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BACTERIAL CONTAMINATION IN VENDED ANIMAL FOOD PRODUCTS AROUND MOTOR PARKS IN IBADAN, SOUTH WEST NIGERIA

Sangoyomi, T .E. [1]***, Bello-Olusoji, O. A.*** [2]***, Ajani, F.*** [3]***, Owoseni, A. A.*** [4] ***and Odeniyi, O.*** [5]
[1]*Department of Crop Production, Soil and Environmental Management, Bowen University, Iwo*
[2]*Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure*
[3]*Department of Animal Science and Fisheries Management, Bowen University, Iwo, Osun State*
[4]*Department of Biological Sciences, Bowen University, PMB 284, Iwo, Osun State, Nigeria.*
[5] *Department of Microbiology, University of Ibadan, Ibadan, Oyo State, Nigeria*
Email:t.sangoyomi@yahoo.com

ABSTRACT

Consumers ingest significant amounts of food being unaware that there is a potential problem hence they become ill. This study was carried out to obtain the bacteriological profiles of vended animal food products. Seven (7) different ready-to-eat animal food products were sampled from different motor parks in Ibadan, southwest Nigeria. Bacteria were isolated on plate count agar (PCA) and eosin methylene blue (EMB) agar for the total aerobic organisms and the presence of coliforms. The isolated organisms were identified and characterized following standard morphological and biochemical tests. A total of thirty-six bacteria were identified and fall into the genera *Bacillus* (25%), *Escherichia coli* (16.7%), *Staphylococcus* (13.9%), *Micrococcus* (13.9%), *Pseudomonas* (13.9%), *Yersinia* (11.1%) and *Actinobacillus* (2.8%). Food sample A (large prawns) had the heaviest microbial load (22%) and food sample E ("Kudu") had the lowest (8.3%). A major concern with street foods is safety. Majority of the foods are prepared and sold under unhygienic conditions. These kinds of foods pose a high risk of food poisoning due to microbial contamination. This study should sensitize public health authorities on the need to impose strict regulations on food standards.
Keywords: ready-to-eat, public health, animal food product, vended food, bacterial contamination

INTRODUCTION

Food poisoning is caused by food which looks normal, smells normal and tastes normal. Because the consumer is unaware that there is a potential problem with the food, a significant amount of food is ingested and hence they become ill. Consequently, it is hard to trace which food was the original cause of food poisoning since probably the consumer will not recall noticing anything untoward in their recent meals [1]. Foodborne illnesses may occur when food sources that contain pathogenic microorganisms are consumed raw or improperly cooked. The health implications cannot be over emphasized. *E. coli* for instance can induce gastroenteritis [2]; *Staphylococcus aureus* isolates have been implicated in a number of clinical cases. [3,4,5] reported the presence of mesophilic aerobic bacteria, Enterobacteriaceae, *S. aureus* and coliforms among ready-to-eat snails. Food poisoning organisms are normally divided into two groups; infections caused by *Salmonella,* pathogenic *Escherichia coli* etc. These are organisms which multiply in the human intestinal tract and they cause food poisoning based on number of cells present. The second group is the intoxications caused by *Bacillus cereus*, *Staphylococcus aureus*, *Clostridium botulinum* etc. These organisms produce toxins either in the food or during passage in the intestinal tract

[1].The modern way of life relies heavily on the availability, quality and safety of ready-to-eat (RTE) foods. The quality of the starting material is always of major importance, factors such as handling, processing, transportation and storage can influence the microbiological composition of the finished product at the consumer's table [6]. In many developing countries, street food vendors are an important component of the food supply chain. Being reasonably priced and conveniently available, street food satisfies a vital need of the urban population. These RTE foods and beverages are prepared and/or sold by vendors or hawkers mainly in streets or other convenient public places such as around places of work, schools, hospitals, railway stations and bus terminals. Several workers have investigated the microbiological quality of their regional RTE foods [7,8,9,10]. Commonly adopted indices of microbial quality include the coliforms, the Enterobacteriaceae and the aerobic plate count [11]. The objective of this study was to obtain the bacteriological profile of vended animal food products around motor parks in Southwest Nigeria.

