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Original Article

Bacteriological assessment of guava and orange fruits in north east Nigeria

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Abstract

The bacteriological assessment of guava and orange fruits sold in Maiduguri metropolis was determined by isolating and identifying bacteria agents associated with contamination of the fruits. One hundred and fifty (150) fruits samples comprising 75 Guava and 75 Orange fruits were assessed using microscopic and biochemical methods. Of the 150 samples investigated, 130 (87.7%) were contaminated with one or two bacteria pathogens. The general distributions of bacterial contaminants were Staph. Aureus 19 (14.6%), Klebsiella 57 (43.8%), Proteus 8 (6.2%), E. coli 14 (10.8%) and mixed growth 32 (24.6%). The highest bacterial contamination was observed in Orange fruit (54.6%) and also among the market and road-side marketers with 44 (33.8%) contamination rates respectively. The contamination could probably be due to poor quality of water used by sellers and buyers in washing the fruits. This therefore calls for health education of the vendors and implementation of standard hygienic practices which may reduce contamination of fruits both at the market places and streets.

Keywords: Guava, Orange fruits, Staph. Aureus, Klebsiella, Proteus.

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1. Introduction

Fruits are well recognized for their vitamins and mineral contents as well as their high nutritive value [4]. For their nutritive value, man has been utilizing fresh fruits for the production of varieties of consumables like juices, jams, beverages, wines and/or eaten directly as food [6]. In many tropical countries, fruits are the common man's food and are sold

mostly in public places and roadside shops. There have been reports of food borne illnesses associated with consumption of fruits in India and elsewhere [3], [5], [9], [8], [10]. Food-borne diseases mainly affect the gastro-intestinal tracts and may be transmitted through the consumption of contaminated fruits. [14].

Contamination of fruits may result from bacterial pathogens at any point during the production process. Also use of unhygienic water for washing, prolong preservation, unhygienic surrounding often with swarming houseflies, and air-borne dust can also act as source of contamination.

The major microflora found on guava and orange includes fungi, bacteria and yeast. Such fruits are sources of bacterial pathogens notably *E.coli.* 057:H7, specie of *Salmonella*, *Shigella* and *Staph aureus*. [7]. The presence of coliform on surfaces of fruits is an indicative of faecal contamination [11]. Improperly prepared fruits are recognized as an emerging cause of food illness [13].

Salmonella, Shigella, Vibrio cholera and *Staph. aureus* are common causes of food-borne infection throughout the world [2]. Guava and orange which are largely consumed in this part of the country are sold under poor hygienic conditions in the market, roadside and hawkers with flies all over the. These can certainly increase the rate of microbial contamination. Thus, the presence of these microorganisms on fruit is dangerous for human consumption [12].

It has been reported [1] that pathogens of main concern of fresh fruits are *Salmonella, Shigella* and gastro intestinal viruses and that man is the main source of *Shigella, E.coli and Streptococcus* while contamination from the environment includes *Staphylococcus, Clostridia, Bacillus and yeast*. Up to 80% and 40% of food poisoning cases were due to *Salmonella* in England and United State respectively. Food borne illnesses could occur as a result of food intoxication or food infection when contaminated food is consumed. Food intoxication is poisoning which occurs due to consumption of food containing preformed toxins produced during microbial growth prior to ingestion. The aim of this research is to isolate and identify bacterial agents associated with contamination of Orange and Guava fruits sold in Maiduguri metropolis.

2. Materials and Methodology

2.1 Study location

Maiduguri is located on latitude 115^0 N and longitude 135^0E it has an area of 50, 778 square kilometers. It's the largest town in north eastern Nigeria. It shares its borders internationally with the republics of Niger to the north, chad to the north east and Cameroon to the East. Within the country, its neighbours are Adamawa to the south, yobe to the west and Gombe to the south – west. It has an annual rainfall of 650mm and it is inhabited by about 908,645 people [13].It has 3 major markets which are Baga, Monday and Custom with other smaller markets that include, muna, bulunkutu, kasuwanshanu etc.

2.2 Study Subjects/Area

Between October and December 2010, a total of 150 fruits comprising of 75 orange and 75 Guava fruits from three places (Monday market, hawkers and road side marketers) were analyzed for the presence of bacterial pathogens. At each point of sale, a sample of each fruit was taken into sterile polythene bags and transported to the laboratory for bacteriological analysis.

2.3 Bacteriological media

The following media were used for processing of the samples; Blood Agar (general purpose), MaCconkey Agar simmon's citrate (Differential) and Deoxycholate citrate Agar (selective).

