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Shelflife of Tilapia Fishmeal, Paste and Cake

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Abstract: The utilization of cheap, abundant, highly prolific whole *Tilapia nilotica* (*Oreochromis niloticus*) processed for fish paste, cake and especially fish meal in fish diets as an alternative to conventional fishmeal is tested in this study. Eight differently processed whole *Tilapia nilotica* fish paste preparations were set up for 7 days. Also well processed dried fish cake and fish meal were produced and kept for 3 months. The unfermented, cooked, salted and frozen (at-25°C) fish paste (super grade 1) of crude protein (c.p) 52.13% was the best. The fish cake (c.p-38.59%) and fish meal (c.p-65.69%) qualities were intact at 3 months.

Key words: Processing, shelflife, tilapia fish paste, cake, fish meal

INTRODUCTION

The need for a cheaper relatively abundant source of fish meal necessitates the search for an alternative source of fish meal production, that the potency will meet or close to the standards of the present stock of imported fish meal available in the market, with crude protein levels ranging from 65-72%[1-3],

McBay[4] reported that Tilapia is of a wide variety of the family Cichlidae which is widely distributed throughout the Tropical and sub-tropical regions of Africa, central and North America; they are omnivores with little selectivity in their feeding habits.

Tilapia niloticus (*Oreochromis niloticus*) have several attributes which makes it a prospective species for large-scale aquaculture in the warm water regions of the world[5]. The species exhibits fast growth and has the ability to breed under the most diverse conditions all year round. It is remarkably hardy, with a high tolerance to high stocking densities, wide range of salinities and generally degraded water conditions. Although *Oreochromis niloticus* is predominantly herbivorous, it has the ability to utilize various kinds of animal and vegetable wastes and would accept supplementary diets with good food conversion. FAO[6] reported that protected harvest of about eight million tonnes per annum is attainable in Africa alone.

The prolific breeding and overpopulation of tilapia nevertheless constitutes their major disadvantage, especially the resultant stunted growth which leaves a large proportion of the fish population below marketable size (much less than 500 gm weight). It is a low priced fish because it is bony and also for its small size. It is cheap when compared with other fresh/frozen fish sold in the market and hence the proposal for its use in fish meal production and its alternative uses as fish pastes and cakes is highly recommended.

The importance of fishmeal can best be judged by the fact that some 30% of the World catch ends up as fishmeal. Fishmeal is produced from a number of raw materials which include: skeletal remains of filleted fish, fish Cannery waste, fish offal, whole fish generally regarded as inedible, some varieties of herring, pilchards and many very small fish[7-8]). About 90% of world fish meal production is from only fish species such as mackerel, pilchard, capelin and menhaden. Less that 10% is from white fish offal such as cod and haddock. Only 1% produced from other sources such as shellfish and whales. The majority of fishmeal is "whole' that is, only water and some oil are extracted from the fish[9].

According to FAO[9] fishmeal is used for poultry, pigs, ruminants, farmed fish and for producing animals. It increases productivity and improves the efficiency with which feed is converted to animal protein. It is of special value in diets for young animals, for example in broiler starter diets for early weaned pigs, also for farmed fish and for producing animals.

Fish meal has been shown to be superior to other proteins, especially vegetable proteins, in supplying a balance of amino-acids for farmed fish. Fish meal is particularly beneficial in situations which are less than ideal, for example, where feed mixing and quality control of ingredients is poor, where husbandry standards are less than ideal and where disease problems are prevalent. Although fishmeal is often traded on a price per unit of protein, the commercial value of fishmeal is determined

not only on the basis of protein. Its value is affected by fishmeal supply, price of other fish feed protein sources like, G.N.C (Ground Nut Cake), soyameal etc and of course demand.

This study therefore explores the possible uses of *Tilapia nilotica* for (a) fish paste (b) fish cake and (c) fish meal. Apart from an attempt to determine their shelf life, potency, quality and especially the suitability of using *Tilapia nilotica* fishmeal as an alternative to the conventional fishmeal was tested experimentally in this study by supplementing levels of *Tilapia nilotica* fish meal for the conventional fish meal in the diets of *Clarias gariepinus* fry/fingerlings.

The objectives of this study are:

- To produce *Tilapia nilotica* fishmeal, paste and cake and determine their shelf life.
- To determine the suitability of *Tilapia* fishmeal as an alternative to the conventional fishmeal in the diet of *Clarias gariepinus*.

MATRIALS AND METHODS

Quality assessment of fresh tilapia fish: Twenty kilograms live tilapia fish were bought from Asejire dam and transported straight to the Department of Wildlife and Fisheries Management laboratory Organoleptic assessment of the fresh fish was carried out and the following observations were recorded.

