommendations.

Authors	Date	Title	Findings and recommendation	Journal
Tortoe et al.	2013	Systematic Approach for the Management and control of food safety for the street/informal food sector in Ghana	Modules developed for RTE street foods in Accra. Microbiological survey showed that some street foods are intrinsically safer than others thus requiring systems of control. Intensified training of street food vendors and consumers created awareness of the relationship between contaminated food and food disease.	Food and Public Health. 2013, 3(1):59–67
Ababio et al.	2012	Food Safety Management Systems their availability and maintenance among food industries in Ghana	International food safety management systems were sparingly in use in the country especially among locally owned businesses. It was recommended that there is the need for awareness creation and manpower development with improved surveillance and legislative backing.	Food Science and Technology. Featured article Nov. 2012 https://fstjournal.org/features/http%3A/www.fstjournal.org/node/add/article
Feglo and Sakyi	2012	Bacterial contamination of street vending food in Kumasi, Ghana	Most ready to eat food are contaminated with enteric bacteria and other pathogens at higher levels than acceptable. Food vendors needed to be trained on food hygiene	Journal of medical and Biomedical Sciences(2012) 1(1):1–8

Authors	Date	Title	Findings and recommendation	Journal
Saba and Gonzalez-Zorn	2012	Microbial food safety in Ghana- meta-analysis	Microbiological food contamination in Ghana was alarming. There was a downward trend in research in microbiological food safety and a concerted effort in this area was needed in Ghana to help curb the incidence of preventable food-borne disease.	Journal of Infection in Developing Countries(2012); 6(12):828–835
Bempah et al.	2011	Monitoring of Organochlorine Pesticide Residues in locally produced fruits-based soft drinks in Ghana	Most of the fruit-based soft drinks sampled contained residues of the monitored pesticides above the EU MRL level in drinking water. There was the need for changes in processing to ensure food safety especially for children	Internet Journal of Food Safety. Vol. 13 2011p 315–320
Annor, and Baiden,	2011	Evaluation of food hygiene knowledge attitude and practices of food handlers in food businesses in Accra Ghana	Microbial counts of all food sampled were generally high and food handler's hygiene knowledge was inadequate and knowledge was not reflected in their practices. Food managers were advised to develop tactics to motivate staff to practice food hygiene	Food and Nutrition Sciences, 2011, 2, 830–836
Donkor et al.	2009	Application of the WHO keys of safer food to improve food handling practices of food vendors in poor resource community in	Food vendors acquired knowledge after training was put into practice. Lack of food safety equipment was a major hindrance to behavioral change among vendors. It was recommended that workshops on food safety and hygiene should be organized	International Journal of Environment Research and Public Health. Vol 6(11) Nov. 2009

Authors	Date	Title	Findings and recommendation	Journal
		Ghana	for vendors to help them put acquired knowledge into practice	
Johnson et al.	2008	A case study to develop an appropriate quality assurance system for two cassava-based convenience foods in Ghana	Food safety management based on the HACCP principles is applicable to food processing industry in Ghana and HACCP Plan was contingent on addressing some of the constraints facing the industry.	Internet Journal of Food Safety, Vol. 10. 2008 p 81–84
Rheinlander et al.	2008	Keeping up appearances: perceptions of street food safety in urban Kumasi Ghana	Both consumers and vendors in Kumasi used aesthetics appearance of food and stand, appearance of vendor, interpersonal trust and price and proximity as main food selection criteria. Food handlers over all hygiene practices were not sufficiently safe to ensure biomedically safe food. It was recommended that practices such as good hand hygiene and cleanliness of kitchen should be emphasized during training	Journal of Urban Health. 2008 Nov. 85(6):952–64
Addo et al.	2007	Food and its preparations in hotels in Accra, Ghana: A concern for food safety	Food served in sampled hotels had satisfactory results although most locally produced juices were contaminated with coliforms. Stringent measures to insure safety and good hygiene in the preparation of juices was	African Journal of Food, Agriculture Nutrition and Development Vol 7 No 5. 2007

Authors	Date	Title	Findings and recommendation	Journal
Mensah et al.	2002	Street foods in Accra, Ghana: how safe are they?	Out of 511 menu items selected 69.7% were contaminated with mesophilic bacteria. Salads, macaroni, fufu and omo tuo and red pepper had unacceptable levels of contamination. Human pathogens including <i>Salmonella</i> were isolated from light soup. Street foods could be sources of enteropathogen and street vendors required education in hygiene training.	Bulletin of World Health Organisation. 2002:80(7): 546–54

