International Journal of Scientific Engineering and Science
Volume 1, Issue 5, pp. 1-4, 2017. ISSN (Online): 2456-7361

Bacteriological and Nutritional Qualities of Street – Vended Seafoods in Parts of Rivers State, Nigeria

Beka, Sylvia E[1,3,5]; Beka Nathan E[2,3,5]; Sokari, T.G[1,4]
[1]Rivers State University of Science and Technology, Port Harcourt, Nigeria
[2] Igbinedion University Okada, Nigeria
[3,] University of Hertfordshire, Hertfordshire, England
[4] University of Bostwana, Gaborone, Botswana
[5] Inter-Enviroments Limited, Rumuodara, Port Harcourt, Nigeria

***Abstract*—** *It is noted in this study that one of the core principles of prevention of consumption of seafoods contaminated with microorganisms which may be pathogenic to consumers or that may cause food poisoning, is prevention of contamination by food handlers at wholesale and retail levels. However, the barriers of old practices and perhaps the most important of all, the yet unfulfilled need for continuing education of food handlers and street vendors at all levels of processing and retail make implementation of the acknowledged principles difficult. Consumers can protect themselves from potential problems that could arise from contamination, by refrigerating street-vended shucked shellfish as soon as possible after purchase and consuming them, adequately cooked, within two to three days*.

I. INTRODUCTION

One of the great attractions of the Niger Delta region of Nigeria is the availability of seafood delicacies. Among the favourites are fresh fish, crustaceans and shellfish. There are numerous molluscan shellfish in the vast mangrove of the Niger Delta region of Nigeria but only a few reports on their ecology and distribution have been made (Deekae & Idoniboye-Obu, 1995).

These molluscs occur in several habitats in the mangrove and are found within salinities ranging from 2 to 4 ppt in the Nigeia and other estuaries in West Africa (Deekae & Idoniboye-Obu, 1995). They constitute a major source of protein in the diet of the people of the Niger Delta and other coastal states of Nigeria. Studies by Umoh and Basir (1977) and Mba (1980) showed that the protein contents and chemical composition of the molluscs are comparable to those of eggs.

Seafoods of economic importance popularly consumed by indigenes of the Niger Delta, especially the residents of the coastal areas of Nigeria include *Thais callifera* locally called 'ngolo', *Tympanotonus fuscatus* locally called 'isam' or 'mfi' and *Arca senilis* locally called 'ofingo or clam'. These sea foods are highly proteinous and tasty (Edmund, 1978).

In addition to the nutritional qualities of the flesh, the shells have found widespread use as high calcium sources in animal feed supplementation, and in decoration and road construction. Effective utilization of these protein rich aquatic resources is recommended to improve the protein intake of rural peasant populations usually affected by protein deficiency syndrome.

Risks Associated with Bare-Hand Contact with Food

In the food industry, contamination from microorganisms can be responsible for infectious disease outbreaks passed from food handlers to consumers via food (Paulson, 1996). Microflora of skin is categorized into resident and transient types. Resident bacteria are those that normally reside on the skin, in this case, the skin of the hands. Ninety percent of the resident flora of the hands are coryneform and coagulase negative *staphylococci* (Miller, 1994).

Among the resident microflora, *Staphylococcus aureus* is the only true pathogenic organism of food safety concern (Lowbury et al., 1964; Miller, 1994).

Resident flora are not easily removed by mechanical friction (Larson, 1995) since they are buried deep within the pores where they are protected by sebaceous gland secretions (Miller, 1994; Restaino & Wind, 1990). Transient organisms are of concern because they are readily transmitted by hands unless removed by mechanical friction of washing with soap and water or destroyed by the use of an antiseptic solution (Larson, 1995). Transient organisms can be considered skin contaminants that are acquired from environmental sources and become attached to the outer epidermal skin layer (FDA, 1999; Restaino & Wind, 1990). Hands as well as contaminated gloves, serve as vectors for transmission of transient microorganisms (Fendler et al., 1998).

II. MATERIALS AND METHODS

Source of Samples

Samples were collected from 6 popular sea food vendors at the Creek Road market and seafood harvesters at the waterside. The sea foods were all harvested from the Primroze Channel of Bonny River (Fig. 1).