	Observation	Description	Score
1.	Skin pigmentation	Viviid colour	2
2.	Skin mucus	Transparent	1
3	Eye tint	Black brilliant pupil	1
4	Eye shape	Bulging	1
5	Gills tint	Brilliant colours	1
6	Gills colour	Sea weedy	1
7	Flesh rigidity	elastic	2
8	Rigidity of the abdominal wall	intact	1
9	State of peritoneum	intact and adherent	1
10	Adherence of back bone	Adherent	1
11	Colour of flesh surrounding back bone	Normal/ same colour as the rest of the flesh	1
12	Odour of cooked flesh	Sea weedy	1
13	Flavour of cooked flesh	Slightly specific	2

N.B - Organoleptic assessment scores • Excellent • Very good • Good • just fair • poor • very poor

Preparation of tilapia fishmeal, paste and cake

Fishmeal preparation: Materials/equipment: fresh *Tilapia nilotica* weighing balance/scale, wire gauze, oven, grinder, sieve net/mesh, plant containers, knife.

Procedure:

- 6 kg fresh fish (*Tilapia*) was weighed out gutted and washed.
- The fish was left on wire gauze for a while to allow water drip off
- The fish was loaded into the oven, which was regulated to 75°C till the fish was thoroughly dried.
- The fish was taken to be dried when the pieces begin to crumble between the fingers (This took 34 h)
- The fish was reweighed after drying (The weight of the dried fish was 1. 50 kg)
- The dried fish was ground into fine meal with an electric grinder.

A sample was taken for proximate analysis some were kept and the remaining meal used in compounding diet for the experiment Scales were not removed from the fish and the drying temperature was between 70-80°C as against 80-90°C used for *Ethmalosa fimbriata* (Bonga) fishmeal preparation.

Fish paste preparation: Materials/equipments:- fresh fish (tilapia), water ,salt, weighing balance/scale, grinder, knife, pot, hotplate, strirrer, plastic containers.

Procedure for fermented and unfermented fish paste preparation: A total of 8 sample (4 sample for unfermented and 4 samples fermented) were prepared for the fish paste 7 days experiment as follows.

Unfermented:

- 2 kg fresh Tilapia fish was gutted, descaled and thoroughly washed in water.
- The fish was ground with an electric grinder completely into fine paste, with a little quantity of water added.
- The fish was reweighed after grinding; a weight of 2.460 kg was recorded due to the water added to the paste during the process of grinding.
- This was cooked for 30 min. with a new weight of 1.80 kg of cooked fish paste recorded.
- This was divided into four equal part of 0. 45 kg each and treated as follows.
- 1st sample (unfermented)- the 0.45 kg cooked sample was salted with 45 gm salt (i.e.10%salting) and frozen at-25°C (freezer temperature) for 7 day (covered)
- 2rd sample (unfermented)- the 0.45 kg cooked fish paste sample was salted with 45 gm salt (i.e., 10% salting) but left at room temperature (ambient temperature of 26°C) on a shelf for 7 days (opened).
- 3rd sample (Unfermented)-the 0.45 kg cooked fish paste sample was not salted but frozen at 25°C (freezer temperature for 7 days (covered)

- 4th sample (Unfermented)- the 0. 45 kg cooked fish paste sample was not salted, but left at room temperature of 26°C on a shelf for 7 days (opened).

Fermented:

- Another 3 kg of fresh Tilapia fish was gutted descaled following earlier procedures for the unfermented, but was not cooked and the uncooked fish paste were treated as follows:-
- 5th sample (Fermented)-the 0.45 kg uncooked fish paste sample was salted with 45 gm salt (i.e., 10% salting), covered and left at room temperature of 26°C.
- 6th sample (Fermented)-the 0.45 kg uncooked fish paste sample was salted with 45 gm salt (i.e., 10% salting), opened and left at room temperature of 26°C.
- 7th sample (Fermented)- the 0.45 kg uncooked fish paste sample was not salted, covered and left at room temperature of 26°C.
- 8th sample (fermented)- The 0.45 kg uncooked fish paste was not salted, opened andleft at room temperature of 26°C.
- Proximate analysis of the best fish paste was carried out. This was referred to as the super grade 1.

Fish cake preparation

Materials/equipment: Weighing balance, oven grinder, plastic container, knife, hot plate, strirrer, cake can, fresh Tilapia fish, water, Irish potatoes, flour.