[Bempah et al. \(2011\)](#) reported on detectable levels of organochlorine pesticides in sampled fruit based drinks with an average concentration of 0.0019 mg l⁻¹ which they alerted was 4 times much higher than the EU's Maximum Residual Limits (MRL) for the sum of pesticides permitted in positive samples. [Amoah et al. \(2006\)](#) reported that 78% of vegetables sampled from 3 major cities across the country were chemically contaminated with chlorpyrifos residue exceeding the recommended level of 0.05 mg kg⁻¹. This chemical has an Acceptable Daily Intake (ADI) of 0.01 mg kg⁻¹ ([WHO, 1997](#)) indicating possible high exposure. Hotels in the Capital region were reported to have improved hygiene practices after implementing Good Hygiene practices but with the need for improvement in cleaning of food contact surface ([Addo et al., 2007](#)).

3.2.2. Food handlers demographics and effects

[Ababio and Adi \(2012\)](#) and [Ababio et al., 2012](#) and [Feglo and Sakyi, 2012](#) and [Tomlins et al. \(2002\)](#) reported on low level of education among food handlers in Kumasi and Accra respectively. They also reported of limited numbers of food safety management systems across the country mostly among locally owned businesses. These were mostly small and micro

enterprises that lacked the capacity to implement and maintain acceptable international standards. The international food manufacturers and processors mostly had food safety management systems in place showing their commitment to legislation and customer requirement. [Rheinlander, Bakang, Takyi, Konradsen, and Samuelson \(2008\)](#) reported of some level of food safety and hygiene awareness in Kumasi but added that food handling practices did not reflect knowledge. They reiterated that both consumers and food handlers used aesthetic qualities including appearance of environment, appearance of the vendor, others included consumer and vendor relationships, price and proximity as food hygiene and buying indicators neglecting good hygiene practices like hand washing procedure and kitchen cleanliness. There was a growing concern as food handlers in the country overlooked documentation and quality assurance part of food production. This could be happening due to the absence of stipulated qualification for persons who prepare food for sale and this affects the acceptable practices in food preparation. Whilst it is mandatory as a public health policy for food handlers to be screened before preparing food for sale ([Feglo & Sakyi, 2012](#)), a research conducted by [Ackah et al. \(2011\)](#) showed that only 40% of sampled food handlers for their study had health certificates and there was absence of periodic screening in the capital city of the country. [Ababio and Adi \(2012\)](#) equally reported of higher levels of screening but lack of renewal in Kumasi of the Ashanti Region.

3.3. Ready to eat (RTE) foods and processed foods with needed control

Selected foods for hazard analysis by researchers revealed varying microbiological contamination levels ([Addo et al., 2007](#), [Feglo and Sakyi, 2012](#), [Mensah et al., 2002](#) and [Tortoe et al., 2013](#)). Food from hotels sampled in Accra showed acceptable levels whiles street food from the same city had detectable levels of enteric pathogens. Kenkey due to low pH was reported to be a low risk food in terms of microbial load, wakye (cooked rice and beans mixed) had a similar report but both could be contaminated with lead above the acceptable levels of 0.2 mg/kg due to usage of informally manufactured pots that could have lead levels as high as 419 mg/kg ([Tortoe et al., 2013](#)) causing cumulative harm. Fufu due to its method of preparation ([Table 4](#)) had *Escherichia coli* and detectable *Staphylococcus aureus*. Similar reports were made on High Risk street foods in Kumasi. Food studied included ice kenkey, cocoa drinks, fufu, ready to eat red pepper sauce,

salad and macaroni. All had plate count levels above the acceptable national standard of $\leq 5.0 \log_{10}$ cfu/ml ([Feglo & Sakyi, 2012](#)). Enteric bacterial were also isolated.

Table 4.

Reported Ready to eat (RTE) food types and style of preparation locally.

