Research Journal of Medical Science

Prevalence of Bacteria and Parasites Among Food Handlers in a Community in South- South, Nigeria

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Key words: Bacteria, parasites, staphylococcus, streptococcus, restaurants, food handlers

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Page No.: 15-25
Volume: 16, Issue 2, 2022
ISSN: 1815-9346
Research Journal of Medical Sciences

Abstract: A food handler is a person with any job that requires them to handle unpackaged foods or beverages and be involved in preparing, manufacturing, wait service, inspecting or even packaging food and beverage items. This study was carried out to assess the prevalence of bacteria and parasites carriage among food handlers in Ekpoma, Esan West Local Government Area, Edo State. Participants were selected from Bars, Restaurants, Butcher/suya shops and included all staff that prepare and serve food. A total of one hundred samples were collected from different food handlers in Ekpoma, Edo State. Structured and pre-tested self-administered questionnaires were used to obtain information on socio-demographic characteristics. The stool samples were collected into clear, transparent, wide mouthed universal containers without disinfectant or detergent residue and tight-fitting leak proof lids. Finger nail content was obtained with the aid of a sterile swab stick. The sample analysis was carried out using standard bacteriological and parasitological examination techniques. The results shows bacteria and parasites isolated from fingernail content and stool samples of food-handlers in Ekpoma. For finger nail contents, bacteria isolated include, Staphylococcus epidermidis (52%), Staphylococcus aureus (36%) and Streptococcus species (12%). While that of stool, the parasites isolated were Ascaris lumbricoides (14%) and Hookworm (6%), while the bacteria isolated for stool culture include; Staphylococcus epidermidis (36%), Escherichia coli (28%) and Salmonella species (12%). The results on sensitivity showed that Zinnacef had the highest sensitivity to Staphylococcus (44.4%). This was followed by Ciprofloxacin (27.8%). The lowest sensitivity was recorded for Ampiclox (5.6%). Furthermore, the result showed that Salmonella species was more sensitive to Chloramphenicol (75%) followed by Ciprofloxacin (50%) and Amoxacillin (50%). Hence, this study showed that food handlers are predisposed to either one of these micro-organisms. Therefore, both traditional and new technologies for assuring food safety should be employed and fully exploited by food handlers

INTRODUCTION

According to Food Handlers Job Descriptions, a food handler is a person with any job that requires them to handle unpackaged foods or beverages and be involved in preparing, manufacturing, wait service, inspecting or even packaging food and beverage items. All food handlers are required to use proper hygiene and sanitation methods when working with food; however different food handling jobs require different duties. The food manufacturer type of food handler is responsible for the manufacture or preparation of food or beverages in a factory setting. A food handler of this type may be employed to add sacks of sugar to candy vats or operate a machine that cracks walnut shells to remove the kernels. The specific duties and job description of a food handler in the industry of manufacturing is determined by the food that is being produced or manufactured. In the food industry, another type of food handler employed at a factory that has direct contact with unpackaged food is the team of food handlers employed to package the products. The packaging food handler will hold the product in clean or gloved hands and wrap or place the food product into protective packaging to prevent the food from becoming stale, growing mold or being exposed to germs and bacteria during transportation of the product from the factory to consumers.

Cooks are the food handlers responsible for preparing food in a restaurant setting and mix various foods together to create different flavours, dishes to delight and sustain their customers. Cooks will be required to follow health standards of handling food and keeping their cooking areas clean and bacteria-free. In addition to these responsibilities, a cook must be open to suggestions or special requests from customers. Wait staff are another type of food handler. The job of waiter or server requires an individual to handle a customer's food indirectly and transport the dish from the kitchen area to the customer's table. While waiters and servers do not always directly touch the food they are transporting, they still are required to follow rules and regulations of other food handlers.

A food inspector may handle and observe food dishes to determine if the food is safe for consumption by public consumers. A food inspector also may observe the cleanliness of the kitchen or preparation area in a factory to check for conditions, such as pests, that may make the food unsafe. An adequate supply of safe, wholesome and healthy food is essential to the health and well-being of humans[1]. However, at times, food itself can pose a health threat. The consumption of contaminated or unsafe foods may result in illness, also referred to as food borne disease[2]. Food borne diseases remain a major public health problem across the globe. The problem is severe in developing countries due to difficulties in securing optimal hygienic food handling practices. An estimated 70% of cases of diarrheal disease are associated with the consumption of contaminated food[1].