Preparation of Samples for Analysis

Samples of street-vended seafoods which included *Thais callifera*, *Tympanotonus fuscatus* and *Arca senilis* (fig. 2) were purchased from street vendors at the Creek Road market over several weeks. The fresh, processed (i.e. shucked) samples, processed by the street vendors themselves, were collected and placed in labeled sterile sampling containers and kept in an ice box with temperature maintained at 4°C to minimize changes in population and concentration of bacteria.

Fresh live samples of each of the seafoods, to be processed aseptically in the laboratory, were also collected from harvesters at the waterside and placed in labeled sampling

International Journal of Scientific Engineering and Science
Volume 1, Issue 5, pp. 1-4, 2017. ISSN (Online): 2456-7361

containers. The samples were taken immediately to the laboratory and processed aseptically for analysis.

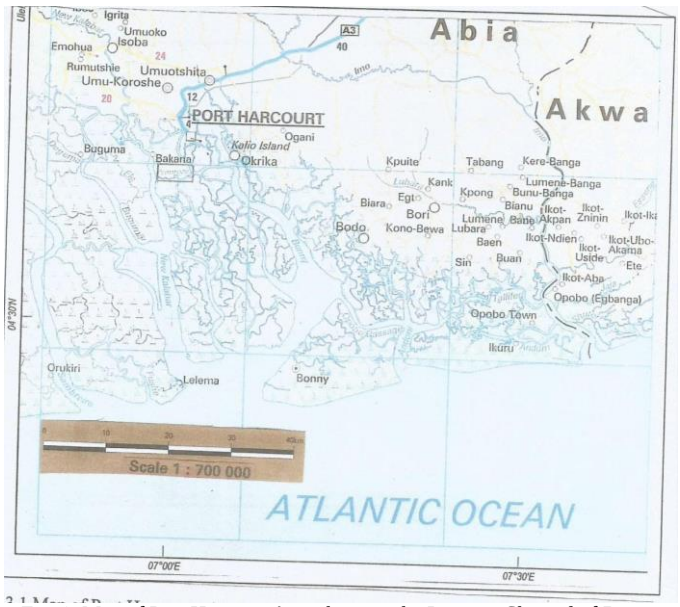

Fig. 1. Map of Port Harcourt Area showing the Primoze Channel of Bonny River.

A portion of samples of each of the street-vended seafoods were subjected to further treatment in the laboratory by rinsing with sterile distilled water before bacteriological analysis.

Another portion of samples of each of the street-vended seafoods were also subjected to further treatment in the laboratory by precooking at 80°C for 3 minutes before bacteriological analysis.

Analysis for Proximate Composition

Analysis of proximate composition of each type of sea food was carried out to determine the moisture, carbohydrate, lipid, protein and ash contents as well as mineral composition.

III. Presentation of Results

Proximate values of some street-vended sea foods in Port Harcourt.

The proximate compositions of the selected molluscan shellfish sold in port Harcourt are presented and discussed. Values for mineral content of the selected molluscan shellfish are presented are also presented and discussed. They include calcium and phosphorus in significant amounts. Values for iron, magnesium, manganese, sodium and zinc are also shown. Heavy metals were not detected (Table 1).

TABLE 1. Mineral and heavy metal contents of some street-vended seafoods in Port Harcourt.

Parameter	Value (%)		
	Thais callifera	Tympanotonus fuscatus	Arca senilis
Calcium (ca)	0.402	0.582	0.610
Iron (Fe)	0.392	0.401	0.552
Magnesium (Mg)	0.028	0.024	0.032
Manganese (Mn)	0.108	0.113	0.168
Potassium (K)	0.128	0.182	0.180
Sodium (Na)	0.178	0.088	0.250
Zinc (Zn)	0.062	0.700	0.124
Phosphorus (P)	0.800	0.700	0.800
Cadmium (Cd)	ND*	ND	ND
Chromium (Cr)	ND	ND	ND
Lead (Pb)	ND	ND	ND
Mercury (Hg)	ND	ND	ND

