BIORESEARCH BULLETIN
Sapience Research Labs

ORIGINAL PAPER OPEN ACCESS

Microbiological Quality of Fish Pellet

Awe S and Ajimobi IK

Received: 03 November 2010 / **Accepted:** 01 December 2010 / **Published online:** 02 February 2011

Abstract

Background: Fish production has been one of the fastest growing segments of the global food production sector in recent decades. The demand for fish pellet is on daily increase in Nigeria due to a desire for high yield in fish production. The need to meet increasing demand leads to multiple fish pellet production factories and errors in handling during processing may cause spoilage. A total of six samples were collected from retail outlets in Oyo market and the microbiological quality examined in terms of total bacterial count, coliform count, and fungal count, types of bacterial and fungal species present. Their physicochemical parameters: pH, titratable acidity (TTA) and percentage moisture content were also assessed.
Results: The pellets were found to have pH ranging from 5.00 and 5.80, the titratable acidity ranges between 0.80 and 4.10 while the percentage moisture content ranges between 5.0% and 10.0%. The bacterial counts ranged from 0.0 to 17.0 x 10^4 cfu/g, coliform count ranged from 0.0 to 74 x 10^4 cfu/g while the fungal count ranged from 0.0 to 2.0 x 10^4 cfu/g. Six bacterial species namely *Streptococcus* sp., *Bacillus* sp., *Klebsiella* sp., *Salmonella* sp. and *Streptococcus epidemidis*, and three fungal species: *Aspergillus niger, Rhizopus stolonifer* and *Mucor* sps. were isolated. Their distribution pattern showed that *Stapylococcus aureus* was present in almost all the samples.
Conclusion: The presence of some potential food borne pathogen in the samples indicate that fish pellet could pose a food safety risk to fishes. To avoid cross contamination, manufacturing industries should reduce direct hand manipulation and ensure the use of automated equipments in their production.

Key words: Fish, Pellet, Microbial quality.

Awe S and Ajimobi IK.

Department of Biological Sciences,
Ajayi Crowther University,
P.M.B. 1066, Oyo,
Oyo State,
Nigeria.

Correspondence to: E-mail: asflor5@yahoo.com.

Web address:
http://bioresonline.org/archives/A134.pdf

Article citation:
Awe S and Ajimobi IK. 2011. Microbiological Quality of Fish Pellet. Bioresearch Bulletin 4: 245-249.

INTRODUCTION

Fish is a staple article food in the tropics. It is a cold- blooded vertebrate, living wholly in water and breathing through gills, with fins for swimming. It is a good source of protein, has vitamins such as Vitamins A and D and also minerals like calcium and phosphorous. Fish is of high biological value, it has essential sulphur containing amino-acids such as lysine and methionine (Adegoke, 2000). The flesh from healthy fish contains 60-84% water, 15-24% protein, 0.1-22% fat and 1-2% minerals (Clucas, 1981).

Fish pellet is from a generic term for a nutrient rich feed ingredient used primarily in diets for domestic animals, sometimes used as a high quality organic fertilizer. Fish pellet can be made from almost any type of seafood but is generally manufactured form wild caught, small marine fish that contains a high percentage of bones and oil, and usually deemed not suitable for direct human consumption. These fishes are considered 'industrial' since most of them are caught for sole purpose of fishmeal and fish oil production. A small percentage of fish pellet is rendered from the by-catch of other fisheries, and by-products or trimmings created during processing of various seafood products destined for direct human consumption (Miles and Chapman, 2010).

The high quality and concentration of essential nutrient, especially of well balanced amino acid, essential fatty acids and energy content makes fish pellet an indispensable ingredient in diet of most aquaculture species and many land-farm animals. Because of these nutrient content, high digestibility and palatability, fish pellet serves as the benchmark ingredient in aquaculture diets (Miles and Chapman, 2010).

