Internet Journal of Food Safety, Vol.13, 2011, p.41-44

Internet Journal of Food Safety

Microbial And Proximate Composition of Some Fish Meal Samples

Olaitan Olubunmi Olajuyigbe*, Gbola R. Akande., Martha Onyekachi Ezekiel, Adeseye Olufemi Olusola, Mutiat Motolani Salaudeen, Esther Esak Amusan, Abisoye Felicia Babalola.

Department of Fish Technology/ Biotechnology, Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos Nigeria.

Abstract

Fish meal samples of different protein composition, and products of different manufacturers were purchased from a popular fish meal market in Lagos state, Nigeria. The samples were analysed for their microbial quality and the proximate compositions of the samples were also determined. A total of 25 bacteria isolates and 19 fungal isolates were obtained. The bacteria isolates were mainly *Bacillus sp*, and *Staphylococcus* sp. *E. coli*, *Vibrio spp*, *Salmonella* and *Shigella* were totally absent. The fungal isolates obtained were identified to belong to genera such as *Aspergillus*, *Rhizopus*, *Mucor*, and *Neurospora*. The proximate composition of the samples showed that the percentage crude protein ranged between31.38-71.65%. The protein composition of most of the samples was less than what they were labelled to have contained. There is therefore a need for regulatory bodies to ensure that good quality products of high standard are supplied in our markets.

Keywords: Fishmeal, microbial quality, pathogenic bacteria, proximate composition.

Introduction

Fish meal is a ground solid product that has been obtained by removing most of the water and some or all of the oil from fish or fish waste (Ruiter 1995). It is a high protein feed supplement which is mixed with other feed supplements to produce a balanced diet for livestock. Fish meal has been used as a livestock feed for many years. It is popular because of its high nutritional value. It has high levels of essential amino acids such as lysine ($C_6H_{14}N_2O_2$), which is often deficient in grain products that are the typical base for most animal feeds. It also contains vitamins such as B12 ($C_{63}H_{88}CoN_{14}O_{14}P$), choline ($C_5H_{14}NO$), niacin ($C_6H_5NO_2$), pantothenic acid ($C_9H_{17}NO_5$) and riboflavin ($C_{17}H_{20}N_4O_6$) and is a good source of calcium (Ca), copper (Cu), iron (Fe), phosphorous (P) and other trace minerals. Fish meal is low in fibre and easy to produce (Hall 1992). It also has a high methionine and cysteine content and a high digestibility and biological value (Keller 1990).

*Corresponding author's mailing address: *Nigerian Institute for Oceanography and Marine Research, P. M. B. 12729, Victoria Island, Lagos Nigeria.*
Tel:234-8034271794,
Email: <olaitan_afolabi@yahoo.com

Fish meal is the major source of protein in fish and livestock feeds. Protein represents the major component of fish feeds. It is a source of energy for the fish, but also a medium for micro-organisms, especially proteolytic bacteria and ammonifiers (Zmysłowska and Lewandowska, 2000). Protein can be easily denatured leading to deterioration. There is therefore the need to ensure that fish meal of good quality is used so as to produce fish feed of a high quality standard.

The availability, suitability and the quality of raw materials and the processing equipments are very important in the overall quality of fish meal and consequently the fish feed produced with the fish meal. Cultured aquatic species are more sensitive to the quality of raw feed ingredients than other livestock and have higher nutritional requirements; therefore only high quality raw materials are needed in aqua feeds (Michael et al., 1995). There have been some complains (especially on the crude protein content) on the quality of fish meal in our markets, this work was therefore embarked upon to assess the microbial quality and the proximate composition of some fish meal available in a popular fish meal market in Lagos, Nigeria.

Material and Methods

Sample collection. Five fish meal samples of different percentage protein composition and products of different manufacturers were obtained from Oko oba (a popular livestock feed market) in Lagos, Nigeria. They were kept in sterile polythene bags and taken to the laboratory for analysis. Samples A, B, C, and E were imported into the country while sample D was produced in Nigeria.

- Sample A: 72% fish meal
- Sample B: 72% fish meal
- Sample C: 65% fish meal
- Sample D: 60% fish meal
- Sample E: 72% fish meal

Isolation Technique. Ten grams of each sample were aseptically weighed and homogenized in 90ml of sterile distil water. Ten- fold serial dilutions of samples were done in 1% peptone water and plated out on six different culture media; Nutrient Agar (NA) was used to determine the total viable count (TVC), Potato Dextrose Agar (PDA) and Malt Extract Agar (MEA) were used to detect the presence of fungi and moulds, Salmonella-Shigella Agar (SSA) was used to detect the presence of Salmonella and Shigella. Lactose broth and Eosine Methylene Blue (EMB) Agar were used to detect the presence of coliforms, while Thiosulphate citrate bile salt (TCBS) Agar was used to detect the presence of Vibrio. The plates were incubated at room temperature (30oC) for fungal isolates and 35oC for bacteria isolates. Pour plat e method of Harrigan and McCance (1976) was used for the isolation.

Identification of Isolates. Pure bacteria isolates were identified through their microscopic and biochemical characteristics according to the Bergy's Manual of Systematic Bacteriology (Seneath et al., 1986), while the pure fungi isolates were identified using their cultural/microscopic characteristics (Domsch et al., 1980).

Proximate composition. Crude protein, crude fat, moisture, ash and fibre determination were done according to the AOAC (1998) methods.