*ND: Not Detected

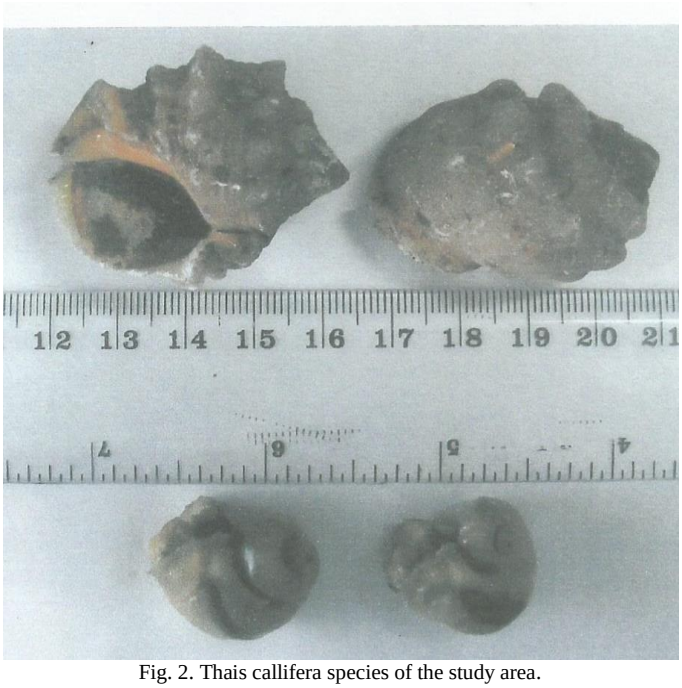

Fig. 2. Thais callifera species of the study area.

Bacteriological analysis of samples of some street-vended seafoods in Port Harcourt

Total viable bacterial counts of processed street-vended seafoods are presented and discussed. Values for processed street-vended seafoods purchased from street vendors and rinsed in the lab using sterile distilled water processed street-vended sea foods purchased from street vendors and precooked at 80°C for 3 minutes, and seafoods processed in the laboratory hygienically are also discussed.

Plate count values of street-vended seafoods were 4.06 x $l0^7$cfu/g for *Thais callifera*, 3.85 x $l0^7$cfu/g for *Tympanotonus fuscatus* and 1.21 x $l0^8$ cfiu/g for *Arca senilis.*

The mean pH value of the seafoods, 8.62 for *Thais callifera*, 8.72 for *Tympanotonus fuscatus*, 6.62 for *Arca senilis*, is optimum for microbial growth. Most bacteria have pH minimums ranging from 4,0 to 5.0. The mean holding temperature of the sea foods by the street vendors was 2 9°C.

Staphylococcal counts

Staphylococcus counts on selective medium counts were $5.30x10^4$ cfu/g. $4.45x10^4$ and $7.0x10^4$ cfu/g in street- vended samples of *Thais callifera*, *Ttympanotonus fuscatus* and *Arcas senilis* respectively.

Plate counts were 5.36 x 10^4 cfu/g, 4.45 x 10^4 cfu/g and 7.09 x 10^4 cfu/g in street-vended samples of *Thais callifera*, *Tympanotonus fuscatus* and *Arca senilis* respectively.

Vibrio spp. were neither detected in samples processed in the laboratory nor in samples preheated at 80°C for 3 minutes (Fig. 3)

International Journal of Scientific Engineering and Science
Volume 1, Issue 5, pp. 1-4, 2017. ISSN (Online): 2456-7361

Counts of salmonellae

Salmonella plate counts were 1.07 x 10^4 cfu/g, 2.00 x 10^2 cfu/g and 3.50 x10^4 cfu/g in street-vended samples of *Thais callifera*, *Tympanotonus fuscatus* and *Arca senilis* respectively, and *Shigella* plate counts were 1.07 x 10^4 cfu/g, 2.00 x 10^2 cfu/g and 3.50 x 10^4 cfu/g in the same order.

Coliform counts

Total coliform counts and faecal coliform counts are presented in Tables 2. Generally, counts were lower in samples of *Tympanotonus fuscatus* than in samples of *Thais callifera*.

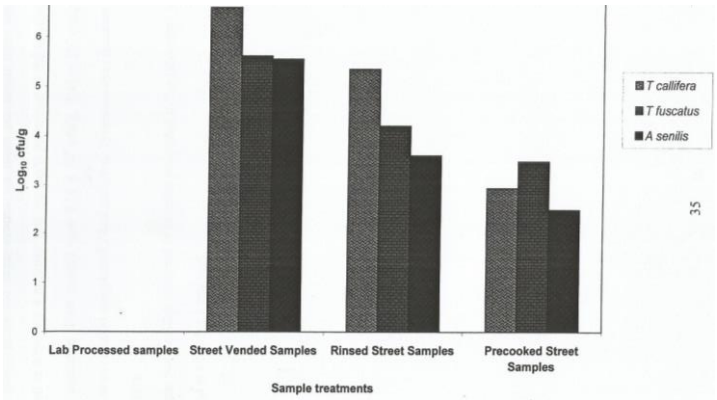

Fig. 3. Staphylococcocus counts from samples of street vended sea foods in Port Harcourt

TABLE 2. Total Coliform counts in samples of street- vended seafoods in port Harcourt.