The quality of different feedstuff is generally dependent on the amino acid profile in their proteins, digestibility of proteins, freshness of raw materials, and their storage. Plant based proteins, even when properly processed, are usually not as digestable as fish pellet; and their inclusion rate into the diet is often limited as it results in depressed growth rates and feed intakes. Over-all protein digestibility value for fish pellets are consistently above 95%. In comparison protein digestibility for many plant based proteins varies greatly, for example, from 77% to 96%, depending on the species of plant used for feed preperation (Mass van Berkel, *et al*., 1994). The quality of fish pellet and the effectiveness of fish pellet production process are important issues for both fish pellet suppliers and fish farmers. This would in turn result in an overall positive economical effect in the fish pellet production (Mass van Berkel, *et al*., 1994).

A very important reason why fish pellet is sought after as an ingredient in aquaculture diets is because fish pellet contains certain compounds that make the feed more acceptable and agreeable to taste (palatable). This property allows for the feed to be ingested rapidly, and will reduce nutrient leaching (Mass van Berkel, *et al*., 1994).

Thus, this study was therefore undertaken to investigate the microbiological safety of the available fish pellet sold in Oyo market.

MATERIAL AND METHODS

Collection of Samples:

Six bags of the pellet in duplicates were purchased from retailers in Akesan market within Oyo metropolis, Nigeria. They were named as A, B, C, D, E, and F. These samples were immediately taken to the laboratory for analysis.

Physico-chemical parameters

Determination of pH and Moisture content.

The pH was determined with a pH meter Pye model 292 MK 3 Unicon. The moisture content was determined using the method described by AOAC (1995). The pH of the sample was measured by dissolving l.0g of the sample in 10ml of distilled water, the electrode inserted in the solution and reading taken.

Microbial assay

Viable counts of bacteria in the samples were determined with standard plate count agar employing suitable tenfold serial dilution of the samples in 0.1% peptone water as described by APHA (1985) using the pour plate method. While the coliform count was determined using MacConkey agar and maintained at 37^0Cfor 48hrs. Fungal load was assessed on potato dextrose agar (PDA) incubated at 27 ± 1^0c for 72hrs (Fawole and Oso, 2004).

Representative colonies of bacterial isolated were selected and purified by subculturing on nutrient agar using the streaking method. Pure cultures were then characterized and subsequently identified according to Cowan and Steel's Manual for the identification of Medical Bacteria. (Barrow and Feltham, 1995). While fungi were identified according to Kulwant et al., (1991).

RESULTS AND DISCUSSION

The mean pH (Hydrogen ion concentration) and Titratable acidity (TTA) of the samples are shown in **Figure 1.** The pH ranged between the 5.0 and 5.80; while TTA ranged between 4.95 and 0.08. The pH values obtained shows that the pellets are slightly acidic, thereby indicating that pellets could permit and tolerate the growth of bacteria and fungi (Frazier *et al.,* 1967) (Figure 1). The ability of fungi and bacteria to survive pH alone is not sufficient parameter to predict the chances of survival and proliferation of bacterial in pellets (Marcus, 1997).

Figure 2 shows the percentage moisture content of the pellet sample which ranged between 5.00% and 10.00%. The moisture content obtained is generally low. High moisture content has been reported to accelerate food spoilage (Prescott, 2008); if low moisture content is held under humid condition it is able to support growth of moulds. If the water absorption continues to rise bacteria will be able to grow.

The total bacterial, coliform and fungal count of the examined samples is shown in **Table 1.**The bacterial counts ranged from 0.0 to 17.0 x 10^4 cfu/g, coliform count ranged from 0.0 to 74 x 10^4 cfu/g while the fungal count ranged from 0.0 to 2.0 x 10^4 cfu/g. It is observed that Sample F has the highest number of bacteria value while Samples C has no bacteria growth while. Sample E has the highest number of coliform value 74 x10^4 cfu/g .whereas samples A and B has no coliform. **Table 2** shows the distribution and occurrence of bacterial and fungal species isolated among the pellet sample. The high bacteria, coliform and fungi counts obtained may be due to poor hygienic standard of preparation, or handling and storage (Table 1) (Asta, 1999). Some of the organisms isolated have been implicated as causative agents of gastroenteritis (Nester *et al.,* 2001).