MATERIAL AND METHODS

Sampling Procedure: Seven different ready-to-eat animal food products namely: prawns, snails, *Chrysichthys nigrodigitatus*, *Parachama obscura* (okodo), kudu, fried and smoked Tilapia were bought from different motor parks in the Ibadan metropolis. Each sample was aseptically packed in polythene bags and transported to the laboratory for bacteriological analyses within 24 hours of collection.

Isolation of bacteria: A 25g portion of each of the samples was homogenized with 225ml of peptone broth [12]. One millilitre of the homogenate was pour plated on plate count agar (PCA)(LabM) for aerobic bacteria and Eosin methylene blue (EMB) agar (LabM) for isolation of *E. coli*. Plates were incubated for 24h i.e. PCA and 48h i.e. EMB at 37°C. Distinct colonies were re-streaked on fresh agar plates and pure colonies were kept on agar slants at 4°C.

Identification of isolates: The bacterial colonies were differentiated first on the basis of colonial morphology followed by microscopic examination after Gram staining. Biochemical tests including catalase, oxidase, gelatin hydrolysis, motility and fermentation of sugars were carried out to characterize the isolates as described by [13, 14].

RESULTS

Thirty six bacteria were isolated in all. The food samples and their descriptions are shown in Table 1. The food sampled were all protein rich foods which could be consumed directly upon purchase. The isolated bacteria fall into 7 genera namely *Bacillus*, *Actinobacillus*, *Escherichia*, *Staphylococcus*, *Micrococcus*, *Yersinia* and *Pseudomonas*. The distribution of the isolated genera in the RTE vended food samples are shown in Figure 1. *Bacillus* was the most frequently occurring bacteria (9 times out of 36), followed by *Escherichia coli* (6). *Staphylococcus, Micrococcus* and *Pseudomonas* occurred at the same rate (5) with Yersinia and Actinobacillus occurring 4 times and 1 time respectively (Fig. 1).

Table 1: Description of foods sampled

CODE	Name	Processing/Description
A.	Large Prawns	These are parboiled and put on sticks for sale on the highways. They are consumed directly.
B.	Snails	The shells are removed, and the flesh cleaned. The flesh is fried and arranged in glass cupboards for sales. The snails on purchase are wrapped in old newspapers and consumed directly as a snack.
C.	*Chrysichthys nigrodigitatus* (catfish)	They are small sized fishes smoked (not fully dried) and displayed in small baskets. They are consumed directly or used for soup preparation.
D.	*Parachama obscura* (Okodo, African snakehead)	These are medium sized fishes smoked and displayed for sales. They are consumed directly or used for soup preparation
E.	Kudu	These are small sized bony fishes. And prepared as in C and D above.
F.	Tilapia	These are small flat fishes, smoked and eaten as snacks.
G.	Tilapia	These are small flat fishes, fried and eaten as snacks.

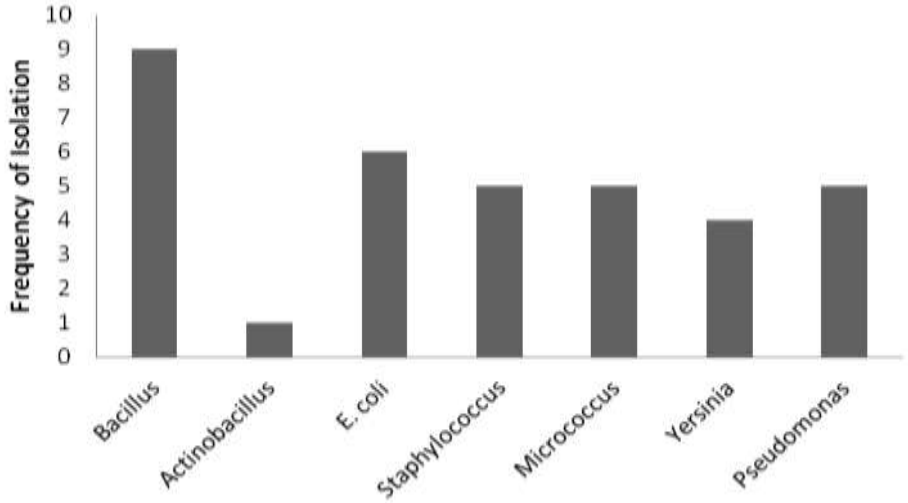

Figure 1: Distribution of isolated genera in the RTE vended food samples.