Diarrhoeal diseases, mostly caused by food borne or waterborne microbial pathogens are leading causes of illness and deaths in developing countries, killing an estimated 1.9 million people annually at the global level. Even in developed countries, an estimated one-third of the population are affected by microbiological food borne diseases each year[1]. In contrast, Kaferstein and Abdussalam[3] reported that up to 10% of the population of industrialized countries might suffer annually from food borne diseases.

However, it can be expected that a large number of illnesses remain under reported as only the most serious cases are usually investigated. On the other hand, many food borne illnesses share common symptoms and cannot be distinguished by the symptoms alone. Diagnosis of a food borne illness can only be made after considering the recent food-consumption history of a patient and performing proper laboratory tests for disease-producing parasites, bacteria and bacterial toxins. In addition, health departments may not detect food-borne illness for several reasons. Merely, a small proportion of people infected with enteric pathogens seeks treatment and consequently submits specimens for testing. Even a smaller proportion of people tests positive for a pathogen that healthcare providers and laboratories notify to the health department.

Transmission of intestinal parasites and enteropathogenic bacteria is affected directly or indirectly through objects contaminated with feaces. These include food, water, nails and fingers, indicating the importance of feacal-oral human to human transmission[3]. Accordingly, food-handlers with poor personal hygiene working in food-serving establishments could be potential sources of infections of many intestinal helminth, protozoa and enteropathogenic bacteria. Food-handlers who harbor and excrete intestinal parasites and enteropathogenic bacteria may contaminate foods from their feaces via their fingers, then to food processing and finally to healthy individuals. Compared to other parts of the hand, the area beneath fingernails harbors the most microorganisms and is most difficult to clean[4].

Biological contaminants largely bacteria, viruses and parasites constitute the major cause of food-borne diseases. In developing countries, such contaminants are responsible for a wide range of diseases, including cholera, campylobacteriosis, Escherichia coli gastroenteritis, salmonellosis, shigellosis, typhoid and paratyphoid fevers, brucellosis, omnibuses and poliomyelitis[5]. Diarrheal diseases, taken together and

especially infant diarrhoea are the dominant food borne illness problem in the developing world and indeed one of massive proportions[5]. Various factors such as the general sanitary standards of the house, the proper use of sanitation facilities like latrines, hand-washing lavatories, refuse management systems and dishwashing facilities affect food safety in food establishments. Food handling, preparation and servicing practices are other important factors in determining the safety of food. Conditions of cooking utensils, food storage systems (time and temperature), as well as food handlers' knowledge and practices similarly affect food safety directly or indirectly[6-8].

Ekpoma is presently experiencing rapid growth. As a result, the number of commercial food establishments in the city has been visibly increasing. Research has shown that most Ekpoma residents and students eat in restaurants and fast food due to their busy schedules and such are prospective subjects of food borne disease. Food prepared in large quantities is more liable to contamination, hence there is a greater potential for the occurrence of food borne disease outbreaks if basic sanitary practices are not maintained[1,8]. There is need to ensure good hygienic food handling and preparation practices in such public food establishments to safeguard the health and well being of consumers[6,7]. Furthermore, Food safety is an increasingly important public health issue[1]. Governments all over the world are intensifying their efforts to improve food safety[1,6]. These efforts are in response to an increasing number of food safety problems and rising consumer concerns[1]. Therefore, there is need to carry out this study within the study area as this will enlighten food handlers and other food organizations on the possible bacteria and parasites that are associated with improper food hygienic practices, hence appropriate precautionary measures taken to safeguard the health of the consumers.

MATERIALS AND METHODS

This study was carried out in the Ekpoma, Esan West Local Government Area of Edo State. Edo state lies between longitude 06°04^{l}E and 06°43'E and latitude 05°44'N and 07°34'N with a land mass of 17,450 km^2 located in the South-South geopolitical zone of Nigeria with a population of 3.1 million people. Ekpoma is a semi- urban town with the major occupation of farming, trading, civil servants and students.

Ethical permission: Ethical approval was obtained from the Health Research Ethics Committee, Ambrose Ali University and informed consent was sought from the Management of the various food handling units and participants.

Study population: Participants were selected from the list of strata below and included all staff that prepare and serve food. They include cook, production staff, butcher and waiter:

- Bar include establishment that serves alcoholic drinks: beer, wine, liquor cocktails and pepper soup for consumption on the premises
- Restaurant include establishments that prepares and serves food, drink to customers. Meals are generally served and eaten on premises, but may also offer take-out and food delivery services
- Butcher/suya shop include establishment that slaughter animals, dress their flesh and sell their meat or any combination of these three tasks. They may prepare standard cuts of meat, poultry, fish and shellfish for sale in retail or wholesale to other food establishments
- Ice cream/fruit juice shop includes establishments that prepare frozen dessert usually made from dairy products, such as milk and cream and often combined with fruits or other ingredients and flavours

A total of one hundred samples were collected from different food handlers in Ekpoma, Edo State.