Table 1: Total fungal, bacterial and coliform counts in pellet samples

Samples	Mean fungal count x 10^4 (cfu/g)	Mean Bacteria count x10^4 (cfug)	Mean Coliform count x10^4 (cfu/g)
Sample A	0.0	2.0	0.0
Sample B	1.0	1.0	0.0
Sample C	0.0	0.0	55.0
Sample D	0.0	2.0	1.0
Sample E	2.0	13.0	74.0
Sample F	0.0	17.0	2.0

A total of six bacterial species were isolated from the samples and they were identified to be *Streptococus* sp, *Bacillus* sp, *Stapylococcus epidermidis, Klebsiella* sp, *Salmonella* sp, and *Staphylococcus aureus*. It can also be seen that *Stapylococcus aureus* is the major bacterial contaminants. Sample E has the highest number of contaminant while Samples A and D has lowest bacterial contaminant in them.

The presence of *Staphylococcus aureus* and other related species like *Staphylococcus epidermis* indicates contamination by human (Wolfyang *et al.,* 2006). *Staphylococcus aureus* is carried in the nose of 50% of healthy people (Aspinis, 1997). Its' occurrences in the fish feed may be through activities such as sneezing and coughing of the feed handlers. The organism is associated with enterotoxin characterized by short incubation period, violent nausea, vomiting and diarrhea. The occurrence of *Bacillus sp* is an indicative of environmental contamination from soil or dust and has been considered to be one of the important spoilage organisms.

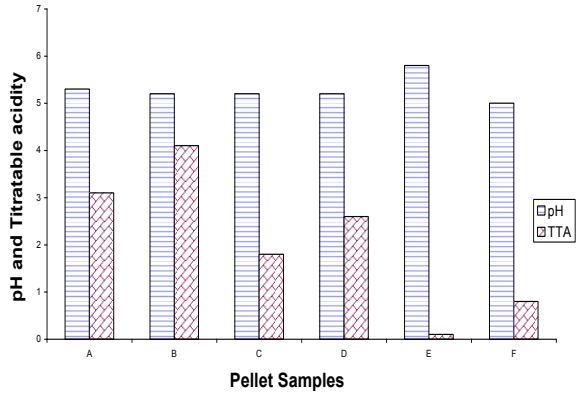

Fig. 1: pH and tiratable acidity of fish pellets

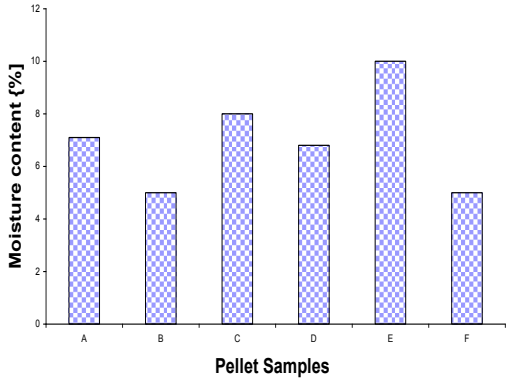

Fig. 2: Percentage moisture content of fish pellets

Table 2: Distribution of bacterial and fungal isolates among samples.

Isolates	Sample A.	Sample B	Sample C	Sample D	Sample E	Sample F
Streptococcus sp,	-	+	-	-	+	+
Stapylococcus epidermidis	-	+	+	+	+	-
Bacillus sp	-	-	-	-	+	-
Klebsiella sp	-	-	-	-	+	+
Salmonella sp	-	-	+	-	-	+
Staphylococcus aureus	+	+	+	-	+	+
Fungal species						
Aspergillus niger	-	+	+	-	+	-
Rhizopus sp	-	-	+	-	-	+
Mucor sp	-	+	-	-	+	-

Key : + = Present, - = Absent

Epidemiological evidence has implicated food as a vector of pathogenic organisms (Ericsson *et al.*, 2000; Dupont et *al.*, 2000). When these organisms affect fishes and ingested, this would cause greater harm to human health. *Salmonella sp* are responsible for causing salmonellosis characterized by typhoid, paratyphoid fever and dysentery (WHO, 1976). *Klebsiella* sp causes gastro -intestinal tract infection.

