

# STORAGE POTENTIAL AND UTILIZATION OF TILAPIA MINCE

A.A. EYO

*National Institute for Freshwater Fisheries Research (NIFFR)  
P.M.B. 6006, New Bussa, Nigeria.*

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## ABSTRACT

Production of mince from Tilapia using a combination of physical and chemical methods was found to improve the storage life of the mince in the deep freezer. Though the chemical composition of the mince was slightly affected, the mince was microbiologically stable throughout the five weeks frozen storage. Fish cakes prepared traditionally from tilapia minces were more acceptable than oven dried cakes. Production of fish cakes from tilapia will improve utilization of this species in areas where small size tilapia are regarded as fish of low economic value.

**KEY WORDS** - Frozen storage, deep freezer, Tilapia mince, fried fish cakes, oven dried fish cakes, acceptability

## INTRODUCTION

The ubiquitous tilapia (*Sarotherodon* sp, *Oreochromis* sp, and *Tilapia* sp) are important tropical freshwater fish because of their relative abundance. They are wide spread in tropical Africa contributing about 13 % of the ichthyomas in Kainji Lake (Ita, 1978), 57 % in Lake Volta, 35 % in Lake Kariba (Petr, 1967), and a considerable quantity in other man-made lakes and rivers. Tilapia have also gained popularity in tropical fish culture due to their high fecundity although they have a tendency to overpopulate the ponds. This behaviour has led to the production of small size Tilapia which mature when still small (Lowe, 1955) and may reduce yield and size of the fish at harvest (Hickling, 1960).

In Nigeria, stunted tilapia when harvested are often discarded because they fail to command a good market price; their small size is not easily accepted by consumers. With the shortfall in fish supply and the rising cost of other animal protein sources, such tilapia could supply the much needed protein if they are reintroduced into the human food chain. The production of mince from tilapia could be a valuable source of utilizing unacceptable tilapia for the production of a versatile protein rich product.

Fish mince is flesh separated in a comminuted form from the skin, bones, scales and fins of fish (Grantham, 1981). Production of mince from

underutilized and unused species is not only an efficient way of recovering flesh for direct use as human food, but also a wide range of by-products such as pet foods and livestock meal can be made from the bones as well as the scales, liver, swim bladder etc. (Allsop, 1974).

Considerable research into ways of utilizing the unused fish products have been extensively conducted by various workers (Young *et al*, 1979, Poulter and Trevino, 1983; Poulter and Poulter, 1984) although less work has been done on mince from Tropical and Sub-tropical species (Grantham, *op. cit*). However, spice minced fish have been produced in Malaysia from Tilapia (Zain, 1980) and locally from by-catch (Akande, 1991). Thus, increased utilization of tilapia could be achieved if a variety of products acceptable to the local consumers are made from these species. This paper describes the production of fish cakes of acceptable quality from tilapia mince.

## MATERIALS AND METHODS

- (a) **Raw materials:** Tilapia (*Oreochromis niloticus*) purchased fresh from fishermen and stored in a deep freezer for approximately 24 hours before use.
- (b) **Preparation of fish:** The frozen fish were allowed to thaw in air at room temperature, scaled, headed, gutted and washed thoroughly

in tap water before they were cut into small pieces of about 1 cm.

- (c) **Deboning:** Mince was separated from the bones by a combined chemical and physical methods as reported by Gelman, Benjamin and Herzberg (1985).
- (d) **Dewatering:** The minced fish was filtered thorough approximately 1 mm mesh cloth. Sufficient pressure was applied to squeeze out excess water until solid fragments started passing through the cloth. The mince was weighed.
- (e) **Storage:** The minced fish prepared at weekly intervals was stored in a deep freezer operating at a temperature not below - 8°C for a maximum of five weeks during which time chemical analysis and bacterial counts were carried out at weekly intervals.

#### Analytical Methods

Chemical composition:- All samples were determined in triplicates. Crude protein, lipid, moisture and mineral contents were determined according to the AOAC (1990) methods of chemical analysis. Free fatty acid was determined according to Pearson (1976). pH was determined using pH meter. The Total Volatile Nitrogen (TVN) was determined according to the method of Lucke and Geidel (1935).

#### Total Viable Count (TVC)

The standard pour plate method was used for the TVC. The nutrient agar and relevant glass wares were autoclaved at 121 °C for 15 minutes. 1 gm sample was homogenised for 2 minutes in 50 cm<sup>3</sup> distilled water. Serial dilution of the homogenate was carried out and 1 cm<sup>3</sup> of diluent was poured on the sterilized petri dishes. Nutrient agar was poured on the diluent in the petri dishes and after thorough mixing, the petri dishes were incubated at 35°C for 48 hours and the organisms counted in colonies using colony counter.