Inclusion criteria: Food handlers with no obvious signs and symptoms of any underlying illness were included in this study. Also food handlers who fell into the category listed under the study population were also included.

Exclusion criteria: Furthermore, food handlers outside the study area and having diarrhea, fever, taking antibiotics, antihelminthics and incomplete questionnaires were excluded from the study.

Study design: This study was a descriptive/ analytical study. It was designed to assess the prevalence of bacteria among food handlers in Ekpoma, Edo State. One hundred food handlers were selected. Specimens such as stool and finger nail contents were collected and analyzed in the laboratory using standard methods. Results were presented in tables.

Methods of data collection: Structured and pre-tested self-administered questionnaires was used to obtain information on socio-demographic characteristics of establishment owners/managers and food handlers, repair conditions of premises, availability of water supply, toilet facility, refuse management, dish/hand washing facility. Data quality was ensured by regular supervision, spot checking and reviewing the completeness and consistency

of questionnaires on a daily basis. Medical laboratory Scientists were recruited for sample collection of participants in establishments and transportation. Inoculation and isolation of the desired organisms were performed in a laboratory using standard procedures and culture Media as recommended.

Specimen collection: The stool samples were collected into clear, transparent, wide mouthed universal containers without disinfectant or detergent residue and tight-fitting leak proof lids. The name, age and sex of the subjects were properly labeled on the universal containers containing the samples. Also, fingernail content was obtained with the aid of a sterile swab stick.

Sample analysis/methods: The sample analysis was carried out in two parts; bacteriological and parastological examination.

Bacteriological examination

Culture of the feacal specimens: The feacal specimens were cultured into liquid and onto solid media for isolation and identification of the Bacterial pathogens. Enrichment broth (Selenite F) was used to allow the multiplication of bacteria; this was subsequently sub-cultured on Salmonella-Shigella Agar (SSA) and Mac Conkey Agar (MCA) and incubated aerobically at 37°C for 24 h.

Culture of finger nails content: Finger nails content was obtained with the aid of a sterile swab stick. The swab stick was inoculated on each plate of MacConkey and blood agar by making a primary inoculum on a small area of the agar plate and then streaked out. The inoculated media was incubated aerobically at 37°C for 24 h. Identification of bacteria was done by carrying out biochemical tests.

Gram staining: The Gram staining technique is used to help identify pathogens in specimens and cultures by their Gram reaction (Gram positive or Gram negative) and morphology.

Biochemical screening tests: Identification of bacterial isolates involved the use of biochemical screening media that are usually used. One hundred bacterial isolates (100) were subjected to various biochemical tests; Catalase, Coagulase, Motility, Indole, Oxidase, Urease and Citrate utilization tests.

Sensitivity test: The disc diffusion method (Kirby-Bauer) on Nutrient agar was used to assess the sensitivity of isolated pathogens to Streptomycin; Septrin; Chloramphenicol; Sparfloxacin; Ciprofloxacin; Amoxacillin; Augmentin; Gentamycin; Perfloxacin and Tarivid. The interpretation of inhibition zones was performed by observing the guidelines of the Clinical and Laboratory Standards Institute (CLSI).

Parasitological examination: Parasitological examination of the stool sample was carried out in two parts; Macroscopy and Microscopy.

Microscopy of finger nails content: The microscopy of the finger nails content was done using the normal saline/iodine method described above.

Statistical analysis: The collected data were expressed as Frequency and Percentage. Comparison of qualitative variables were made using Chi-square test. In all cases studied, the difference having $p \leq 0.05$ was considered statistically significant using SPSS software (version 21).

