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**MICROBIOLOGICAL STUDIES OF THE MANGROVE OYSTER  
*Crassostrea gasar* (ADANSON 1757) FROM AN EXPERIMENTAL  
FISH FARM OF THE LAGOS LAGOON, NIGERIA.**

BY

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# MICROBIOLOGICAL STUDIES OF THE MANGROVE OYSTER

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## ABSTRACT

*Crassostrea gasar*, the mangrove oyster and the surrounding fish farm water were examined microbiologically. The aim was to determine the bacterial load and level of contamination. Oysters were collected from the experimental fish farm of the Nigerian Institute for Oceanography and Marine Research, with its water source from the Lagos Lagoon. The oysters were discovered to be contaminated, with the Coliform/*Escherichia coli* counts in the range of 56/100g to above 1,800/100g for samples collected. Salmonella pathogen was present and the counts were in the range of  $3.10 \times 10^2$  to  $1.99 \times 10^6$  per gram. The total viable bacteria counts were in the range of  $3.18 \times 10^2$  to  $2.20 \times 10^6$  per gram.

Analysis of the farm water revealed a positive correlation in microbial counts of the oysters and the surrounding water.

## INTRODUCTION:

Amongst fisheries products the world over, oysters play an important role in the provision of needed protein for the populace. They are cultivated in large numbers in countries like Japan and the Phillipines (4). In Nigeria, there is beginning to be an awareness in the oyster as a protein resource and employment for artisanal fishermen.

*Crassostrea gasar*, the mangrove oyster is located along the West African Coast, from Senegal down to Angola (2). Resource survey conducted under the Nigerian Institute for Oceanography and Marine Research located large numbers in the Lagos Lagoon, Badagry and Kuramo creeks, Niger Delta and the coastline of Cross River State, and physiochemical parameters suitable for growth were established (5). In Rivers, Cross River and Akwa Ibom States, the mangrove oyster has come to be an essential part of the diet of the local inhabitants and is found all the year round in most markets in Port Harcourt (1).

But inspite of the abundant availability of the oyster and suitable growth conditions as well as its acceptance in certain areas of the Nigerian society, there is a general bias against the oyster as a source of food and protein. The reason being due to apparent fears of the oyster being a source of outbreak in food borne diseases. Although such fears may not be far fetched, there is need to understand the feeding habit of the oyster as a starting point in evolving adequate processing methods to safeguard against outbreak in food borne diseases

*Crassostrea gasar* is a filter feeder and selects out microorganisms from the surrounding water, concentrating such within its body. It uses the same principles to cleanse itself of such organisms when placed in clean or purified water (3). The level of bacteria load of the surrounding water therefore, to a large extent determines that of the oysters. In order to safeguard against heavy contamination of the oysters, the United States Public Health Standards stipulated that harvesting should be done in waters with coliform counts below 76/100mls and restricted in those with counts above 2300/100mls (9). Between these two figures, harvesting should be on restricted basis if it can be demonstrated that the high coliform count is not faecal in origin e.g. from agricultural waste (9). The total viable bacteria count should be in the range of 50,000- 1,000,000 per gram and coliform count of the oysters should not exceed 350/100mls (6).

The total viable bacteria count is a measure of the microbiological quality of the food and projects the expected shelf life. High faecal coliform counts indicate recent faecal contamination and presence of pathogens, thereby reflecting the sanitary quality of the oysters. Low total viable bacteria and coliform counts do not confer safety per se, as foods with low counts have been incriminated

minated in out-break of foodborne diseases (10). Counts should therefore be seen as measures of food quality and not safety in totality (6).

Oysters were collected from the fish farm, situated south west of Ikoyi, Lagos. It is partially surrounded by residential quarters. The total viable bacteria, salmonella and faecal coliform counts were employed to assess the microbiological quality of the oyster and the surrounding water.

#### MATERIALS AND METHODS:

Oyster and water samples were collected on monthly basis from the farm. The oysters were harvested, cleaned and transported in cellophane bags to the laboratory for analysis. The water samples were collected in sterile containers. The oysters were shucked and macerated. Samples consisted of (1) unwashed shucked oysters, (11) washed shucked oysters, (111) farm water. For each oyster sample, 25g were weighed out, macerated and transferred into 225mls of 1% peptone water. Serial dilutions were carried out and prepared plates of Bismuth sulphite agar and standard plate count agar were inoculated with 0.1ml of the respective homogenate and incubated at 37°C for 24 hours and 48 hours for the total viable bacteria and salmonella counts respectively. The faecal coliform counts were determined using the Most Probable Number Technique with lauryl tryptose broth. *E. coli* was confirmed with the Eijkman reagent (11). In analysing the farm water samples, 25mls were dispensed into 225mls of 1% peptone water and similar tests were repeated.

#### RESULTS:

The total viable bacteria count of the washed and unwashed shucked oyster samples were generally within the stipulated standard of 50,000 — 1,000,000 per gram with exception of samples collected in the month of May (Table 1). Salmonella organisms were present in the unwashed oyster and farm water. The counts reduced for samples collected in the months of June, July and August (Table 2).

