

BACTERIAL QUALITY OF DRIED CRABS SOLD IN VARIOUS MARKETS IN LOKOJA, NIGERIA

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Abstract

Crabs were obtained from five different markets within Lokoja, Nigeria for bacterial analysis and level of moisture content. The results revealed high counts for total aerobic bacteria (TAB) counts, total coliforms and staphylococci counts in the crabs. The moisture contents of the crabs were higher than the acceptable limits (<10%). There were significant differences in the total aerobic bacterial counts, total coliform, staphylococci counts and the moisture content. The bacteria isolated were *Staphylococcus aureus*, *Escherichia coli*, *Salmonella spp*, *Shigella spp* and *Pseudomonas spp*. The presence of these organisms in Crab meat sold in Lokoja is an indication of microbial contamination which may pose health risks to consumers when improperly cooked.

Keywords: Crab meat, Total aerobic bacteria, moisture content, microbial contamination, acceptable limits

{**Citation:** Oshamehin, G.O., Stephen, E., Obi, S. K. C. Bacterial quality of dried crabs sold in various markets in Lokoja, Nigeria. American Journal of Research Communication, 2013, 1(7): 261-270} www.usa-journals.com, ISSN: 2325-4076.

Introduction

Crabs are decapod crustaceans rich in sodium, potassium and phosphorus with good amounts of iron, zinc, copper and manganese. It has a good amount of vitamin A, C, B6, thiamine, riboflavin and is considered in some parts of the world as a delicacy (Nishidha, 2006).

Crabs like fish products, are available to customers in the tropics as salted, smoke-dried or sun-dried (Eyo, 2001). By far, drying is the commonest processing method and the primary aim is to prolong the shelf life of the products by reducing the water content as much as possible, thus protecting the products (Eyo, 2001).

Robert (1989) reported that the major cause of losses in stored dried crabs is microbial spoilage. Bacterial spoilage of improperly dried crab meat is of the putrefaction type. The common spoilage organisms associated with sea foods include *Pseudomonas*, *Acintobacter* and *Moraxella* at chilling temperatures but mainly *Proteus* at higher temperatures (Ezeama, 2007). Crab meat may also contain pathogenic organisms such as *Salmonalla* and *Escherichia coli*. Ezeama (2007) reported the occurrence of *Staphylococcus aureus* and *E coli* in the gills and muscles of crabs obtained within Imo River Basin, Nigeria.

Open display of crab products in the markets may be a likely factor enhancing microbial contamination via dust-laden air (Olonitola *et al.*, 2006). Whong *et al.* (2003) observed that most sea foods in open markets were constantly touched by prospective buyers with bare hands, an unhygienic practice which could contribute significantly to increased microbial load.

Lokoja is a confluence town with abundance of sea foods such as crabs and fish sold either fresh or smoked or sun-dried in her various markets. Crab meat is becoming increasingly popular, hence the need to assess the bacteriological quality of the crab meat sold in the open

markets with a view to raise consumers awareness of the risk associated with the consumption of pathogen loaded crabs, and also , on the need for good hygiene practices during food processing , handling and storage.

Materials and methods

Sample collection

Two samples each were bought weekly for a period of four weeks from five different retail outlets in Lokoja designated as follows : Kpata (LMA), old market (LMB), International market (LMC), Adankolo market (LMD) and Lokongoma market (LME). The samples were collected in polythene bags and taken to the laboratory for bacteriological analysis and moisture content determination.

Moisture content was determined using the dry weight method of Akinsami (1975) while total aerobic bacteria, total coliform and staphylococcal counts were determined by the methods recommended by the International Commission of Microbbiological Specification for Food (ICMSF) as described by Refai (1979). Briefly, samples of the dried crabs were ground to powdery form using sterile mortar and pestle. Ten grammes of each of the dried samples were weighed out and suspended in 90ml of peptone water to give 1:10 dilution. After vigorous shaking, serial dilutions were carried out from which 0.1ml of each dilution was pipetted aseptically into Petri dishes and followed by the addition of the appropriate agar which was allowed to solidify. Nutrient agar was used to determine total aerobic counts, MacConkey agar for total coliform and Mannitol salt agar for staphylococcal counts.

Statistical analysis

The total aerobic, total coliform and staphylococcal counts obtained from the five local markets were subjected to analysis of variance (ANOVA). Experimental precision achieved was reported at $p \leq 0.05$ levels.

Results

The results of total aerobic bacterial counts (TAB), total coliform, staphylococcal counts and the moisture content are shown in Table 1. The TAB counts ranged from $4.55 \pm 0.36 \times 10^7$ cfu/g to $7.83 \pm 0.56 \times 10^7$ cfu/g. the highest TAB counts was observed in the samples from Lokongoma markets (LME). There were statistical differences in the TAB counts at 5% probability levels.

The counts of the total coliform were $4.00 \pm 0.32 \times 10^7$ cfu/g for Kpata (LMA), $3.53 \pm 0.28 \times 10^7$ cfu/g for old market (LMB), $3.85 \pm 0.13 \times 10^7$ cfu/g for International market (LMC) $5.35 \pm 0.55 \times 10^7$ cfu/g for Adankolo market (LMD) and $5.68 \pm 0.42 \times 10^7$ cfu/g for Lokongoma market (LME). There were significant differences (<0.05) in the counts of the total coliforms of the samples obtained from the five markets.

The staphylococcal counts ranged from $4.88 \pm 0.15 \times 10^7$ cfu/g to $6.20 \pm 0.46 \times 10^7$ cfu/g. the highest staphylococcal counts was obtained from the Lokongoma market (LME) while the least count was obtained from the old market (LMB). Significant differences exist in the staphylococcal counts of the crabs obtained from the five markets.