#### Preparation of fish Cakes

The minces of different storage periods were mixed with potato mash in the ratio of 1:1. Onions and spices were added to improve the product flavour. Rectangular cakes of approximately 50 gm weight were formed from the mixture using tin moulds.

The cakes were separated into two groups 'A' and 'B' made of cakes of storage period of one to five weeks. Cakes in group 'A' were fried in hot vegetable oil, while those in group 'B' were oven dried.

#### Organoleptic Assessment

A total of 10 assessors were randomly drawn from the staff of the Institute for the organoleptic assessment. A questionnaire for the assessors was modified from that earlier used (Eyo, 1985) A ten point hedonic scale was used. 1 - 3 points cakes not accepted, 4-5 points fairly acceptable, 6-8 points acceptable and 9-10 points excellent.

#### Statistical Analysis

The correlation coefficient was employed for the statistical evaluation of taste panel scores for acceptability of fish cakes.

## RESULTS AND DISCUSSION

#### Chemical Composition

Table 1 shows the chemical composition and total viable count of stored minced Tilapia. The crude protein level of the mince was 14.93% and this was lower than that of the fresh sample, 18.10%. Poulter and Trevino (1982) had similarly observed lower total crude protein values in minces prepared with acetic acid compared with manually prepared mince. There was also minimal changes in the crude protein content from 14.93 - 14.27% during the five weeks frozen storage of the mince. Similarly, Joseph and Perigreen (1983) reported slight changes in the crude protein level of frozen stored minced fish from threadfin bream.

The lipid content of the mince was quite low 0.40% which was attributed to the use of acetic acid for the preparation of the mince which has been found to degrade fat containing tissues (Grantham *op. cit*), while subsequent washing of the mince was found to remove a considerable amount of fat (Sidewell, 1980). The decrease in the lipid content during frozen storage was followed by an increase in the Free Fatty Acid which determines the extent of lipolysis (Figure 1). Since fat degradation has been identified as a major problem in minces from both fatty and low fat species (Grantham, 1981) and the Free Fatty Acid calculated as Oleic acid were less than 0.5% (a