2.4 Chemical reagent

Table 1: Distribution of bacterial isolates according to location

Bacterial Pathogen	Market	Hawkers	Road-Side Marketers	Total
Staphylococcus aureus	6	4	15	25
Klebsiella spp.	25	23	7	55
Proteus spp.	7	5	10	22
E.coli	6	10	12	28
Total	44 (33.8%)	42(32.3)	44 (33.8%)	130 (86.7%)

Chemical reagents used were urease, kovac's reagent, hydrogen peroxide and plasma (biological). Others would include grams staining reagents (crystal violent, lugols iodine, acetone and neutral red)

2.5 Bacteriological culture

The entire surface of each fruit was swabbed with sterile swab soaked in sterile nutrient broth and then inoculated onto blood agar, MacConkey agar, and deoxycholate citrate agar (DCA) and then incubated at 37^{o}c for 24-48hrs.

2.6 Identification of Isolates

Presumptive isolates were identified based on Gram's staining reactions (microscopy), and biochemical characteristic.

3. Results

Of the 150 samples analysed, 130(86.7%) were found to be contaminated with either one or two bacterial pathogen. From table 1, which shows the distribution of bacterial isolates according to location, 44 (33.8%) each of bacterial isolates were respectively recovered from the market and road-side marketers while hawkers were responsible for 42(32.3%) isolation rate of bacterial agents. Mixed growth was equally responsible for 32 (24.4%) isolation rates.

In table 2, *Klebsiellaspp* had the highest percentage frequency of isolation 57(43.8%), followed by *Staph aureus* 19 (14.6%) while *Proteus spp* had the least frequency of isolation 8 (6.2%). Mixed growth was responsible for 32 (24.6%) isolation frequencies.

From table 3, orange fruit had the highest frequency of bacterial isolate 71(54.6%) while guava fruit had 59(43.8). *Klebsiella spp.* was found to be highest in all the fruit with 32 bacteria on guava and 24 on orange while *Proteusspp.* had the least with 6 bacteria on guava and 3 on orange.

Table 2: Percentage frequency of the bacterial pathogens isolated

Bacterial Pathogen	Percentage (%) Frequency
Staphylococcus aurous	19 (14.6)
Klebsiella spp.	57 (43.8)
Proteus spp.	8 (6.2)
E.coli	14 (10.8)
Total	130 (86.7)

4. Discussion

Fruits in general, though very rich in vitamins and mineral elements, could pose a danger to human health if they are not properly treated prior to consumption as a result of the presence on them of contaminating microbial agents.

The results obtained from this study showed of the 150 fruits generally investigated, 130(86.7%) were contaminated with bacteria pathogens.

Table 3: Distribution of bacterial pathogens according to fruit types

Bacterial Pathogen	Guava	Orange	Total
Staphylococcus aurous	5	20	25
Klebsiella spp.	32	24	56
Proteus spp.	9	12	21
E. coli	13	15	28
Total	59	71	

This contamination might have probably been introduced at the point of distribution either from the market or from the customers and sellers handling them. *E. coli* and other coliform bacteria are generally indicators of faecal contamination of the water. Such contaminated water is often used by sellers and buyers in washing and processing the fruits [13].

These fruits could become contaminated with food borne pathogens by factors such as using materials in unhygienic condition [15], left open in unsuitable places for buyers and irregular hand washing by the sellers. Cross contamination has been identified as an important factor in food borne illnesses [16].

Humans are the primary reserviour of *Staphylococcus aureus* in their nasal passages, hand and skins. As the fruits are handled with bare hands by the sellers and buyers alike, this organism is introduced onto the fruits and during peeling and slicing [17].

Staph specie, *E. coli* and other bacteria isolated could be associated with the general poor sanitary environmental condition under which the fruits are handled [18]. The microbial quality of fruits in their raw forms, contaminated water or inadequate hand washing by fruits handlers and the absence of individuals' sanitary practices are similar to the report of [19]. Also in a related survey of retail establishment reported by [20], only 52% of the fruit handlers knew how to wash their hands.

Conclusion

In conclusion, inadequate level of hygiene among sellers and buyers may be due to lack of knowledge rather than negligence with proper precaution. Among the fruits sampled, the most contaminated was orange which may be due to its high demand by all. This calls for improve surveillance system on fruits and public health education and enlightment of sellers and consumers.

As the result of occurance of potential food borne pathogens, contamination of fruits studied before their purchase for consumption and the possible outbreaks of food poisoning, sellers and consumers are advice to wash fruits properly before peeling, slicing or cutting and also to handle and cut fruits with clean sanitized utensils, surfaces and to store all fruits at (where facilities are available) at 4^{O}C until sold or consumed.

Also since the practice of consuming fruits can't be stopped based on unhygienic grounds, and neither can the street sellers be prohibited from selling fruits, which provides them with a source of livelihood, the Government Health Agencies must put in place measures to educate the sellers on food safety and hygienic practice and enforce adequate guidelines on sellers at the market places and street.

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