The fungal species were *Aspergillus niger, Rhizopus stolonifer* and *Mucor* sp. None of the samples contain all the organisms. The presence of *Aspergillus* in the sample could be because *Aspergillus* is a common soil fungus (Aspinis, 1997). This can get into the feed sample in the process of milling when the producer is so careless to have put some of the feed quantity which has poured on the floor into the bag containing the feed grounded from the machine, this process could introduce the organism into the feed. Also it might have gotten into the grains during dehusking and shelling of grains on the farm and consequent packing from the floor as practiced by many local farmers. Saprophytic soil and air microflora such as species of *Mucor* and *Rhizopus* predominate. The presence of this organism can affect the good health of fish and the consumers.

Since it is neither possible nor desirable that we should live in a sterile environment, what is important is to minimize the contamination of feed materials. High hygienic production and appropriate storage conditions should be ensured.

REFERENCES

American Public Health Association (APHA). 1985. Standard Methods for the examination of water and waste water, 16th ed.

American Public Association, Washington D.C. Asta 1999. http:www.indianspices.com/html/s1490qua.htm.

AOAC. 1995. Official method of analysis 13th edition Association of Official Analytical Chemists.

Arlington V.A. Adegoke, G.O. 2000. Understanding Food Microbiology, First Edition, 1. Shalom Prints.Ibadan. pp 32-35.

Apinis AE, 1997. Mycological Aspect of Stored Grains Bio-deterioration of Materials vol. 2 Applied sc. Publishers London 493-498.

Barrow GI, Feltham RKA. 1995. Cowan and Steel's Manual for Identification of Medical Bacteria. 3rd Edition, Cambridge University press.

Clucas IJ. 1981. Fish Handling Preservation and Processing in the Tropics. Parts 1 &2. Tropical development and research institute, London.

Dupont HL, Sulivan DG, Evans LK, Cherig DJ, Evans jr JS, Viollet CD. 2000. Perception of travelers diarrhea. Prophylactic administration is of subsalicytate bismuth. *Journal of American Medical Association* 243:237-241.

Ericsson CD, Pickering LK, Dupont HC. 2000. The role of location of food consumption in the prevention of diarrhea in Mexico Gastroenterology 79:812-816.

Fawole MO, Oso BA. 2004. Laboratory Mannual of Microbiology. Spectrum Books Limited Spectrum House, Ring Road, Ibadan, Nigeria. Pp 1-48.

Frazier WC, Westhof DC. 1967. Fermentation in food microbiology, 3rd edition, Tata migraine Hill, Publishing company Ltd. 397.

Kulwant SJC, Frisvad U, lf Thrane Mathur SB 1991. An Illustrated Manual on Identification of some seed bone Aspergilli, Fusariua, Penicilla and their Mycotoxins 1st Edition Ryvangs Alle 78. DK-2900 Hellerup, Denmark.

Marcus MJ, Donald NW, Richard AR. 1997. Microbiology for the health sciences. 4th edition. Prentice Hall Upper Saddle River, New Jersey.

Mass-van Berkel B, Boogaard BV, Heijnen CC, 1994. Preservation of Fish and Meat,Translated by Joost Guiyi,Netherlands, Agromisia, 2-3.

Milies RD. Chapman FA. 2010. The Benefits of Fish Meal in Aquaculture Diets. 6th Edition USA.

Nestar EW, Anderson DG, Roberts CE, Peorsal NN, Nester MT. 2001. Food Microbiology Spectrum Book Ltd., Ibadan, Nigeria.

Prescott, Harley klein's. 2008 Microbiology. 7th edition. Mc Graw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.

WHO-World Health Organization. 1976. Microbiological aspects of food hygiene. Technical Report series No. 598.

Wolfyang KJ, Hilda PW, Bernard DA, Cathenne WM. 2006. Enterobacteriaceae Resistance Transfer Factor and Drug Resistant Plasmid Zinsteen Microbiology 20:1294-1296.