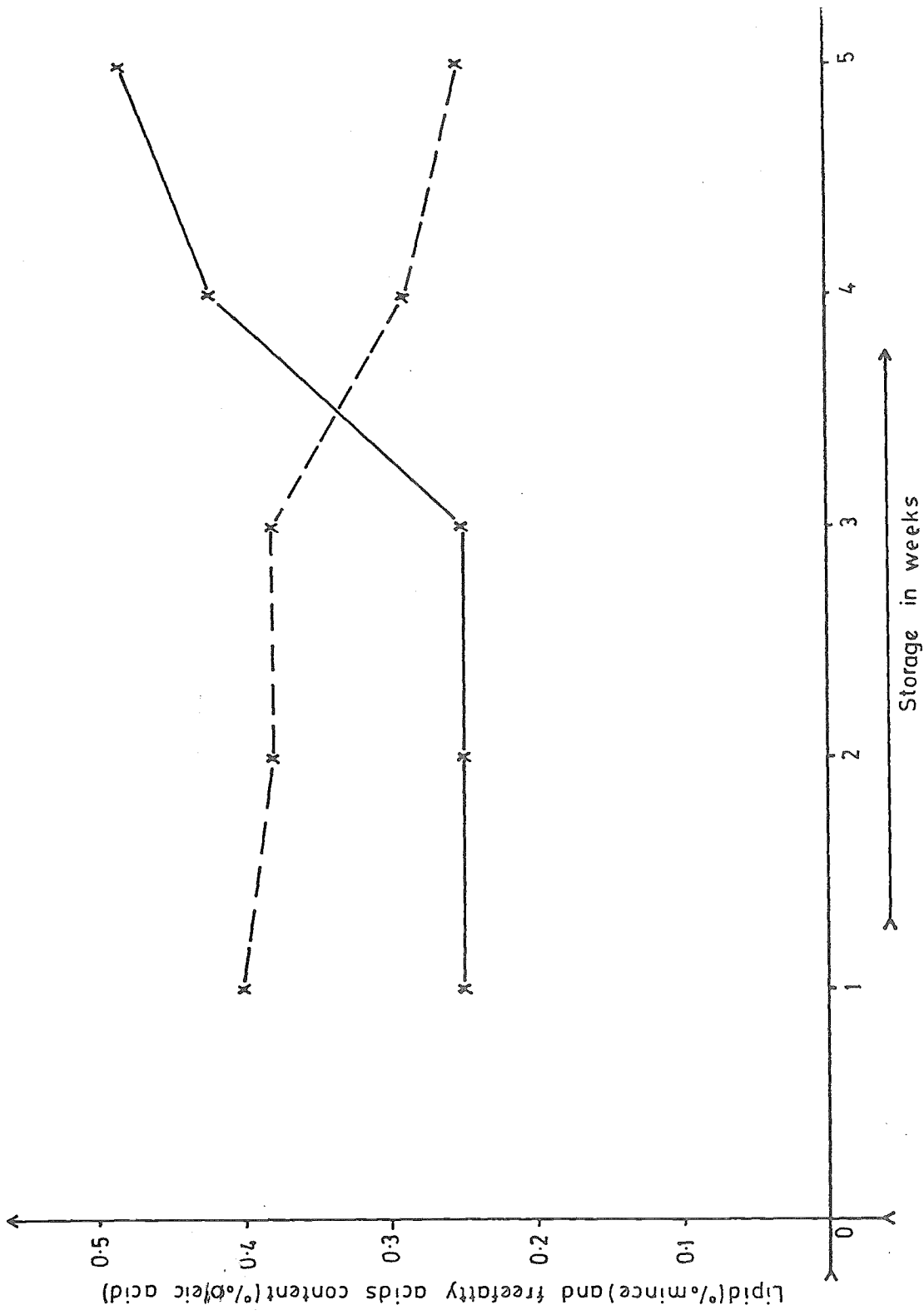


Figure 1: Change in Lipid (-----) and Free Fatty Acid (————) of Tilapia mince During Storage in the Deep Freezer.

Table 1 - Chemical composition and total viable count of tilapia mince

Sample	Storage period (weeks)				
	1	2	3	4	5
Crude protein (% mince)	14.93	14.56	14.56	14.37	14.27
Lipid content (% mince)	0.89	0.68	0.85	0.85	0.83
Moisture (% mince)	68.10	68.12	67.20	67.40	67.60
Mineral content (% mince)	7.12	7.14	6.88	7.60	7.21
Calcium (% mince)	1.32	1.48	1.32	1.50	1.48
Pottasium (%)	0.32	0.40	0.33	0.24	0.33
Iron (ppm mince)	<b>1.06</b>	<b>1.30</b>	<b>1.28</b>	<b>1.36</b>	<b>1.38</b>
Sodium (% mince)	<b>0.33</b>	<b>0.35</b>	<b>0.28</b>	<b>0.41</b>	<b>0.44</b>
pH	6.50	6.70	6.75	6.80	6.80
Total viable counter (TVC) organisms/g.	58	58	70	80	98

**TABLE 2 - TOTAL SCORE OF ORGANOLEPTIC ASSESSMENT FOR THE FRIED CAKES (A) AND OVEN-DRIED CAKES (B)**

Column 'X': Total score per parameter for all the assessors

Column 'Y': Total scores for each assessor for the three parameters tested.

Parameters (A)	Assessors										Total	Mean total
	1	2	3	4	5	6	7	8	9	10		
Colour	9.2	8.4	7.0	7.4	7.8	8.8	7.6	8.2	8.2	7.6	80.2	8.22
Texture	8.2	8.4	7.6	7.6	7.8	6.6	5.4	5.0	7.0	7.0	70.6	7.06
Taste	8.4	7.8	7.0	5.8	8.0	7.6	7.6	5.6	6.8	7.2	71.8	7.18
Y	25.8	24.6	21.6	20.8	23.6	23.0	20.6	18.8	22.0	21.8	214.6	22.36
(B)	X											
Colour	9.0	6.4	8.0	8.6	8.4	7.0	8.0	5.2	7.0	8.8	74.4	7.44
Texture	7.0	6.6	5.6	8.2	8.0	6.0	6.4	8.2	6.8	5.0	67.8	6.78
Taste	4.8	6.6	6.2	4.6	6.4	6.4	7.2	4.4	6.6	4.8	58.0	5.80
Y	20.8	19.8	19.8	21.4	22.8	19.4	21.6	17.8	20.4	18.6	202.2	20.22

minimum level by which the acidic flavour becomes noticeable (Pearson, 1976), it is probable that the mince was stable from excessive fat decomposition during the five weeks frozen storage. The use of antioxidants for fat stabilization of tilapia mince stored for five weeks in the deep freezer was considered unnecessary. There were slight variations in the moisture and mineral contents of the mince during storage though, these were insignificant. Considerable variations among minerals during storage was noticeable which could have been caused by leaching of the minerals during the dewatering and washing stages. The pH was near uniform throughout the storage of the mince.