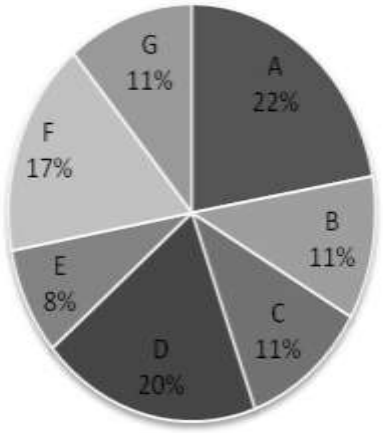

Figure 2: Percentage Prevalence of bacteria in the vended food samples.

(Results expressed as the number of isolated organisms in each food sample/total number of bacteria isolated.). The percentage prevalence of the isolated bacteria from the various RTE foods examined is summarized in Figure 2. Twenty two point two percent (8/36) of the organisms were isolated from food sample A, while 11.1% of total isolates were from food samples B, C and G (4/36). Food samples D and F had 19.4% (7/36) and 16.7% (6/36) of the total isolates respectively. Food sample E had the lowest prevalence rate of 8.3% (3/36) (Fig. 2). Table two shows percentage distribution of the isolated bacteria genera in the different food samples. Food sample A had the highest number of isolates with *Bacillus*, *Actinobacillus*, *E. coli, Staphylococcus, Micrococcus* and *Yersinia* being present. *E. coli* and *Yersinia* both had 25% occurrence while each of the remaining isolates occurred at 12.5%. Food sample B had E. coli and Yersinia isolated from it at 50% each. Micrococcus and E. coli were isolated from Food sample C at the rate of 75% and 25% respectively. The organisms, Bacillus (57.1%), E. coli (14.3%) and Pseudomonas (28.6%) were isolated form food sample D. *Staphylococcus* (66.7%) and *Pseudomonas* (33.3%) was isolated from sample E. Fifty percent of the isolates from sample F were *Bacillus* while *Staphylococcus* was 16.7% and *Pseudomonas* 33.3%. In sample G, 50% of its isolates were *Staphylococcus* while *Micrococcus* and *Bacillus* were distributed at 25% each (Tab. 2).

Table 2: Percentage distribution of bacterial genera isolated in the different food samples

	Distribution (%)						
	A	B	C	D	E	F	G
Bacillus	12.5	-	-	57.1	-	50	25
Actinobacillus	12.5	-	-	-	-	-	-
E. coli	25	50	25	14.3	-	-	-
Staphylococcus	12.5	-	-	-	66.7	16.7	50
Micrococcus	12.5	-	75	-	-	-	25
Yersinia	25	50	-	-	-	-	-
Pseudomonas	-	-	-	28.6	33.3	33.3	-
Total	100	100	100	100	100	100	100

DISCUSSION

Seven ready-to-eat (RTE) vended foods were sampled and bacteria isolated from them. Three Gram negative bacteria were isolated i.e. *E. coli, Yersinia* and *Pseudomonas*. These three are most times pathogenic while four Gram positive bacteria were isolated namely *Bacillus, Actinobacillus, Staphylococcus aureus* and *Micrococcus*. Lactic acid bacteria (LAB) are the only microbial group that should be present in foods. The presence of any other microorganism in ready-to-eat (RTE) foods is justifiable to be referred to as contaminants [6]. *Campylobacter* was isolated from a range of retail foods sampled in three cities of Pakistan [15]. In foods, *Salmonella* spp., *Campylobacter* spp., *E. coli* 0157 and other verotoxigenic strains of *E. coli* and *Vibrio cholera* if detected in 25g, makes the food unacceptable and potentially hazardous [16]. It is the opinion of the ACFDP that ready-to-eat