The moisture contents were above 10% in all the samples. The highest moisture content was observed in the Lokongoma market ($16.55 \pm 0.52\%$) followed by Adankolo market ($14.85 \pm 0.72\%$) while the least moisture content was observed in the samples from Old market ($12.85 \pm 0.27\%$). There were significant differences in the moisture contents of the samples obtained from the five markets.

Table 2 shows the occurrence of bacteria isolated from the samples obtained from the five markets. *Escherichia coli* and *Staphylococcus aureus* were isolated in all the samples from the markets while *Salmonella* spp and *Shigella* spp were isolated only in the samples from Adankolo market. *Pseudomonas* spp was isolated only in the samples from Kpata.

Discussion

The results of the bacterial analysis of crabs bought from five markets in Lokoja, Nigeria indicate high levels of contamination with pathogenic bacteria. The total aerobic bacteria counts (TAB) exceeded the minimum acceptable limit ($<10^5$ cfu/g) for total aerobic counts (Refai, 1979). Total coliform and staphylococcal counts of the crab samples were also above the acceptable limit (coliform $<10^2$ cfu/g, coagulase positive staphylococcus $<10^2$ cfu/g) according to Whong *et al.*(2003). The high total aerobic counts is an indication of reduced shelf-life for the crab meats while the high coliform and staphylococcal counts is an indication of potential food infection/ intoxication (Buchanan, 1991).

Table 1: Bacterial counts and moisture contents of crab samples obtained from various markets in Lokoja

Sample points	TAB(x10 ⁷ cfu/g)	Total coliform (x10 ⁷ cfu/g)	Staphylococcus (x10 ⁷ cfu/g)	Moisture (%)
LMA	4.55 ± 0.36 ^e	4.00 ± 0.32 ^b	5.10 ± 0.41 ^{a,b}	14.48 ± 0.34 ^{b,c}
LMB	5.28 ± 0.18 ^{c,d}	3.53 ± 0.28 ^b	4.88 ± 0.15 ^b	12.85 ± 0.27 ^d
LMC	7.08 ± 0.38 ^{a,b}	3.85 ± 0.13 ^b	5.05 ± 0.40 ^{a,b}	13.15 ± 0.44 ^{b,c}
LMD	6.22 ± 0.47 ^{b,c}	5.35 ± 0.55 ^a	5.30 ± 0.30 ^{a,b}	14.85 ± 0.72 ^b
LME	7.83 ± 0.56 ^a	5.68 ± 0.42 ^a	6.20 ± 0.46 ^a	16.55 ± 0.52 ^a

^{a,b,c,d,e}: means denoted by different superscripts along the same column are significantly (p<0.05) different.

LMA:Kpata market, LMB: Old market, LMC: International market, LMD: Adankolo Market, LME: Lokongoma market, TAB: Total aerobic bacteria, Cfu/g: Coliform forming unit per gramme

Table 2: Occurrence of bacteria in crab samples obtained from various markets in Lokoja

Sample points	E.coli	Salmonella	Shigella	Pseudomonas	Staphylococcus
LMA	+	-	-	+	+
LMB	+	-	-	-	+
LMC	+	-	-	-	+
LMD	+	+	+	-	+
LME	+	-	-	-	+

LMA: Kpata Market, LMB: Old Market, LMC: International Market, LMD: Adankolo Market, LME: Lokongoma Market,

+: presence

-: absence

The lowest moisture content of crab samples obtained from Old Lokoja market may be responsible for their low coliform and staphylococcal counts compared to the samples from Lokongoma and Adankolo markets. The high moisture contents of the samples from Lokongoma market is an indication that the dehydration process was inadequate and might have contributed to their spoilage (Doe, 1985). However, the moisture contents for all the crab samples were higher than the acceptable limits (<10%) (Whong *et al.*, 2003). This could be responsible for the high bacterial load of the crab samples. The storage life of the crabs could be extended if they are dried sufficiently to reduce the moisture content (Doe, 1985). Eyo (2001), reported that dried crabs that contain moisture greater than 10% will be liable to microbial spoilage, shorter shelf life and off-odour and when consumed directly, may result in food poisoning.

The high staphylococcal counts in all the crab samples may be due to the fact that crabs, which were usually selected out of the heaps of Cray fishes, are constantly being touched by both buyers and sellers, thus introducing and increasing the population of *Staphylococcus aureus* (Whong *et al.*, 2003). Ezeama (2007) is of the view that staphylococcal counts exceeding 10^2 cells/g in sea foods may be associated with gross mishandling and contamination.

The presence of *Escherichia coli* in all the samples (particularly the Type I group) may be suggestive of faecal contamination due to poor hygiene and sanitation. *E. coli* has been implicated in human diarrheal particularly type 0157:H7 (Nester *et al.*, 2007).

The presence of *Pseudomonas*, *Salmonella* and *Shigella* in the crab samples from Kpata and Adankolo markets may be due to exposure to flies (Mensah *et al.*, 2002) and prevailing poor

sanitary conditions in the markets. *Salmonella* and *Shigella* are well-known important human pathogens (Olonitola *et al.*, 2006). Their presence is unacceptable because of their attendant health risks (Mensah *et al.*, 2002).

Conclusion

The findings of this study show that crabs sold in Lokoja are highly contaminated and potentially hazardous if consumed directly or without proper cooking. The high bacterial load of these products may be due to inadequate drying process in addition to poor hygiene practices and sanitary conditions prevailing in the markets.

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