#### **Total Volatile Nitrogen (TVN)**

TVN is related to protein breakdown and is widely used as an index of fish spoilage (Chakrabarti, 1984). The gradual increase in the TVN content of the mince was accompanied by a decrease in its crude protein content (Figure 2). The TVN content of 17.5 mg N/100 g mince after five weeks frozen storage was less than the 20 mg N/100 g limit for freshness of white fish using the Lucke and Geidel method (Pearson, 1976). Therefore, the mince was free from deterioration during the period of frozen storage. This observation was further supported by results of organoleptic assessment of cakes prepared from the mince (Table 2).

#### **Microbial Content**

Low microbial count was noticeable during the period of frozen storage. The count ranged from 55 to 98 organisms/g during the five weeks storage and was less than that obtained by Young and Romero (1979) using a Paoli model 19 automatic meat bone separator (180 organisms/g). The use of acetic acid and the low pH during the preparation of the mince produced an unfavourable condition for microbial growth. Subsequent low moisture level in the mince and the inhibitory effect of low temperature storage may have produced adverse conditions for microbial build up in the mince.

#### **Yield**

The minced Tilapia was dewatered to a final weight of 30-35% of the wet weight of the fish. Young *et al* (1979) reported yield of 35-40% for shrimp by catch, while Gelman *et al* (1985) obtained a yield of 42-45% of the weight of whole

small pelagic fish from Israel. The yield of mince is affected by such factors as types and sizes of fish and method of mince production.

### **ORGANOLEPTIC ASSESSMENT OF FISH CAKES**

Table 2 shows the result obtained from the assessors using ten points on the hedonic scale. All the ten assessors, found all the products to be acceptable for all the parameters tested.

#### **Colour**

There was a significant difference ( $P < 0.01$ ) when the oven dried and fried cakes were compared with the assessors showing preference for the colour of the fried cakes. This was attributed to the brownish discolouration of the fish cakes which was more attractive than the pale white appearance of the oven dried cakes. On testing the colour against storage period, no significant difference was observed ( $P > 0.01$ ) indicating that prolonged storage of the mince in the deep freezer had no effect on the appearance of the cakes.

#### **Texture**

The assessors did not observe any significant difference in the texture of the fried and oven dried cakes ( $P > 0.01$ ) nor in the cakes prepared from minces after frozen storage.

#### **Taste**

A large preference which was statistically significant ( $P < 0.01$ ) was given to the taste of the fried cakes. When the taste of the cakes prepared from one to five weeks old samples were compared, assessors noticed changes in the taste of these cakes. Preference was given to cakes prepared from minces that were of less than 4 weeks frozen storage. There was however, no rejection of other cakes. Thus, prolonged storage of mince in the deep freezer affected the taste of the cakes which was noticeable by the assessors.

### **CONCLUSION**

Production of traditionally acceptable fish cakes on a commercial scale from small size tilapia will go a long way in improving revenue of the fish farmer in places where small size tilapia are regarded as fish of low economic value.

