

# Foodborne pathogens and spoilage organisms in chilled and frozen carite (*Scromberomorus brasiliensis*) sold in markets in Trinidad

## Abstract

This study examined the nature and level of foodborne pathogens and spoilage bacteria in Carite (*Scromberomorus brasiliensis*) available to consumers in various market types in Trinidad, West Indies. Chilled and frozen samples (52) were collected between the months of January and June 2014. Popular purchasing venues include from supermarkets (30), wholesale markets, retail outlets, roadside fish vendors and landing sites. Total aerobes were enumerated using standard plate count methods. Samples were also plated on selective media: MacConkey, Eosin Methylene Blue, Aeromonas (Ryan Medium) and Baird Parker. Colonies were selected, purified and biochemically pre-screened before final identification using API20E. Carite purchased from supermarkets, wholesale markets, retail outlets, fish vendors and landing sites had mean aerobic counts of (Log CFU g<sup>-1</sup>) 5.31±2.11, 4.43±0.49, 4.53±0.54, 3.06±0.05 and 2.96±0.40 respectively. Bacterial types with the highest overall prevalence rates include *Staphylococcus aureus* (15.4 %), *Escherichia coli* (7.7 %), *Proteus mirabilis* (9.6 %), and *Raoultella planticola* (7.7 %).

**Keywords:** carite, food safety, prevalence, pathogen, Trinidad, foodborne diseases

## Introduction

Consumption patterns are changing as persons are more knowledgeable of what they eat and healthier eating habits are becoming more and more established. This change has seen a greater demand for food items such as fish and fish products; primarily due to the fact that fish is high in protein and other essential nutrients. The fish industry globally accounted for the livelihood of some 54.8Million persons<sup>1</sup> and is the largest growing subsector in agriculture valued at USD 217.5 billion. The global per capita consumption of fish has increased from 5.6kgs in 1960 to 17.1kgs in 2009.<sup>2</sup> With this increase in consumption and consumer knowledge food safety issues are being highlighted more and more in the media with fish being no exception.

Fish has been implicated as one of the main food categories in which outbreaks of foodborne illness has been reported.<sup>3</sup> In 1998-2008; 3264 cases of foodborne illness was reported in the United States 17% of which was related to fish consumption. It is estimated that one third of the population of the United States acquire foodborne diseases annually. Schlosser indicated that estimates of foodborne diseases are responsible for the approximately 200000 persons becoming ill, 900 of which would be hospitalised and 14 which may die. During a 7week period in 2012, The Caribbean Public Health Agency formerly the Caribbean Epidemiology Centre reported 94 cases of foodborne and water borne diseases from its member countries. Surujal and Badrie reported that there were some 2597 cases of foodborne illness reported in 2000 and 1905 in 2001.

The Caribbean region, and more specifically Trinidad the fish industry estimated value Trinidad and Tobago Dollars (TTD) 94.5Million in 2009 and increase of 6.4% from 2008 data. One of the more popular fish species consumed in Trinidad is Carite. This species accounted for a landing of 1800 metric tons between 1996 and 2006. However, little published information on pathogens associated with this species of fish can be found. Therefore, the objective of this study

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was to determine the prevalence of various foodborne pathogens and spoilage organisms found in Carite, obtained from different market types in Trinidad.

## Methodology

Supermarkets (30), wholesale markets (4), retail outlets (24), landing sites (12) and fish vendors (32) were sampled, between the months of January- June. All market types were sampled once. Samples (chilled and frozen) were immediately packed on ice after purchase, and transported in an insulated ice box to the Food Microbiology Laboratory, Faculty of Engineering, UWI, St. Augustine, Trinidad for analysis. Chilled fish samples were processed on the same day of collection, and frozen samples within 24hours of collection after thawing overnight under refrigerated temperatures (4°C).

Samples were analysed according to a method by Kim et al.<sup>4</sup> In short, 25 grams of combined muscle and skin were aseptically diluted with 0.1% peptone water and plated on 0.5% salted plate count agar. Frozen and chilled samples were incubated at 25°C/3 days and 15°C/5 days respectively. Samples were also spread plated on Aeromonas, MacConkey, Baird Parker and Eosin Methylene blue agar media. After incubation at 35°C/24hours, 15 representative colonies from each medium were, purified on plate count agar and subjected to the following tests: Gram stain, lactose fermentation, indole, methyl red-Voges Proskauer, lysine decarboxylase, urease, citrate, production of hydrogen sulphide, and motility. Final identification was done using API20E (Biomerieux).

## Statistical analysis

Statistical analysis was conducted using SPSS version 17.

## Results and discussion

There is an increased demand for fish during the Easter/Lenten

season in Trinidad when this study was conducted, that may have accounted for the relatively small number of samples collected from the outlets. Percentage collection was lowest in retail and fish vendors (12.5% each) and highest for wholesale market (100%). Supermarkets had as many as three brands which accounts for the high sample collection.

Microbial counts increased with handling along the food supply chain.<sup>5</sup> This observation is supported in this study, where supermarkets had the highest microbial counts ( $5.3 \pm 2.11$  Log CFU/g) and landing sites had the lowest counts ( $2.96 \pm 0.40$  Log CFU/g) (Table 1). Chilled samples were collected from the outlets that held the products at temperatures of 1°C-10°C, outside the recommended range of 1-4.4°C for fish products.<sup>2</sup> Supermarkets maintained temperatures ranging from 1°C to 5°C, but fish vendors and landing sites kept their fish on ice with temperatures ranging from 5°C to 10°C. The landing sites had fresh catch that was sold wholesale to retailers.