Food type	Ingredients	How prepared	How served
Kenkey	Corn dough	Semi cooked corn dough shaped in corn husk/plantain leaves and boiled	Mostly hot and intact in local packaging (corn husk/plantain leaves)
Waakye	Rice and beans	Rice added to pre boiled beans/cowpea and boiled until soft	With ladles or hands of food handler
Fufu	Cassava with plantain, yam or cocoyam	Boiling and pounding in wooden mortar with pestle while turning with hands	Served by hand into bowls
Cocoa drinks	Cocoa powder and sugar	Mixture of cocoa powder and water; no boiling	Packaged into polythene bags by hand
Red pepper sauce	Pepper, onion, salt and tomato	Grinding in public disc attrition mills or locally made clay grinders (asanka). No boiling	Served with spoon
Salad	Leaves, fresh vegetables	Washed with water and cut into desired shapes and sizes with knives or hand. No boiling	Served with spoon or hand
Macaroni	Wheat flour	Boiled	Served with spoon or hand
Ice Kenkey	Mixture of milled kenkey, milk powder and sugar	Milled kenkey mixed with water, milk and sugar. No boiling	Packed into polythene bags by hand
Fresh fruit juice	Individual or mixed fresh fruit, water and sugar	Washed, peeled and milled with added water and sugar	Poured into cups or bottles by hand

[Bempah et al. \(2011\)](#) reported on the presence of monitored pesticides in fruit-based drinks sampled to be above the maximum required limits which is a safety issue considering that children are the target consumers in the country. The safety and quality of meals from institutional catering units in the country have not been reported.

3.4. Some recommendations from research out put

Training of personnel in food safety and hygiene was highly recommended across board. Training is a fundamental requirement for food safety management systems and it is a legal requirement for persons in supervisory position to have

the requisite knowledge on the product and process of their operations while those under them are given the necessary training to ensure food safety ([Food Safety Act 1990](#) UK, PNDCL 305B 1992 Ghana). The Codex Alimentarius Commission's Good Hygiene Practices Basic Text recommends all governments to ensure that food handlers receive the necessary training to equip them for their work ([FAO/WHO, 2009](#)). Training is one of the requirements that is seriously neglected by the food industry in the country as reported by [Ababio et al. \(2012\)](#).

Absence of Prerequisite measures and lack of documentation of available ones causes lack of standardization. Hazard Analysis and Critical Control Point (HACCP), a food safety tool upon which all other food safety assurance systems are built is rarely known and or used and [Johnson, Tomlins, Oduro-Yeboah, Tortoe, and Quayson \(2008\)](#) referred to its use as contingent in addressing food safety constraints in the country. [Rheinlander et al. \(2008\)](#) reported of the need to include good hand hygiene and cleanliness of kitchen facilities and environment in training programmes as consumers current risk avoidance strategy of looking at appearance of food, food stands and trustworthiness of food vendors were not enough to protect them from food borne diseases.

[Feglo and Sakyi \(2012\)](#) in their work on Salmonella carrier status of food vendors in Kumasi, Ghana, supported the idea that in developing countries where money and time required to improve existing environmental standards might demand longer waiting periods, the most efficient way to improve on the hygiene activities of food handlers will be through education and regular surveillance. Food handlers in the region were concluded to be of significant risk in the spread of enteric fever.

One of the characteristics of a growing economy is longer food supply chains to satisfy the demands of emerging affluent consumers locally and to access external market with locally produced raw materials and processed foods. This brings in foreign exchange aiding rural development but also calls for quality and safe produce which is achievable only through the strengthening of laws, institutions and infrastructure.

According to [Ministry of Food and Agriculture \(MoFA\)/World Bank's 2007](#) report, sectors that currently have international standards include the cocoa, fisheries and vegetable subsectors thus primary producers in the food chain who are in exporting business. They also called for restructuring and streamlining of the legislative and institutional frame work in the country to bring about efficiencies and increased national and international competitiveness in the private sector.

3.5. Gaps in research

i.

The study on kitchen staff hygiene practices, food hygiene knowledge, food microbiological quality and safety of institutional meals including schools and hospitals.

ii.

Research on food safety in the other regions apart from the capital region.

iii.

Other forms of food hazards including food allergens and sufferers in the population in addition to microbiology with decision on effective control measures for food processing and handling.

iv.

Food poisoning and other forms of food borne diseases, the causative organisms and vehicles of transmission studies and control in the country.

v.

Food safety interventions in the food industry in Ghana.

3.6. Possible support and interventions for Ghana- the UK example

The food industry is only as strong as its weakest link in the food chain ([Taylor, 2001](#)). The food industry in every nation whether developed or not stand to loose if all stages in the food chain are not motivated and strengthened to use food safety approaches. The benefits of reducing hazards in food include reduced morbidity, mortality and demands on healthcare services, a reduction in absences from education or loss of productivity at work and increased consumer confidence in food safety ([Food Standards Agency, 2011](#)). The United Kingdom's efforts listed below could strengthen the food services and manufacturing sectors to become competitive whiles ensuring consumer safety.

i.