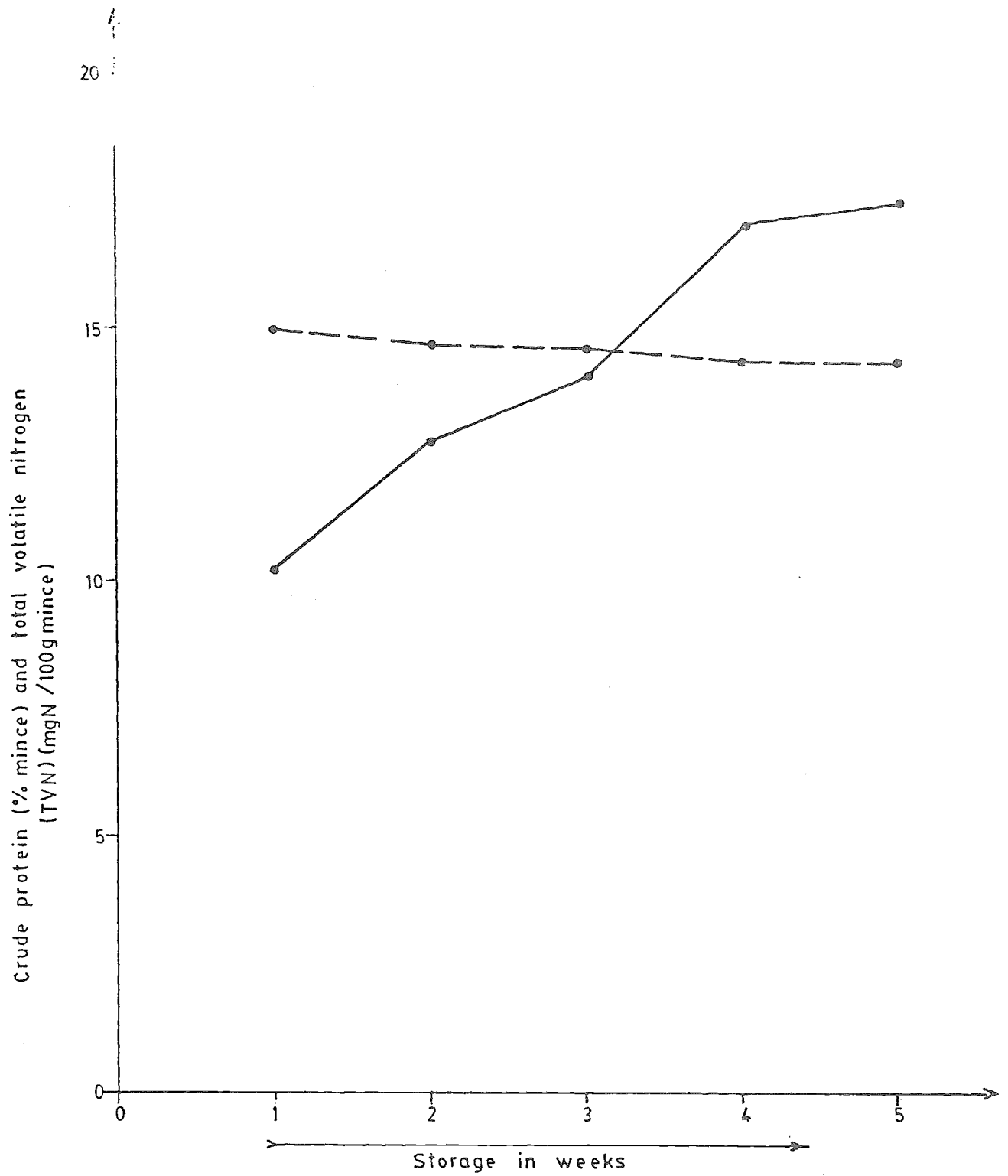
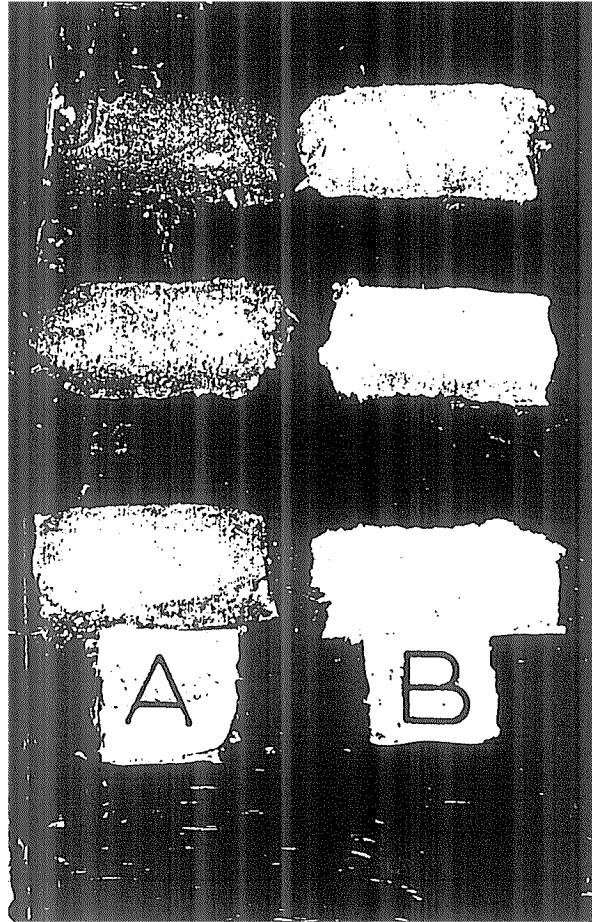


Figure 2: Changes in Crude Protein ( ---- ) and Total Volatile Nitrogen ( — ) of Tilapia mince During Storage in the Deep Freezer.



**Plate 1: Samples of fish cakes prepared from Tilapia mince, Sample A: fried in oil; Sample B: Oven dried.**



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