- Six kilograme of ground Tilapia fish was weighed into a container.
- Four kilogrme cooked mashed Irish potato was added
- The 2 products were mixed thoroughly and the mixture distributed into cake cans
- They were thinly covered with flour and placed in the oven.
- The cakes were baked at a temperature of about 80°C- 90°C in an oven till hard and brown cakes were formed.
- The cakes were allowed to cool and stored for 3 months, after which an organoleptic assessment of the quality was carried out.

The proximate analysis of the fish meal, the fish cake and the best fish paste preparations were carried out; within a week and was based on organoleptic assessment for the fish paste, while the shelf life determination for fish cake and fish meal lasted at least 3 months.

RESULTS

1st Sample - The first sample unfermented.
(Unfermented) cooked, salted maintained at freezer temperature,-25°C had no change in physical appearance. Still retained its sea weedy odour (it is the best) is therefore tagged the (Super Grade I) its proximate composition is given below water settled on top, its physical appearance is intact.
2nd Sample - no change in physical appearance, (unfermented) still retained its sea weedy odour (High Grade 1).
3RD Sample- Strong offensive odour, swelling, (unfermented) colour change to brown (Average Grade 1)
4TH Sample- Green moulds were seen through
(unfermented) transparent nylon, stale, strong offensive odour emanates (Low Grade I)
5TH Sample- no change in the physic appearance.
(unfermented) Weak sickly sweet odour noticed (Super Grade 2).
6th Sample - no maggot, swelling but sickly sweat odour was present (High Grade 2)
(Unfermented)
7th Sample- the product was already spoilt, (fermented) although no maggot, black mould and whitish moulds were visible through the transparent nylon container. the floating liquid did not change in colour and appearance. It had strong offensive odour (Average Grade 2).
8TH Sample-spoilt, maggots seen moving on the product which has now turned nearly to liquid. (it was evident that this product got contamination by house flies) (Low Grade 2).

Table 1: Result of shelf-life determination of tilapia fish paste

	Super	High	Average	Low
Unfermented	Cooked salted freezer temperature (1) 1st circle	Cooked salted room temperature (2)	Cooked without salt freezer (3) temperature 2nd circle	Cooked without salt room (4) temperature
Fermented	Uncooked salted covered (5)	Uncooked salted opened (6)	Uncooked without salt covered (7)	Uncooked without salt opened (8)

Table 2: Proximate composition of tilapia fishmeal paste and cake

	%					
	Moisture	Crude protein	Fat	Crude fribre	Ash	N.F.E
Fishmeal	5.60	65.69	10.54	0.99	17.05	0.13
Fishcake	9.42	38.59	14.23	1.06	10.89	25.75
Fishpaste	34.08	52.13	0.89	1.66	10.42	0.82

Referring to

Table 2 the products that fell into the 1st circle were satisfactory, whereas the products that fell into the 2nd circle were unsatisfactory,

- Salting had significant effect on the quality of the products (Tilapia paste). the salted products preserved better whether cooked or uncooked, weather freezer temperature or at room temperature, whether covered or opened.
- In order to achieve the best keeping, quality for tilapia fish paste, salting should be accompanied by either cooking or freezing or both.

The result of the proximate composition of the three(3) Tilapia products showed fishmeal with the highest crude protein of 65.09% followed fish paste 52.13% and lastly fish cake 38.59%. The initial and final proximate composition was determined according to the methods of AOAC,[10].

DISCUSSION

The salted products of the Tilapia fish paste preserved better whether cooked or uncooked, whether at room temperature or freezer temperature, whether covered or opened as shown in the results of fish paste samples 1, 3, 5 and 6. However in order to achieve the best keeping quality for tilapia fish paste, *salting* should be accompanied with *cooking* and *freezing*; this is what proofed the 1st fish paste sample Table 1 tagged Supper Grade 1, as the best out of the 8 samples, set up, within the 7 day fish paste observation period. Also the samples of fishmeal and fish cake kept for 3 months in closed containers were still found to be organoleptically acceptable, without any form of deterioration whatsoever.

From the foregoing it could be argued that Tilapia fish meal contained a balanced protein/amino acid profile, because the production of the Tilapia fish meal in this study is from the whole fish which included the head, gut, scales, muscle, fins etc. unlike the conventional fish meal products in the market (like the 72% Danish fish meal) which is a product of many sources such as fish waste by catches, shell fish etc. FAO[9].

CONCLUSION

The manufacture of quality fishmeal and other nutritious products from whole Tilapia fish *Oreochromis niloticus* is a viable option to the use of conventional fishmeal.

The well processed fish cake and fish meal had better keeping qualities like any other livestock and fish feed products and could still maintain a high grade of quality even after 3 months of keeping in a safe dry place.

High quality or SUPER GRADE 1, quality of Tilapia paste could be produced by *salting cooking* and *freezing*.

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