Continuous sensitization programmes for food handlers and consumers along the food chain of their roles on compliance with food safety requirements.

ii.

Good Hygiene Practices which are mostly called Prerequisite measures to be available and enforced as the basic requirement for food industries and vendors. These include the establishment of the following; process and facility design to acceptable standards, personal hygiene of food handlers which include effective hand washing, use of protective clothing, reporting and proper handling of infectious diseases including diarrhoea and vomiting, absence of jewelry/self adornment during preparation and service etc, cleaning procedures for both equipment and food environment, waste management, pest control, routine training programmes for staff, planned preventive maintenance and transport, supplier and raw material monitoring and control, process control and temperature monitoring ([WHO/FAO, 2009](#)). These when available creates a safe and conducive environment for the processing and or preparation of food.

iii.

HACCP which is a more flexible, industry specific food safety tool could be made a legal requirement for manufacturing and processing industries with a given period within which absence could be a breach of the national law. This will help to raise the standard of operations and practices of the food industry in Ghana to an international level ([FAO/WHO, 2009](#)), enabling them to compete in the international market.

iv.

Small and Medium Size Enterprises (SMEs) support systems could be initiated by the Government's appropriate agencies and educational institutions to help them establish acceptable food safety management systems. Government and local authority's intervention in the form of free or subsidized training, developed food safety standards by appropriate agencies, training manuals and videos on good practices for the easy training of food vendors, could go a long way to solve some of the existing hurdles ([FSA, 2007](#)).

v.

Raising man power through educational institution programmes for surveillance and supervision with stringent legal backing on penalties for non compliance could also raise food safety standards whilst creating jobs for the public too.

These efforts have extremely improved the industry with a reported over 93% of 1143 SME's surveyed across Europe enrolling with positive feedback on benefits including, confidence, preparedness for Environmental Health Officers' visits, effective training, reduced waste and hence cost and overall profit increase.

4. Conclusion

The food industry as reported by researchers has more room for improvement. Good Hygiene Principles need to be regulated and enforced. There is the need for the introduction of standards, development of food safety management systems that are suitable for the locality with continuous and intensive workshops for food handlers. Small and Medium Size enterprises require government's special intervention in form of sponsored training, publicity and other means of awareness creation. There is also the need for increased public awareness on good hygiene and food safety practices that consumers should look out for apart from aesthetic attributes. This will increase demand for quality and safe food, a driving force that has pushed food safety and quality systems up in developed countries. Research in various regions and sectors of the food industry was inadequate and more should be done. Every nation has regulations that are supposed to protect its people against unsafe practices in food production, and the existing agencies needs to be equipped to enhance control.

References

1.
 - [Ababio and Adi, 2012](#)
 - P.F. Ababio, D.D. Adi
 - **Evaluating food safety practices among food handlers in the Kumasi Metropolis**
 - Internet Journal of Food Safety, 14 (2012), pp. 35–43
2.
 - [Ababio et al., 2012](#)
 - P.F. Ababio, D.D. Adi, V. Commey

- **Food safety management systems, availability and maintenance among food industries in Ghana**
 - Food Science and Technology (2012) www.fstjournal.org/node/add/article viewed 17/11/12
- 3.
- [Abelson et al., 2006](#)
 - P. Abelson, P.M. Forbes, G. Hall
 - **The annual cost of food borne illness in Australia**
 - Commonwealth of Australia (2006), pp. 1–108 www.ag.gov.au/cca
- 4.
- [Ackah et al., 2011](#)
 - M. Ackah, E.T. Gyamfi, A.K. Anim, J. Osei, J.K. Hansen, O. Agyeman
 - **Economic profile, knowledge of hygiene and food safety practices among street–food vendors in some parts of Accra- Ghana**
 - Internet Journal of Food Safety, 13 (2011), pp. 191–197
- 5.
- [Addo et al., 2007](#)
 - K.K. Addo, G.I. Mensah, C. Bonsu, M.I. Akyeh
 - **Food and its preparation conditions in hotels in Accra, Ghana. A concern for food safety**
 - African Journal of Food Agriculture Nutrition and Development, 7 (5) (2007)
- 6.
- [Afoakwa, 2005](#)
 - E.O. Afoakwa
 - **Enhancing the quality of school feeding programs in Ghana**
 - Unpublished article Department of Nutrition and Food Science, Legon (2005)

7.