Sample code	Holding temperature(oC)	Thais callifera		Tympanotonus fauscatus		Arca senilis	
		pH of Sample	MPN/100g	pH of sample	MPN/100g	pH of sample	MPN/100g
Lab1*	30.0	8.72	>1100	8.78	240	6.46	1100
Str1*	30.0	8.48	>1100	8.77	150	6.44	>1100
Str2	30.0	8.60	>1100	8.72	120	6.68	>1100
Str3	28.5	8.62	>1100	8.72	>1100	6.68	>1100
Lab2	28.5	8.69	93	8.65	>1100	6.74	1100
Str4	28.5	8.48	>1100	8.77	>1100	6.44	>1100
Str5	28.5	8.62	>1100	8.73	150	6.68	>1100
Str6	28.5	8.62	>1100	8.73	>1100	6.68	>1100
Lab	29.0	8.69	>1100	8.72	1100	6.74	1100
Str	29.0	8.63	>1100	8.65	>1100	6.69	>1100
Rin*	29.0	7.55	>1100	8.72	>1100	6.74	>1100
Pre*	29.0	7.54	>1100	8.62	4	6.70	

*-, rods, gram negative rods; +, ++, +++, indicate density of metallic sheen colour of colonies--, colonies exhibiting green metallic sheen not seen; lab, laboratory processed sample; Str, street vended sample; Rin, rinsed street-vended sample; pre, precooked street- vended samples

IV. Discussion of Result

The nutritional and bacteriological qualities of the popular street-vended molluscan shellfish *Thais callifera, Tympanotonus fuscatus* and *Arca senilis* were determined. The proximate composition of the sea foods show the sea foods to contain an appreciable percentage crude protein. *Thais callifera* has a substatial content of carbohydrate material. Molluscan shellfish differ in chemical composition from both fish and crustacean shellfish in having significant carbohydrate material, largely in form of glycogen (Watt & Merrill, 1950). Seafoods provide high quality protein which ensures proper functions of the body.

An evaluation of the bacteriological quality of the selected street-vended seafoods showed that these sea foods contained various bacteria including *Vibrio* spp., *Enterobacter* spp., *Micrococcus* spp., *Bacillus* spp., *Pseudomonas* spp., *Salmonella* spp. and *Shigella* spp. and *Staphylococcus* spp.

The microbial quality of the river, estuarines and seashores from which seafoods are harvested influence the microflora of seafood samples (Pelczar et al., 1986).

The isolation of faecal coliforms, *Shigella* spp. and *Bacillus* spp. from samples processed in the laboratory would indicate that the sea foods were contaminated from where they were harvested.

It was also observed from processed (shucked) street-vended samples, that during processing, further contamination with bacterial pathogens occurred. The process of shucking with bare hands in an uncontrolled and filthy environment, with little or no regard for proper food handling practices, could result in further contamination of the seafood with bacteria and bacterial spores from the hands, nails, nasal passage and mouth of the workers during processing and from the environment where the processing was being carried. Also, poor handling practice during retailing and purchase results in further contamination of the seafood. The isolation of *Staphylococcus* spp., faecal coliforms, *Vibrio* spp. and *Salmonella* spp. as well as the dominance of *Bacillus* spp. in total viable bacterial plate counts may confirm this. Further studies showed most of the *Staphylococcus* species isolated to be non pathogenic *Staphylococci*.

Using the MPN technique, faecal coliforms were detected in street-vended samples of *Thais callifera*, *Tympanotonus fuscatus* and *Arca senilis*. Faecal coliforms were also detected in samples of the same seafoods processed in the laboratory. This indicates that faecal contamination of the street-vended samples of the seafoods is from where the seafood was harvested.

Ninety percent (90%) of the samples of *Thais callifera* and all samples of *Arca senilis* studied in the laboratory demonstrated faecal coliform counts of 1100 coliforms per

l00g and more than (>) 1100 coliforms per 100g. Lower coliform counts were observed in both street-vended samples and laboratory processed samples of *Tympanotonus fuscatus*. Further tests confirmed the presence of *Escherichia coli* in all street-vended samples. Such high counts indicating gross faecal contamination of these seafoods are most likely due to faecal pollution of the environment from where these seafoods were harvested.