RESULTS

Table 1 shows the socio-demographic profile of food handlers in Ekpoma. The results showed that, 36% of participants are male while 64% are females ($\chi^2 = 3.920$, p-value = 0.048). Forty four percent of the participants are between the age 16-20 years, 28% within 21-25 years, 20% within 26-30 years and 8% within 31 years and above ($\chi^2 = 13.68$, p-value = 0.003). Based on religion, 96% of the participants are Christians, 4% are Muslims while none reported for traditional and others ($\chi^2 = 42.32$, p-value = 0.000). While 28% of participants are married, 64% are single, 8% are divorced. However, there were no separated or widowed participants in this study ($\chi^2 = 24.16$, p-value = 0.000). Based on educational status, 64% are graduate or undergraduate, 28% are secondary school students while 8% had no formal education ($\chi^2 = 24.16$, p-value = 0.000). Concerning the place of residence, participants who reside in urban areas are 40%, 28% reside in semi-urban and 32% reside in the rural areas ($\chi^2 = 1.120$, p-value = 0.571). Also, 8% of the participants reside in duplex, 4% in bungalow, 52% in block of flat, 36% in room in general compound and none reside in native compound ($\chi^2 = 31.60$, p-value = 0.000). Concerning the years of service, 8% has less than 1-year experience, 28% between 1-2 years, 4% 3 years and above and 60% do not report any years of service in their establishment ($\chi^2 = 39.28$, p-value = 0.000). Also, 48% has held a post in the capacity of sales person while 56% have not held any post ($\chi^2 = 0.720$, p-value = 0.396).

Table 2 shows response of the food handlers based on their knowledge on food borne illness. The results showed that 44% of the respondents strongly agreed that diseases

Table 1: Socio-demographic characteristics of food handlers in Ekpoma

Variables	Categories	No encountered	Percentage	χ^2	p-value
Sex	Male	18	36		
	Female	32	64		
	Total	50	100	3.92	0.048
Age	16-20	22	44		
	21-25	14	28		
	26-30	10	20		
	Above 30	4	8		
	Total	50	100	13.68	0.003
Religion	Christian	48	96		
	Muslim	2	4		
	Traditional	0	0		
	Others	0	0		
	Total	50	100	42.32	0
Marital status	Married	14	28		
	Single	32	64		
	Divorced	4	8		
	Separated	0	0		
	Widowed	0	0		
	Total	50	100	24.16	0
Educational status	Graduate	32	64		
	Primary	0	0		
	Secondary school	14	28		
	No formal education	4	8		
	Total	50	100	24.16	0
Place of residence	Urban	20	40		
	Semi urban	14	28		
	Rural	16	32		
	Total	50	100	1.12	0.571
Nature of residence	Duplex	4	8		
	Bungalow	2	4		
	Block of flat	26	52		
	Native compound	0	0		
	Room in general compound	18	36		
	Total	50	100	31.60	0
Years of service	Less than 1 year	4	8		
	1-2 years	14	28		
	3 and above	2	4		
	None	30	60		
	Total	50	100	39.28	0
Post held	Sales person	22	48		
	None	28	56	0.72	
	Total	50	100		0.396

can be transmitted through food, 36% agreed, 16% responded not sure, 4% disagreed while none responded strongly disagree (χ^2 = 20.08, p-value = 0.000). A preponderance majority of the respondents agreed that they have knowledge that food borne illness can be transmitted by bacteria (96%), while 4% reported having no knowledge on bacteria (χ^2 = 42.32, p-value = 0.000). Similarly, 72% of the respondents agreed that food borne illness can be transmitted by parasite, 12% responded No while 16% responded not sure (χ^2 = 33.76, p-value = 0.000). Also, 60% of the respondents agreed that they have knowledge on the risk factors associated with food borne illness, 20% responded No while 20% also responded Not sure (χ^2 = 16.00, p-value = 0.000).

Majority of the respondents agreed that poor personal hygiene of food handlers is a risk factor (72%), while 28% responded No (χ^2 = 9.68, p-value = 0.002). Similarly, 76% of the respondents agreed on poor food hygiene of food handlers as a risk factor while 24% responded No (χ^2 = 13.52, p-value = 0.000). Also, 68% of the respondents agreed improper cooking temperatures as a risk factor, while 32% responded No (χ^2 = 6.48, p-value = 0.011). Forty percent 40% of the respondents responded Yes to improper cold and holding temperatures as a risk factor while 60% responded No (χ^2 = 2.00, p-value = 0.157). Eighty eight percent 88% of the respondents agreed to dirty and contaminated utensils as a risk factor while 12% responded No (χ^2 = 28.88, p-value = 0.000). Furthermore, 76% responded Yes to Fecal contamination of food and drinking water as a risk factor while 24% responded No (χ^2 = 13.52, p-value = 0.000). Eighty eight percent 88%