foods should be free from *Samonella* spp, *Campylobacter* spp and *E. coli* 0157 and other verocytotoxin producing E. coli (VTEC). Appropriate control measures during production, adequate hygiene standards and appropriate cooking during final preparation should ensure that the end products are free from viable organisms and that the foods are therefore of good quality. RTE foods containing salmonellas or other pathogens may not always cause illness but there is good microbiological and epidemiological evidence that small numbers of pathogens in foods have caused illness [16, 17]. The presence of foodborne agents that may cause illness in RTE foods is a significant risk to consumer health and their absence is of paramount importance. The genus *Bacillus* is a spore producing group of bacteria. *Bacillus cereus* has been isolated in cooked foods and is known to produce toxins which can cause food poisoning. *Bacillus sporothermodurans* was isolated from Indian curry soup that had received a thermal treatment [18]. *Staphylococcus aureus* produces several staphylococcal virulence factors including enterotoxins (SE A to SE E and SE G to SE Q) and other toxins, such as exofoliative toxin A and B, and toxic shock syndrome toxin (TSST-1). Staphylococcal food poisoning is recognised as a cause of foodborne diseases [19]. Staphylococcal enterotoxins are heat-stable and can survive some normal cooking processes including boiling, hence active toxin can be present in the absence of viable organisms. *Pseudomonas aeruginosa* an opportunistic pathogen is a ubiquitous environmental Gram negative bacterium inhabiting terrestrial and aquatic environments as well as animal and plant tissues [20, 21]. *Escherichia coli* and other groups of coliforms may be present where there has been faecal contamination originating from warm-blooded animals [22]. *E. coli* is recognised as a good indicator of faecal contamination. It is identified as the only species in the coliform group found exclusively in the intestinal tract of humans and other warm-blooded animals and subsequently excreted in large numbers in faeces approximately 10^9 per gram [23]. It is estimated that there are about 76,000,000 cases of foodborne illness in the United States every year [24]. Most of these illnesses originate from improper cooking or handling of foods [25].

The presence of indicator bacteria in RTE food, although not inherently a hazard, can be indicative of poor practice that may be one or more of the following: poor quality of raw materials or food components; under-cooking; cross-contamination, poor cleaning and poor temperature and time control. Indicator bacteria may be associated with an increased likelihood of the presence of the pathogens [26]. Examination for the presence of pathogens in RTE food products contributes to food safety [27, 28]. Although low numbers of food pathogens probably represent a low risk, their presence can suggest fault(s) in the production and/or subsequent handling which, if not controlled, could lead to an unacceptable increase in risk [29]. The presence of *Bacillus* spp. in these foods indicates the possibility that spices such as pepper have been added after the main cooking process [29].
Evidence showing that food can be a reservoir for extra-intestinal *E. coli* includes: community-based outbreaks of extra-intestinal infections caused by epidemic strains of *E. coli* causing uncomplicated urinary tract infections [30] and other severe infections [31, 32] secondly, the determination that these epidemic strains share antimicrobial drug susceptibility patterns and genotypes with isolates from retail meat [33] and thirdly, the epidemiologic association between retail meat consumption and intestinal acquisition of

antimicrobial drug-resistant *E. coli* causing UTIs [34]. On the basis of these observations, the study carried out by [35] reported strong support for the fact that retail chicken is the main reservoir for *E. coli* causing human extra-intestinal infections. This is based on genetic similarities between food and human clinical isolates. Workers have observed and reported that antimicrobial drug-resistant bacteria from human faeces and human bloodstream infections tend to be more similar to antimicrobial-resistant and susceptible bacteria from retail poultry meat sources [33, 35]. They also observed that genetically related enteric bacteria from food sources and human infections tended to be susceptible, suggesting that both resistant and susceptible isolates causing UTIs in women may be transmitted through the food supply. Food safety is a major concern with street foods. These foods are generally prepared and sold under unhygienic conditions, with limited access to safe water, sanitary services or garbage disposal facilities. Hence, street foods pose a high risk of food poisoning due to microbial contamination, as well as improper use of food additives, adulteration and environmental contamination [36].

In conclusion, this study has shown that pathogenic bacteria are readily available in vended food products. These bacteria are liable to cause food infections, food intoxifications and /or food poisoning. Further studies are required on the seasonal prevalence of these bacteria in the different food samples and the antibiotic sensitivity or resistance patterns of the isolates. These results may be helpful to public health officers to identify foods that are of high risk to cause infections and to advice food hawkers on good hygienic practices.

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