Results and Discussion

Microbial Analysis. The results of the microbial analysis are reported in tables 1and 2. The total viable count(TVC) ranged between 1x 10^1 and 2.64x 10^3 cfu/g. A total of 25 bacteria isolates and 19 fungal isolates were obtained. Table 1 show the bacteria growth on the different media used. The bacteria isolates obtained were identified to belong to genera such as *Bacillus* , *Staphylococcus* , and other genera yet to be identified. *Salmonella* and *Vibro* were absent in all the samples tested. The absence of *Salmonella* and *Vibro* spp in all the samples showed that the samples were adequately processed and that post-processing contamination was prevented. Gas production was observed only in lactose broth containing sample C, this showed the presence of coliforms in sample C and this was then plated out on EMB, but *E.coli* was absent. C also had the highest microbial load (2.63 x 10^3cfu/g.

Fungal growth was observed in all the samples analysed. The fungal isolates obtained were identified to belong to genera such *Aspergillus*, *Rhizopus*, *Mucor*, *Fusarium*, *Penicillium* and some yeast. Table 2 shows the presence of the fungal isolates in the fish meal samples. At least three or more of the identified genera were present in all the samples, this shows that fish meal is more likely to be prone to fungal attack than bacterial attack.

Proximate Analysis. Table 3 shows the results of the proximate analysis of the five fish meal samples. The moisture content of the samples ranged from 5.84% and 11.17%. The moisture content of sample A(8.05%) and B(5.84%) are within the normal limit as reported by Burt et al. 1992 that moisture contents between 5% and 10% are quite normal. The results of the proximate analysis showed that the protein content of the different fish meal samples were less than what was specified on the products. Only sample E with 71.65% crude protein was very close to the quantity specified on the product. This will affect the nutritive value of the feeds produced from such fish meal samples. Samples A and B whose moisture content were within the normal limit had lower bacteria count, while sample C which had the highest moisture content also had the highest bacteria count. Thus, it can be inferred that growth of microorganisms is influenced by presence of adequate moisture.

Table 1: Growth of bacteria on different media

Sample	NA(cfu/g)	SSA	TCBS	LB	EMB
A	1.0 x 10^1	-	-	-	-
B	1.0 x 10^1	-	-	-	-
C	2.64 x 10^3	-	-	+	+
D	3.0 x 10^2	-	-	-	-
E	1.4 x 10^2	-	-	-	-

Key: +: Growth present, -: No growth, A: 72% fish meal, B: 72% fish meal, C: 65% fish meal, D: 60% Fish meal, E: 72% fish meal , cfu: colony forming unit

Note: Values are means of three replicates.

Table 2: Presence of Fungal Isolates from Fish meal Samples

Fungal Isolate	Sample A	Sample B	Sample C	Sample D	Sample E
Aspergillus sp	+	+	+	+	+
Rhizopus sp	-	-	+	+	
Mucor sp	-	+	-	+	+
Fusarium sp	+	+		-	+
Penicillium sp	-	-	+	-	-
Trichoderma sp	+	+	-	-	-
Yeasts	+	-	+	-	+

Key: +: Growth present, -: No growth, A: 72% fish meal, B: 72% fish meal, C: 65% fish meal, D: 60% fish meal, E: 72% fish meal.

Table 3: Proximate composition of fish meal samples

Sample	%Crude Protein	%Fat	%Fibre	%Ash	%Moisture
A	59.67	5.94	0.78	8.76	8.05
B	68.96	7.58	1.07	16.88	5.84
C	31.38	3.44	8.79	6.94	11.17
D	39.78	3.89	1.45	7.97	11.03
E	71.65	4.85	1.05	12.05	10.40

Key: A: 72% fish meal, B: 72% fish meal, C: 65% fish meal, D: 60% fish meal, E: 72% fish meal.
Note: Values are mean of two replicates.

Conclusion

All the fish meal samples were of good microbial quality, they were all free of pathogenic bacteria. It is essential that regulatory bodies such as the Federal Department of Fisheries (FDF) and Standard Organization of Nigeria (SON) should ensure that products imported into the country are of high standard and that the consumers get good value for their money.

Acknowledgements

The authors wish to express our gratitude to the Executive Director and the management of the Nigerian Institute for Oceanography and marine Research (NIOMR) for providing the fund for this research.

References

Association of Official Analytical Chemists 1998. Official methods of analysis.

Burt JR, Hardy R, Whittle K.J. 1992. Pelagic fish the resource and its exploitation.pp222-231.In Urdahl, N. ed. By-products from pelagic fish. Cambridge. The University Press.

Domsch KH, Gams W,Traute-Heidi.1980. Compendium of Soil Fungi.Vol 1.Anderson Academic Press (London) Ltd.

Hall GM. 1992. Fish processing technology.pp155-192. In Ockerman, HW. ed. Fishery by-products. New York: VCH publishers.

Harrigan WF, McCance ME. 1976. Laboratory methods in microbiology. Academic press, London, New York.

Keller S. 1990. Making profits out of seafood wastes. Pp. 109-120. In Hardy, R.W. and Masumoto, T. eds. Specifications for marine by-products for aquaculture. Alaska.

Michael BN, Albert GJT, Imre C. 1995. Farm made aquafeeds. Pp282-295. In Utama, C.M.C. ed. Aquafeeds and feeding strategies in Malaysia. Rome: FAO.

Ruiter A. 1995. Fish and fishery products composition, nutritive properties and stability pp. 347. In Schmidtdorff, W. ed. Fish meal and fish oil-not only by-products. United Kingdom

Seneath PHA, Mair NS, Sharpe ME, Holt JG. 1986. Bergy's Manual of Systematic Bacteriology, 9th Edition. Williams and Wilkins, Baltimore.

Zmysłowska I, Lewandowska D. 2000. The effect of storage temperature on microbiological quality of fish feeds. Polish Journal of Environmental studies, 9(3): 223-226.