Table 2: Knowledge of food handlers on food borne diseases

Knowledge	Response	No encountered	Percentage	χ^2	p-value
Diseases can be transmitted through food	Strongly agree	22	44		
	Agree	18	36		
	Not sure	8	16		
	Disagree	2	4		
	Strongly disagree	0	0		
	Total	50	100	20.08	0
Do you have knowledge that food borne illness	Yes	48	96		
can be transmitted by bacteria?	No	2	4		
	Total	50	100	42.32	0
Do you have knowledge that food borne illness can	Yes	36	72		
be transmitted by parasite?	No	6	12		
	Not sure	8	16		
	Total	50	100	33.76	0
Do you have knowledge on the risk factors associated	Yes	30	60		
with food borne illness?	No	10	20		0
	Not sure	10	20	16	
	Total	50	100		
Poor personal hygiene of food handlers	Yes	36	72		
	No	14	28		
	Total	50	100	9.68	0.002
Poor food hygiene of food handlers	Yes	38	76		
	No	12	24		
	Total	50	100	13.52	0
Improper cooking temperatures	Yes	34	68		
	No	16	32		
	Total	50	100	6.48	0.011
Improper cold and holding temperatures	Yes	20	40		
	No	30	60		
	Total	50	100	2	0.157
Dirty and contaminated utensils	Yes	44	88		
	No	6	12		
	Total	50	100	28.88	0
Faecal contamination of food and drinking water	Yes	38	72		
	No	12	24		
	Total	50	100	13.52	0
Food from unsafe sources	Yes	44	88		
	No	6	12		
	Total	50	100	28.88	0

agreed to food from unsafe sources as a risk factor while 12% responded No (χ^2 = 28.88, p-value = 0.000).

Table 3 shows the level of personal hygiene of food handlers. Seventy two 72% of the respondents agreed that they wash their hands properly after using the toilet before handling food while 28% responded No (χ^2 = 9.68, p-value = 0.002). Seventy six percent 76% of the respondents agreed that they use hand washing facility in their establishment while 24% responded No (χ^2 = 13.52, p-value = 0.000). Seventy six percent 76% of the respondents agreed that they use sanitizers/liquid hand wash and disinfectants after using the toilet, before handling food and after handling raw meat, while 24% responded no (χ^2 = 13.52, p-value = 0.000). None (0%) of the respondents agreed on having open wound (χ^2 = 0.040, p-value = 0.477). Forty eight percent 48% agreed that they go for regular medical examination while 52% agreed that they do not go for regular medical examination (χ^2 = 0.080, p-value = 0.777). 16% of the respondents agreed to have undergone medical examination on stool analysis while 84 responded No (χ^2 = 27.040, p-value = 0.000).agreed that Parasites and bacteria enter the body due to lack of hygiene, 60% agreed, 4% responded Not sure while none (0%) responded for disagree and strongly disagree (χ^2 = 23.68, p-value = 0.000). 36% of the respondents strongly agreed that De worming helps get rid of parasitic worms that enters the human body, 56% agreed, 8% responded Not sure while none responded for disagree and strongly disagree (χ^2 = 17.44, p-value = 0.000).Sixty eight percent 68% also agreed that they deworm themselves while 32% responded No (χ^2 = 6.48, p-value = 0.011). Also, 28% responded that they deworm every 4 months, none for 6 months, 20% agreed for yearly while 52% of the respondents cannot remember how often they deworm (χ^2 = 8.32, p-value = 0.016). 84% of the respondents agreed that they isolated or stay away from work when sick/vomiting or having diarrhea while 16% responded No (χ^2 = 23.12, p-value = 0.000). Furthermore, 48% agreed that their establishment provide them with

Table 3: Personal hygiene practices of food handlers

Personal hygiene	Response	No encountered	Percentage	χ^2	p-value
Do you wash hands always and properly after using the toilet, before handling food and after handling raw eat?	Yes	36	72		
	No	14	28		
	Total	50	100	9.68	0.002
Do you use hand washing facility in your establishment?	Yes	38	76		
	No	12	24		
	Total	50	100	13.52	0
Do you use sanitizers/liquid hand wash after using the toilet, before handling food and after handling raw meat?	Yes	38	76		
	No	12	24		
	Total	50	100	13.52	0
Do have any open wound or cut?	Yes	0	100		
	No	50			
	Total	50	100	0.04	0.477
Do you undergo regular medical examination?	Yes	24	48		
	No	26	52		
	Total	50	100	0.08	0.777
Have you gone for medical examination on stool analysis?	Yes	8	16		
	No	34	68		
	Total	50	100	27.04	0
Parasites and bacteria enter the body due to lack of hygiene	Strongly agree	18	36		
	Agree	30	60		
	Not sure	2	4		
	Disagree	0	0		
	Strongly disagree	0	0	23.68	0
	Total	50	100		
Deworming helps get rid of parasitic worms that enters the human body	Strongly agree	18	36		
	Agree	28	56		
	Not sure	4	8		
	Disagree	0	0		
	Streongly disagree	0	0	17.44	0
	Total	50	100		
Do you deworm your self?	Yes	34	68		
	No	16	32		
	Total	50	100	6.48	0.011
How often do you deworm?	Every 4 months	14	28		
	Every 6 months	0	0		
	Yearly	10	20		
	Cannot remember	26	52		
	Total	50	100	8.32	0.016
Are you isolated or stay away from work when sick/ vomiting or having diarrhea	Yes	42	84		
	No	8	16		
	Total	50	100	23.12	0
Does your establishment provide you with medication when you are ill?	Yes	24	48		
	No	26	52		
	Total	50	100	0.08	0.777

medication when ill, while 52% responded No (χ^2 = 0.080, p-value = 0.777).