**Table I** Mean Aerobic plate counts at various market types and fish conditions

Market type	Mean log count (CFU/g)		Total
	Chilled samples	Frozen samples	
Supermarket	5.19±1.33	5.44±2.28	5.3±2.11
Wholesale Market	N/A	4.43±0.49	4.43±0.49
Retail Outlets	N/A	4.53±0.54	4.53±0.54
Fish Vendors	3.06±0.05	N/A	3.06±0.05

N/A = Not Applicable

The relatively high microbial counts of the vendors and landing sites may be due to their inadequate holding temperatures. However, fish at landing sites were held for shorter periods which probably accounted for their lower counts. The higher counts in supermarket may be due to loss of control during handling, processing and storage. Frozen samples were collected from the supermarket outlets that kept the products within acceptable temperatures <-18°C. However, there were quality variations that may have been influenced by variations in storage conditions, packaging, and length of time held, as evidence by the observation of freezer burn and stuck pieces of fish. This phenomenon may have accounted for the relatively high counts in these samples.

Foodborne pathogen associated with fish can be categorized into three broad groups: (1) indigenous bacteria belonging to the natural microflora of fish (*Clostridium botulinum*, pathogenic *Vibrio* spp., *Aeromonas hydrophilia*); (2) enteric bacteria present due to fecal contamination (*Salmonella* spp., *Shigella* spp., pathogenic *Escherichia coli*, *Staphylococcus aureus*) and (3) bacterial contamination during processing, storage or preparation for consumption (*Bacillus cereus*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Clostridium perfringens* and *Salmonella* spp.).<sup>6,7</sup>

Microbial population of Chilled samples showed that *Staphylococcus aureus* was seen in all market types with the highest prevalence in fish vendors. *Vibrio fluvialis* and *Proteus mirabilis* were seen in 66.7 % of market types. Landing sites had the greatest microbial diversity, followed by supermarkets. The most isolated bacterial type were pathogens, which could be due handling.

*Vibro fluvialis* is an emerging pathogen commonly found in coastal

environments.<sup>8</sup> *V. fluvialis* was reported to be responsible for diarrhoeal outbreaks and sporadic extra- intestinal cases.<sup>8</sup> Additionally, the characterization of the an enterogenic El Tor like haemolysin in *V. fluvialis* which represents one of the virulence factors in *V. cholera* makes this bacterium one of public health interest.<sup>9</sup>

The bacteria found in frozen samples were *Staphylococcus aureus*, *Escherichia coli* and *Enterobacter cloacae*- were seen in all market types. *Escherichia coli* had the highest prevalence of all isolated bacteria, when looking at market type. Supermarkets had the largest variation of organisms followed by wholesale market. Spoilage organisms were the most isolated when looking at the variations within organisms' type. *Pseudomonas oryzihabitans*, *Serratia liquefaciens*, *Pseudomonas luteola* and *Raoultella planticola* were isolated in 66.7% of market types.

## Conclusion

Fifteen (15) microorganisms were isolated from 52 samples, with *Staphylococcus aureus* being the most prevalent. The isolation of pathogenic bacteria namely *Staphylococcus aureus*, *Escherichia coli* and emerging foodborne pathogens such as *Vibrio fluvialis*, reveal that there is a risk to public health. Market type influenced aerobic counts, with supermarkets having statistically higher counts. High bacterial counts strongly suggest the need for improved quality control in retailing Carite in Trinidad.

## Acknowledgements

None.

## Conflict of interest

The author declares no conflict of interest.

## References

- FAO. *State of world Fisheries and Aquaculture 2012*. Italy: Food and Agriculture organization; 2012.
- FDA. *Fish and Fishery product hazard and Control Guidelines*. 2014.
- Center for Disease control and Prevention. *Surveillance for foodborne disease outbreaks- United States, 2009–2010*. Morbidity and Mortality Weekly Report. 2013;62(3):41–47.
- Kim SH, Ben Gigirey B, Barros Velázquez J, et al. Histamine and Biogenic amine production by *Morganella morganii* isolated from temperature abuse Albacore. *J Food Prot*. 2000;63(2):244–251.
- Singh M, Badrie N, Newaj Fyzul A, et al. A prevalence study of Histamine and Histamine producing bacteria in two commercial Tropical marine fish sold in Trinidad, West Indies. *Journal of Nutrition and Food Science*. 2012;2(2):1–6.
- Lyhs U. Microbiological methods. In: Rehbein H, Oehlenschager J, editors. *Fishery products: quality, safety and authenticity*. 1st ed. USA: Wiley Blackwell; 2009. p. 318–348.
- Elhadi N. Prevalence and antimicrobially resistance of *salmonella* spp. in raw retail frozen imported freshwater fish from Eastern provience of Saudi Arabia. *Asian Pac J Trop Biomed*. 2014;4(3):234–238.
- Ramamurthy T, Chowdhury G, Pazhani GP, et al. *Vibro fluvialis*: an emerging human pathogen. *Front Microbiol*. 2014;5:91.
- Amel BK, Amine B, Amina B. Survival of *Vibro fluvialis* in seawater under starvation condition. *Microbiol Res*. 2008;163(3):323–328.