

**Author Affiliation:**

\*MD Student, Department of Clinical Sciences, Saint James School of Medicine, 1480 Renaissance Drive, Suite 300, Park Ridge, IL 60068, USA.

\*\*Departments of Microbiology and Epidemiology, Saint James School of Medicine, Albert Lake Drive, The Valley, Anguilla - 2640 (British West Indies)

**Reprint Request:**

**Harish C. Gugnani,**

Departments of Microbiology and Epidemiology, Saint James School of Medicine, Albert Lake Drive, The Valley, Anguilla - 2640 (British West Indies)

E-mail:

harish.gugnani@gmail.com

## Detection of *Staphylococcus Aureus* for Food Safety in Ground Beef in Supermarkets in Bonaire (Dutch Caribbean)

John Rusuriye\*, Margaret Duru\*, Harish C. Gugnani\*\*

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### Abstract

**Background:** There is lack of information on staphylococcal contamination of foods in the Dutch Caribbean. The aim of this study was to evaluate retailed ground beef for contamination with *Staphylococcus aureus* in Bonaire (Dutch Caribbean). **Methods:** Fifty-one samples of ground beef collected from three different supermarkets in Bonaire were inoculated on Mannitol Salt Agar (MSA) for selective isolation of *Staphylococcus aureus*. Aseptic techniques were used for collection and processing of samples. **Results:** The isolates tentatively identified as *S. aureus* on MSA were confirmed by characteristic microscopic morphology in Gram stain and by production of catalase and coagulase. The presence of *Staphylococcus aureus* in ground beef samples from the three markets varied in quantities from 130 to 300 colony forming units/g. **Conclusion:** The detection of *S. aureus* in high quantities in samples of retail ground beef emphasizes the public health importance of this work. The public health authorities in Bonaire should alert the management of the supermarkets of this finding, and urge them to take precautionary measures to avoid or minimize bacterial contamination.

**Keywords:** Ground Beef; Bonaire; *Staphylococcus aureus* Count

### Introduction

*Staphylococcus aureus* is a major medically important species of Gram positive cocci. Staphylococcal diseases range from local infections manifesting as abscesses, carbuncles, boils to systemic infections like pneumonia, subacute endocarditis, osteomyelitis, and food poisoning [1, 2]. *S. aureus* occurs as a component of the normal

microflora of nose, pharynx and sometimes skin [2]. This organism produces a variety of toxins, viz. (SEs; SEA to SEE, SEG to SEI, SER to SET with demonstrated emetic activity [3]. When these bacteria contaminate food and are allowed to grow, they secrete enterotoxin, ingestion of which can cause food poisoning. The incubation period of staphylococcal food poisoning is short i.e. 4-6 hours because the enterotoxin in the food has already been formed by the staphylococci before the food is ingested. Staphylococcal enterotoxins are superantigens and cause gastro-intestinal symptoms such as nausea, vomiting and diarrhea. Illness is acute and usually mild, and can regress after one to three days by itself [3]. The aim of this study was to detect the presence of *Staphylococcus aureus* in samples of ground beef sold in three big supermarkets in Bonaire

### Methodology

Fifty-one samples of ground beef from three different supermarkets located in Bonaire, Dutch Caribbean were collected aseptically in ziplock polythene bags surface sterilized from inside and outside by swabbing with 70% isopropyl alcohol. The markets were labelled as #1, #2, and #3 for privacy concerns. The samples from these markets were examined over a period of several weeks in the month of November - December, 2013 for presence of staphylococci. Altogether 17 samples from each of the supermarkets were investigated. The samples were handled using sterile gloves, hand sanitizer, and 70% isopropyl alcohol was used in cleaning surface area of the working bench before and after processing of the samples to prevent bacterial contamination. The shelf life of the samples was not provided by the operators of the super markets. The

samples were processed immediately after collection. The inoculating loops were sterilized with the use of Bunsen burner prior to inoculation. Two mm loopful's of each sample (equivalent to one gram) were inoculated on three plates of Mannitol Salt agar (MSA) (allowed to warm to room temperature and the agar surface to dry before inoculating) by streaking according to standard streaking procedure, for selective isolation of *Staphylococcus aureus*. MSA was used as a selective medium for the study as this medium is recommended by the American Public Health Association for the enumeration of staphylococci in food and dairy products[4]. The inoculated plates were incubated for 24-36 hours mostly at 37<sup>o</sup> C in The Bon Lab, Krandedjik. At times when the incubator in BonLab was not accessible, the plates were incubated at room temperature (27-32<sup>o</sup> C). Incubating at the latter temperatures did not affect the growth of Staphylococci. The number of colonies suggestive of *S. aureus* in the inoculated plates of MSA was counted manually or sometimes with the help of colony counter available in Bon Lab. The average of counts on three plates inoculated with

each sample was computed.

## Results

The isolates tentatively identified as *S. aureus* on MSA on the basis of yellow colouration of the colonies were further studied by Gram-stain and tested for catalase, and coagulase. All isolates showed microscopic morphology as Gram positive cocci in irregular clusters and were positive for production of catalase and coagulase, thus confirming their identity as *S. aureus*. The presence of *Staphylococcus aureus* in ground beef samples from the three markets varied in quantity from 130 to 300 colony forming units (CFU)/g, as given in the table below. The differences in counts of CFU in the samples from the three markets were statistically significant, as a comparison of the data by ANOVA showed a p-value of 6.92682. *S. aureus* was most frequently recovered from market #1, followed by markets #2 and #3.

**Table 1:** No. of colony forming units (CFU) per gram in 17 consecutive samples of ground beef from three supermarkets in Bonaire

Serial no. of sample	Average number of CFU		
	Supermarket #1	Supermarket #2	Supermarket #3
1.	230	170	130
2.	130	230	200
3.	270	230	170
4.	170	200	100
5.	230	200	170
6.	270	270	170
7.	270	170	170
8.	300	170	130
9.	270	170	200
10.	270	170	170
11.	300	300	170
12.	270	170	130
13.	270	170	230
14.	300	170	230
15.	230	130	170
16.	230	170	200
17.	230	200	130

## Discussion

*S. aureus* food poisoning is one of the commonest causes of food borne illnesses world-wide, resulting from preformed enterotoxins in foods contaminated with the organism, and is one of most frequent causes of reported cases of food poisoning in USA [5]. Investigation of the sources and implications of *S. aureus* in retail ground beef is important. The public

should be educated on safe beef-handling practices. It is known that not all strains of *S. aureus* are toxigenic [3]. Though we did not test our isolates of *S. aureus* for toxin production, it is possible that some of them were toxin producers. Also methicillin resistant *S. aureus* may be present in retail ground beef as reported from Georgia, USA [6]. This together with the fact that the contamination of the retail beef with *S. aureus* was very high in terms of CFU/gm emphasizes the public health importance of this work. Some investigators have found major source

of contamination of ground beef with *S. aureus* to be the hands of workers who slaughter the cattle [7]. The results of this study can later be presented to various health organizations and professionals on the island if needed to motivate them to enhance their food bacterial monitoring system to prevent outbreaks of food-borne illnesses.

### Conclusion

The presence of *S. aureus* in high quantities in samples of retail ground beef in supermarkets in Bonaire is of public health concern. The public health officials in Bonaire should draw the attention of the management of the supermarkets to this finding for enforcing hygienic precautions to avoid bacterial contamination of meat products.

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