- [Amoah, Abaidoo, & Ntow, 2006](#)
- P. Amoah, D.P. Abaidoo, W.J. Ntow
- **Pesticides and pathogen contamination of vegetables in Ghana's urban markets**
- MOFA/World Banks (2007), Review of food safety in Ghana (2006) <http://www.worldband.org>. Viewed 14/02/12

8.

- [Annon, 2010](#)
- Annon
- **Outbreak of food poisoning at child naming ceremony – Anyaa, Ghana**
- Training Programmes in Epidemiology and Public Health Interventions Network (TEPHINET) library (June, 2010)

9.

- [Annor and Baiden, 2011](#)
- G.A. Annor, E.A. Baiden
- **Evaluation of food hygiene knowledge attitude and practices of food handlers in food businesses in Accra Ghana**
- Food and Nutrition Sciences, 2011 (2) (2011), pp. 830–836

10.

- [Bempah et al., 2011](#)
- C.K. Bempah, A. Donkor, R. Agei, A. Buah-Kwofie, J. Boateng
- **Monitoring of organochlorine pesticide residues in locally produced fruits-based soft drinks in Ghana**
- Internet Journal of Food Safety, 13 (2011), pp. 315–320

11.

- [Citifm, 2013](#)

- Citifm
 - **Over 40 student hospitalised in Adonten Secondary in Eastern region of Ghana over food poisoning**
 - (2013) Case under investigation. CITIFMONLINE. Viewed 18/4/2013
- 12.
- [Daily guide, 2007](#)
 - Daily guide
 - **Dozens of pupils from two basic schools in Madina admitted in various hospitals for food poisoning after eating rice balls**
 - (2007) www.modernghana.com Viewed 21/11/11
- 13.
- [Der et al., 2009](#)
 - J. Der, F. Dzata, L. Ayittey, A. Laweh, S. Mantey, B. Apanya, *et al.*
 - **Outbreak of food poisoning at a salad joint- Koforidua, Ghana Nov. 2009. A field epidemiology and laboratory training programme**
 - School of public health University of Ghana Legon (2009) www.tephinet.org Viewed 18/4/2013
- 14.
- [Donkor et al., 2009](#)
 - S.E. Donkor, B.B. Kayang, J. Quay, M.L. Akyeh
 - **Application of the WHO keys of safer food to improve food handling practices of food vendors in poor resource community in Ghana**
 - International Journal of Environment Research and Public Health, 6 (11) (Nov. 2009)
- 15.
- [FAO/WHO, 2005](#)
 - FAO/WHO
 - **Informal food distribution sector in Africa– street foods, importance and challenges**

- FAO/WHO, Harare- Zimbabwe (2005)
- 16.
- [FAO/WHO, 2009](#)
 - FAO/WHO
 - **CODEX ALIMENTARIUS – Food hygiene basic texts**
 - (4th ed.)FAO/WHO, Rome (2009)
- 17.
- [Feglo and Sakyi, 2012](#)
 - P. Feglo, K. Sakyi
 - **Bacterial contamination of street vending food in Kumasi, Ghana**
 - Journal of Medical and Biomedical Sciences, 1 (1) (2012), pp. 1–8
- 18.
- [Food and Drugs Board, 2013](#)
 - Food and Drugs Board
 - **FDA school caterers on good hygiene practice**
 - Ghana News Agency (12 March 2013)
- 19.
- [Food and Drugs Board, 1992](#)
 - Food and Drugs Board
 - **The food and drugs act. PNDCL 3058 1992**
 - (1992) www.fdb.gov.gh
- 20.

- [Food and Drugs Board, 2008](#)
 - Food and Drugs Board
 - **Contaminated food killed 90,692 in 2006**
 - (2008) www.modernghana.com Viewed 29/4/13
- 1.
- [FSA, 1990](#)
 - FSA
 - **Food Safety Act**
 - (1990) <http://www.legislation.gov.uk>
- 2.
- [FSA, 2007](#)
 - FSA
 - **Food safety management evaluation research**
 - (2007) www.jigsaw-research.co.uk Viewed 14/12/12
- 3.
- [FSA, 2011](#)
 - FSA
 - **Food borne disease strategy 2010-2015. An FSA programme for the reduction of food borne disease in the UK**
 - (2011) www.fsa.gov.uk viewed 11/8/12
- 4.
- [Ghana Health Service, 2007](#)
 - Ghana Health Service
 - **Annual report 2007**