Table 4 shows the response of food handlers based on their level of food hygiene. Twenty four percent 24% of the respondent agreed that they do not wear hand gloves when cooking or serving meals while 76% of the respondents responded No (χ^2 = 22.80, p = 0.000). Thirty two percent 32% of the respondents strongly agree that Changing of hand gloves between ready to eat meal and raw food such as meat help reduce food borne diseases, 32% agreed, 36% were not sure, none responded for disagree and strongly disagree (χ^2 = 0.160, p = 0.923). Forty eight percent 48% of the respondents do wear apron and head tie when cooking and serving meal while 52% of the respondents do not wear apron and head tie when cooking and serving meal (χ^2 = 0.080, p = 0777). 40% of the respondents strongly agree that Washing and changing of apron regularly help reduce transmission of food borne pathogens, 56% agreed, 4% were not sure, none responded for disagree and strongly disagree (χ^2 = 21.28, p = 0.000). 28% of the respondents do attend regular training on food hygiene and safety while 72% do not attend regular training on food hygiene and safety (χ^2 = 9.68, p = 0.010). 16% agreed that they use thermometer to check food temperature while 84% responded No (χ^2 = 23.12, p = 0.000). 72% of the respondents strongly agreed that the use of proper waste disposal system is vital in preventing the menace of

Table 4: Food hygiene practices of food handlers in Ekpoma

Food hygiene	Response	No encountered	Percentage	χ^2	p-value
Do you wear hand gloves when cooking/serving a meal?	Yes	12	24		
	No	38	76	28.8	0
	Total	50	100		
Changing of hand gloves between ready to eat meal and raw food such as meat help reduce food borne diseases.	Strongly agree	16	32		
	Agree	16	32		
	Not sure	18	36		
	Disagree	0	0		
	Strongly disagree	0	0	0.16	0.923
	Total	50	100		
Do you wear apron and head tie when cooking/serving meal?	Yes	24	48		
	No	26	52	0.08	0.777
	Total	50	100		
Washing and changing of apron regularly help reduce transmission of food borne pathogens?	Strongly agree	20	40		
	Agree	28	56		
	Not sure	2	4		
	Disagree	0	0		
	Strongly disagree	0	0	21.28	0
	Total	50	100		
Do you attend regular training on food hygiene and safety?	Yes	14	28		
	No	36	72	9.68	0.01
	Total	50	100		
Do you use thermometer to check food temperature?	Yes	8	16		
	No	42	84	23.12	0
	Total	50	100		
The use of proper waste disposal system is vital in preventing the menace of microbial food poisoning?	Strongly agree	36	72		
	Agree	10	20		
	Not sure	4	8		
	Disagree	0	0	34.72	0
	Strongly disagree	0	0		
	Total	50	100		

Table 5: Parasites and bacteria isolated from the finger nails content and stool samples of food handlers in Ekpoma

Sample	Micro-organisms	No examined	No positive	Prevalence (%)	χ^2	p -value
Nail culture	Staphylococcus epidermidis	50	26	52		
	Streptococcus species		6	12		
	Staphylococcus aureus		18	36		
	Total	50	50	100	12.16	0.002
Nail parasitology	None	50	Nil	-	-	
Stool parasitology	Ascaris lumbricoides		7	14		
	Hookworm	50	3	6		
	Total	50	10	20	2	0.157
Stool culture	Staphylococcus epidermidis					
	Escherichia coli	50	18	36		
	Salmonella species		14	28		
	Total	50	36	72	6	0.112

Table 6: Antibiotic sensitivity of coagulase positive Staphylococcus and Salmonella species isolated in this study

Antibiotics	Coagulase Positive Staph (n = 18)	Antibiotics	Salmonella Species (n = 4)
Streptomycin	2 (11.1%)	Chloramphenicol	3 (75%)
Zinnacef	8 (44.4%)	Ciprofloxacin	2 (50%)
Perfloxacin	3 (16.7%)	Amoxacillin	2 (50%)
Erythromycin	3 (16.7%)	Streptomycin	NS
Ciprofloxacin	5 (27.8%)	Sparfloxacin	NS
Ampiclox	1 (5.6%)	Septrin	N

microbial food poisoning, 20% agreed, 8% were not sure, none responded for disagree and strongly disagree ($\chi^2 = 34.72$, $p = 0.000$).