However, when processed samples were precooked at 80°C for 3 minutes, faecal coliforms were no longer detected in samples of *Tympanotonus fuscatus* and *Arca senilis*; counts of up to 900 coliforms per 100gg of sample were still observed for *Thais callifera*, indicating that *Thais callifera* must be boiled properly to eliminate coliforms in the samples.

This may be because *Thais callifera* is larger in flesh size than *Tympanotonus fuscatus* and *Arca senilis.* Most strains of *Escherichia coli* are harmless commensals.

However some strains are pathogenic and can cause diarrhoeal disease. The infectious dose of E. coli is quite low, so as much as possible their mere presence must be avoided.

In summary, although species of bacteria which include pathogenic strains were isolated from the seafoods, the plate count values of *Staphylococcus* spp., *Vibrio* spp. and *Salmonella* spp. were below growth values required to cause disease, whereas the values for faecal coliforms and *Shigella* spp. were high. Although most of these bacteria may be non-pathogenic to humans, some strains cause various forms of gastroenteritis, while some are important human pathogens responsible for a variety of diseases (Prescott et al., 1996). However, the pH of the seafoods and the holding temperature of the seafoods by the street vendors may encourage bacterial proliferation.

Species of *Vibrio, Shigella* and faecal coliforms were found to be present due to faecal contamination of the seafoods from the water where they were harvested, and species of *Staphylococcus, Salmonella and Vibrio* were found to be present as a result of poor food handling practice by the street vendors during processing and retail operations.

Hygienic food handling involving the use of clean potable water and minimal contact with bare hands as well as mild heat processing of the seafoods, was observed to have improved the overall bacteriological quality of the seafoods by reducing the overall total viable counts and eliminating the presence of *Staphylococcus* spp., *Salmonella* spp. and *Vibrio* spp. in processed seafoods.

REFERENCES

[1] Deekae, S.N. & T.I.E. Idoniboye-Obu 1995. Ecology and chemical composition of commercially important molluscs and crabs of the Niger Delta, Nigeria. *Environment and Ecology*. 13, 136-142.
[2] Edmund, J. 1978. Sea shells and other molluscs found on West Africa coast and estuaries. *Ghana University Press,* Accra. 139 pp.
[3] FDA)9P9 va/iw &,%‘d/& M//7wrci7,7 food by food preparation workers and the effectiveness of interventions to minimize those risks. Center for Food Safety and Applied Nutrition, FDA, US Department of Health and Human Services.
[4] Fendler, E.J., M.J. Dolan & R.A Williams 1998. Handwashing and gloving for food protection, Part I: Examination of the evidence. *Dairy,Food and Environmental Sanitation. 18(12), 814-823.*
[5] Larson, E.L. 1995. APIC guidelines for handwashing and hand antisepsis in health care settings. *American Journal of Infection Control. 23, 251-269.*
[6] Lowbury, E.J.L,. H.A. Lilly & J.P.Bull 1964. Disinfection of hands: removal of transient organisms*. British Medical Journal*.2,230-233
[7] Mba, A.U. 1980. Chemical composition of some local sources of protein foods for man. *Nigerian Journal of Nutritional Science.* 1,142-147.
[8] Miller, M.L. 1994. A field study evaluating the effectiveness of different hand soaps and sanitizers. *Dairy, Food and Enviromental Sanitation*. 14, 155-160.
[9] Paulson D.S, 1996. Get a handle on contamination. *Food Quality April. 42-46*
[10] Pelczar, M.J.,R.O. Reid & J.R.Chan 1986. Microbiology, 5th ed. Tata Publishers .The McGraw-Hill Companies, Inc., USA.
[11] Prescott, L.M., J.P. Harley &D.A Klien 1996. *Microbiology,* 3rd ed. Wm.C. Brown Publishers. The McGraw-Hill Companies, Inc., USA. Pp.766-771.
[12] Restaino, L.& C.E. Wind 1990. Antimicrobial effectiveness of hand washing for food establishments. *Dairy,Food and Environmental Sanitation*.. 10, 136-141
[13] Umoh, I.B & O. Basir 1977. Lesser known sources of protein in some Nigerian peasant diets. Food Chemistry. 2,315-329.
[14] Watt, B.K & A.L. Merril 1950. *Composition of Foods- raw, processed, prepared. Agricultural Handbook no.8.* Washington D.C., USDA.