- (2007) www.ghanahealthservice.org viewed 29/4/2013
- 5.
 - [Ghana Web, 2011](#)
 - Ghana Web
 - **Dozens suffer food poisoning in Obuasi**
 - (2011) www.ghanweb.com Viewed 29/4/13
- 6.
 - [Ghana Health Service, 2012](#)
 - Ghana Health Service
 - International Federation of Red Cross and Red Crescent Societies. Disaster Relief Emergency Fund (Dref) Final Report (2012) Viewed 18/4/2013
- 7.
 - [Ghana Statistical Service, 2010](#)
 - Ghana Statistical Service
 - **Population and housing censuses, 2012, Ghana statistical service**
 - (2010)
- 8.
 - [Ghana Standard Authority, 2013](#)
 - Ghana Standard Authority
 - **Personal communication with standard documentation department**
 - (2013)
- 9.
 - [Johnson et al., 2008](#)

- T.P. Johnson, K.I. Tomlins, C. Oduro-Yeboah, C. Tortoe, T.E. Quayson
 - **A case study to develop an appropriate quality assurance system for two cassava-based convenience foods in Ghana**
 - Internet Journal of Food Safety, 10 (2008), pp. 81–84
- 10.
- [Joy news, 2010a](#)
 - Joy news
 - **Archbishop Porter girls school breaks following a food poisoning incident**
 - (2010) [Archive.maxihana.com](#) viewed 21/11/11
- 11.
- [Joy News, 2010b](#)
 - Joy News
 - **Pupils reject weevil infested meal at Akropong-Atwima Nwabiagya**
 - (2010) [Myjoyonline.com/Ghana/pdf](#) Viewed 21/11/11
- 12.
- [Joy News Ghana, 2008](#)
 - Joy News Ghana
 - **12 students and 2 teachers at Teshie Southern cluster of schools hospitalized after reacting to food bought at the school**
 - (2008) [www.crownprinceacademy.com](#) Viewed 21/11/11
- 13.
- [Mensah et al., 2002](#)
 - P. Mensah, D. Yeboah-Manu, K. Owusu-Darko, A. Ablordey
 - **Street foods in Accra, Ghana: how safe are they?**
 - Bulletin of World Health Organisation, 80 (7) (2002), pp. 546–554

14.

- [Ministry of Food and Agriculture/World Bank, 2007](#)
- Ministry of Food and Agriculture/World Bank
- **Review of food safety in Ghana**
- (2007) www.worldbank.org Viewed 14/10/12

15.

- [Opare et al., 2010](#)
- J. Opare, J. Der, K. Afakye, G. Bonsu, C. Oluabunwo, E. Afari, *et al.*
- **Outbreak of cholera East-Akim Municipality, Ghana**
- (Nov. 2010) www.tephinet.com Viewed 18/4/2013

16.

- [Rheinlander et al., 2008](#)
- T. Rheinlander, M.O. Bakang, H. Takyi, F. Konradsen, H. Samuelson
- **keeping up appearances: perceptions of street food safety in urban Kumasi Ghana**
- Journal of Urban Health, 85 (6) (2008 Nov), pp. 952–964

17.

- [Saba and Gonzalez-Zorn, 2012](#)
- S.K.C. Saba, B. Gonzalez-Zorn
- **Microbial food safety in Ghana- meta-analysis**
- Journal of Infection in Developing Countries, 6 (12) (2012), pp. 828–835

18.

- [Taylor, 2001](#)
- E. Taylor

- **HACCP in small companies: benefit or burden**
 - Food Control, 12 (4) (2001), pp. 217–222
- 19.
- [Tomlins et al., 2002](#)
 - K. Tomlins, P.N. Johnson, O.P. Aseidu, B. Myhara, P. Greenhalgh
 - **Street food in Ghana: A source of income, but not without hazards**
 - Available at (2002) www.iita.org/info/phnews5/mr8.htm Accessed on 01.03.2011
 -
- 20.
- [Tortoe et al., 2013](#)
 - C. Tortoe, P.-N.T. Johnson, M. Ottah-Atikpo, K.I. Tomlins
 - **Systematic approach for the management and control of food safety for the street/informal food sector in Ghana**
 - Food and Public Health, 3 (1) (2013), pp. 59–67
- 1.
- [WHO, 1997](#)
 - WHO
 - **Pesticides residues in food: 1997 evaluations**
 - World Health Organisation Expert Group On Pesticides Residues, Geneva, Switzerland (1997) December 6–15, 1997