Table 5 Results show the frequency and type of bacteria and parasites isolated from finger nails content and stool of food-handlers in Ekpoma. For finger nail contents, bacteria isolated include, *Staphylococcus epidermidis* (52%), *Staphylococcus aureus* (36%) and *Streptococcus species* (12%) ($\chi^2 = 12.16$, $p = 0.002$). No parasite was isolated from finger nails. For stool, the parasites isolated are *Ascaris lumbricoides* (14%) and Hookworm (6%); ($\chi^2 = 2.00$, $p = 0.157$) while the bacteria isolated for stool culture include; *Staphylococcus epidermidis* (36%), *Escherichia coli* (28%) and *Salmonella* species (8%); ($\chi^2 = 6.00$, $p = 0.112$).

Table 6 showed the sensitivity test on coagulase positive. *Staphylococcus* and *Salmonella* species. The results showed that the Zinnacef (44.4%) had the highest sensitivity to *Staphylococcus.* This was followed by Ciprofloxacin (27.8%). The lowest sensitivity was recorded for Ampiclox (5.6%). Also, the result showed that *Salmonella* species was more sensitive to Chloramphenicol (75%) followed by Ciprofloxacin (50%) and Amoxacillin (50%).

DISCUSSION

Poor and faulty food-handling practices have been identified as the leading cause of the majority of food borne diseases[9]. However, pathogens that are most commonly associated with poor hygienic practices are the *enterobacteriaceae*, such as *Escherichia coli* and other *coliforms*, as well as members of the genera *Salmonella*, *Shigella, Yersinia*, *Proteus* and *Klebsiella*. The prevalence of intestinal parasites and bacteria of the fhandlers in this study was in agreement with the findings of other studies. Costa-Cruz *et al.*[10] reported intestinal parasites in 47.1% of the food handlers in public elementary schools. In another study that was carried out in public hospitals, Laurenco *et al.*[11] reported that 17.1% of food handlers had intestinal parasitism. Al-Lahham *et al.*[12] also reported the most common parasites as Ascaris lumbricoides (4.9%), Giardia lamblia (3.9%), Schistosoma mansoni (2.8%) and hookworms (2.5%).

Study also shows a difference in some of the very poor hygiene practices identified. These include, lack of provision of medication by establishment, non-isolation from work environment when sick, irregular use of sanitizers and disinfectants, lack of change of hand gloves between ready to eat meal, irregular food hygiene training, non-use of thermometer to check food temperature. This indicate the health status anhygiene practices of food handlers/establishments in Ekpoma and indeed has buttressed the role of food handlers in disease transmission as several authors all over the world have stressed[13]. The hygiene condition of fast food joints and restaurants was further challenged by the isolation of Staphylococcus aureus and other bacteria from food handlers. Also, E. coli was isolated from stool cultures in this study. Another shocking revelation was the establishment of minimal Salmonella carriage among participants. This value is not in agreement with the rate of 0.13% quoted for the developed world. However, Mensah *et al.*[14] reported 3.2% in Accra. The continued importance of Salmonellae carriers especially food handlers in the spread of the disease is a fact that has been long established and some of the poor hygiene practices mentioned earlier may be responsible[15].

Although the urban centres have barely adequate water supply, many food handlers and consumers, in the course of the day, who use the public toilets are unlikely to wash their hands after using the toilet due to the absence of water at these public toilets. Again, though chlorinated tap water kill Salmonellae, many food handlers living in city slums and shanty towns are without tap water and are at a risk of infection and as enteric fever is known to be endemic in places of low personal hygiene and environmental sanitation[15]. This study has therefore established that food handlers in Ekpoma constitute significant risk in the spread of enteric fever. However, given the time and money required to improve environmental sanitation and increase the accessibility of water, the most rewarding option is regular food hygiene education, the regular screening of food handlers with a view to following up those found infected and getting them cured.

Furthermore, the irregular use of disinfectants/ sanitizers, lack of change of hand gloves between ready to eat meal and irregular food hygiene training are among other risk factors identified in this studies that could pose a threat to food safety. Humans are often the source of disease-producing microorganisms, which occur as normal habitants in certain parts of the body, mainly the hair, nose, mouth, throat, bowels and skin. These microorganisms are then readily transferred to the hands. Even blowing one's nose into a handkerchief can contaminate hands and food handlers should avoid direct contact with food when possible[16]. Epidemiological studies show that one factor that often contributes to *Staphylococcus* food-poisoning outbreaks is the human carrier who handles foods in food service establishments[16].