The faecal coliform counts for the farm water and oysters were high. The counts exceeded the stipulated standard for waters used in cultivating oysters. The faecal counts were particularly high in the month of June, July and August contrary to the reduced counts observed for the salmonella organisms.

in general there was correlation in counts between the water and oyster samples. The microbial counts reduced when the shucked oysters were washed before sampling, the salmonella pathogen was however, not completely removed by washing (Table 1).

#### DISCUSSION:

The microbial counts of the samples analysed were a measure of the sanitary quality of the oyster, *Crassostrea gasar* and the farm water. It was realised that the farm water was heavily contaminated which affected the sanitary quality of the oysters. This was indicated by the high faecal coliform/*E. coli* counts observed for the oyster and water samples with particular reference to samples collected in June, July and August.

The high level of salmonella present in the oyster and farm water revealed the possible presence of other pathogens as indicative of the high faecal counts. Of particular interest was the trend observed between the salmonella and faecal coliform counts for the months of June, July and August. It would be expected that with increase in the faecal coliform counts there would be corresponding increase in the salmonella counts if the former were of act as an indicator and measure for the presence of the latter. However it was observed that with the increase in faecal coliform counts to above 1800/100g salmonella counts decreased from  $1.99 \times 10^6$  per gram for the month of May to  $3.0 \times 10^2$  per gram for the month of August. This observation is contrary to the findings of certain investigators which stated that faecal coliforms are valid indicators for salmonella in irrigation waters. They discovered that when faecal coliform density per 100ml was above 1,000, salmonella occurrence exceeded a 96% frequency while a frequency of only 54% was associated with faecal coliform level of less than 1,000 per 100ml (5). As a result the total viable bacteria count was more of a measure of the number of salmonella organisms present. Its single use as a food quality measure for the oysters was not tenable because counts were within the acceptable standards despite the unacceptable level of salmonella present. In its use as a criteria in oyster quality, there was no alarm as to the presence of pathogens. The faecal coliform counts remained a safer measure in assessing the sanitary quality of the oysters and presence of pathogens.

Although the general microbial counts of the shucked oysters reduced when washed with tap water, salmonella pathogens were not eradicated. Efforts at eradication of pathogens should look further than washing with water after shucking.



TABLE 1: MICROBIAL COUNTS PER GRAM OF OYSTER AND FARM WATER SAMPLES

SAMPLES	TEST	MEDIA	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
OY <sub>NW</sub>	TCS	PCA	8.5 x 10 <sup>5</sup>	1.9 x 10 <sup>5</sup>	9.1 x 10 <sup>5</sup>	2.2 x 10 <sup>6</sup>	2.88 x 10 <sup>5</sup>	4.3 x 10 <sup>4</sup>	3.18 x 10 <sup>4</sup>
	TVC	PCA							
OY <sub>W</sub>	SC	BSA	—	5.1 x 10 <sup>3</sup>	2.2 x 10 <sup>5</sup>	1.99 x 10 <sup>6</sup>	2.03 x 10 <sup>4</sup>	2.0 x 10 <sup>2</sup>	3.0 x 10 <sup>2</sup>
	TVC	PCA	—	3.11 x 10 <sup>3</sup>	2.2 x 10 <sup>3</sup>	4.1 x 10 <sup>5</sup>	3.2 x 10 <sup>3</sup>	2.5 x 10 <sup>2</sup>	2.6 x 10 <sup>3</sup>
OY <sub>FW</sub>	SC	BSA	—	2.6 x 10 <sup>3</sup>	1.5 x 10 <sup>3</sup>	2.72 x 10 <sup>5</sup>	2.1 x 10 <sup>2</sup>	1.0 x 10 <sup>2</sup>	2.0 x 10 <sup>2</sup>
	TVC	PCA	—	2.7 x 10 <sup>3</sup>	4.7 x 10 <sup>4</sup>	2.62 x 10 <sup>5</sup>	1.91 x 10 <sup>4</sup>	3.0 x 10 <sup>3</sup>	2.89 x 10 <sup>4</sup>
	SC	BSA	—	5.0 x 10 <sup>2</sup>	1.55 x 10 <sup>4</sup>	2.1 x 10 <sup>5</sup>	1.09 x 10 <sup>4</sup>	1.0 x 10 <sup>2</sup>	3.0 x 10 <sup>2</sup>

TABLE 2: FAECAL COLIFORM COUNT OF OYSTER AND FARM WATER SAMPLES

SAMPLES	TEST	MEDIA	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.
OY <sub>NW</sub>	CC	LTB	—	210/100ml	170/100ml	130/100ml	1800/100ml	1800/100ml	1800/100ml
OY <sub>W</sub>	CC	LTB	—	110/100ml	130/100ml	56/100ml	540/100ml	540/100ml	540/100ml
OY <sub>FW</sub>	CC	LTB	—	180/100ml	130/100ml	79/100ml	920/100ml	920/100ml	920/100ml

PCA	—	Plate Count Agar	Count	CC	—	Coliform Count
BSA	—	Bismuth Sulphite Agar		OY <sub>NW</sub>	—	Unwashed Shucked Oyster
LTB	—	Lauyl Tryptose Broth		OY <sub>W</sub>	—	Washed Shucked Oyster
TVC	—	Total Viable Bacteria Count		OY <sub>FW</sub>	—	Fish Farm Water
SC	—	Salmonella Count				

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