This study shows that although most of the participants (48%) undergo regular medical examination. Employees suffering from disease symptoms such as fever, diarrhea, stomach upset, nausea, vomiting, sore throat, coughing, sneezing or even individuals suspected to be suffering from or to be carriers of a disease or illness that can readily be transmitted through food should not be allowed to enter any food handling area and should report illness or related symptoms to management. Medical examination of a food handler should be carried out if clinically or epidemiologically indicated.

The safety of food was further challenged by the sanitary condition of some food outfits that participated in this study. Few observations made include Personnel with infections are not restricted from potentially hazardous work, inadequate provision of disinfectants/sanitary products including hand gloves, apron and head tie. This suggests that these outfits do not comply with abatement notices. Health inspectors should therefore work out modalities to ensure that persons with any food borne infection is restricted and treated. As indicated in this study, the majority i.e. (72%) of the respondents reported that they usually washed their hands before starting food

preparation and after handling raw meat. A smaller number reported that they do not use hand wash detergent to wash their hands before starting food preparation and after handling raw meat. In studies conducted by Altekruse *et al.*[17], Yang *et al.*[18] and Shiferaw *et al.*[19] 87-92% of the respondents also indicated that they always or usually washed their hands before handling food and 62-100% that they also always or usually washed their hands after handling raw meat or poultry.

Effective hand washing therefore, being an essential control measure for prevention of pathogen transmission in food service establishments, facilities for Personnel should be adequate and all hand washing basins in toilet areas must be supplied with hot and cold water and hand-cleaning preparations in dispensers and paper towels or air hand-dryers should be provided. The potential for cross-contamination is reduced however, when disposable paper towels are used. Less than one-third of these respondents indicated using soap and water for washing their hands before starting food preparation and or after handling raw poultry or meat. Furthermore, it is most probably that most participants do not wash hands according to good hygienic practices. This may not be unconnected to lack of portable water and standard hand wash facilities in establishments, even when such facilities are available most participants do not have basic understanding of standard hand washing procedures. Other notable violations include; non provision of thermometers for temperature control. It is important to note that further evaluating the above mentioned factors is important in food safety and how best to control these factors will be important in improving the system. The intensity of surveillance for food borne disease can markedly influence the number of food borne disease outbreaks reported. However, a substantial proportion of restaurant-associated food borne illnesses probably goes unreported. This study suggests that a variety of factors influence and challenge the sanitary component and reliability of routine restaurant inspections in preventing food borne disease. Some of these factors may be modified by policies designed to ensure periodic retraining and systematic standardization among inspection. Some of these factors include illiteracy, poverty, poor infrastructural amenities, power, poor road network, corruption and commitment on the part of government. Further evaluating factors important in food safety and how best to control these will be important in improving the system.

CONCLUSION

In order to meet the huge challenge of food safety in the 21st century, a coordinative and cooperative approach is required. This will be a major task of the public health community and will require the use of new methods of identifying, monitoring and assessing of food borne hazards, including the wide application of the hazard analysis and critical control point system. Both traditional and new technologies for assuring food safety should be improved and fully exploited. This needs to be done through public/private partnership, legislative measures where suitable but much greater reliance will have to be placed on voluntary compliance and on education of consumers and other food-handlers:

- Establishments should ensure compulsory and proper treatment of staff with active illness
- In a view to maintain good health, disposable rubber gloves, plasters and other measures for minor cuts should be provided for use as necessary to the personnel who have contact with food
- Establishments should train and re-train staff in good hygienic practices
- Any behavior that could result in the contamination of food, such as eating and chewing (of gum, sticks and sweets) should also be prevented in food-handling establishments. It is also essential, when unprotected food or raw food materials are handled, that personnel remove jewelry from their hands, while fingernails should be kept short and clean to reduce bacteria levels
- Food handlers who are symptomatically ill, therefore, present a serious health hazard and should be excluded from work. Such individuals should furthermore be made aware of the need to immediately report illnesses and should be assured that if exclusion is necessary it will not result in loss of employment or wages

ACKNOWLEDGMENTS

The authors would like to thank all the Laboratory and technical staffs of St Kenny Research Consult, Edo State for their excellent assistance and for providing medical writing support/editorial support in accordance with Good Publication Practice (GPP3) guidelines.

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