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A Preliminary Study on the Keeping Quality of Locally Produced Marine and Freshwater Salted Dried Fish

By

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Introduction

Dried fish is consumed by a large majority of Sri Lankans. But the major part of the dried fish produced in this country is from marine fish and does not meet the demand, and is therefore largely supplemented by imported dried fish. The government policy has been to save foreign exchange by fully utilizing the country's natural resources and it is claimed that the increased consumption of freshwater fish found in Sri Lanka is one of the targets immediately to be achieved. Therefore one of the easiest ways of popularizing freshwater fish consumption in a country, where most people are accustomed to eating of marine fish, is to present it in the salted dried form. Hence the storage shelf life of salted dried fish becomes one of the important factors influencing the full utilization of freshwater fish. Hence experiments on the storage shelf life of locally produced salted dried fish from freshwater and marine species were carried out and results compared.

Materials and Methods

Fish Samples

The samples of marine and freshwater salted dried fish listed in Table 1 were purchased at Talaimannar and Polonnaruwa respectively.

The Leatherskin (*Chorinemus lysan*) had been dry salted and the Gizzard shad (*Goniolosa manminna*) wet salted. The samples were about 4 days old when purchased. They were packed in DAC paper sacks (3 ply paper sack with an inner polyethylene lining) and transported to Colombo.

The dried freshwater Butterfish (*Ompok bimaculatus*) and Common Labeo (*Labeo dussumieri*) has been wet salted. The latter had been beheaded and skinned before salting and drying while the former had been dry salted whole. Both species of fish were about 7 days old when purchased and were enclosed in polythene bags and transported to Colombo.

Storage

The four species of fish were kept uncovered in plastic boxes and stored in a room at temperatures of 24°C–36°C and relative humidity of 65%–86% for the experimental period.

Sensory inspection of quality

The texture and moisture content were assessed by touch and the extent of bacterial pinking and mould attack were recorded on visual inspection. The degree of insect infestation was assessed. The odour of the samples was also noted.

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Discarding of Fish

The marine fish were discarded when quite inedible and the experiment concluded. But the freshwater fish were discarded quite prematurely (44 days after start of experiment due to authors attending the FAO/DANIDA Workshop on Fish Technology and Inspection held at the Institute from 16th October to 25th November, 1978). Yet some very helpful conclusions were drawn.

Salt Content

The salt content was determined as chloride where the ions are precipitated by silver nitrate and the excess silver ions are determined by titration with potassium thiocyanate. (Pearsons, 1970). All analyses were performed in duplicate.

Moisture Content

Duplicate samples (2g.) were dried in a convection oven at 105°C for 24 hrs. The weight loss was noted as due to removal of water.

Bacteriological Analysis

Dried fish (10g.) were chopped aseptically into small pieces and weighed into sterile blender jars (MSE homogeniser) and, after the addition of 90 ml. sterile saline water (9g. sodium chloride and 1g. peptone per 1 litre), the contents were homogenised for 2 minutes. Sampling was carried out either in triplicate or in duplicate for each species.

Total Counts

Total counts were made according to standard procedure of serial decimal dilution where diluted aliquots (1ml.) were mixed with molten Plate Count Agar (Difco). The plates were incubated at 30° C/72 h.

Results

Table 1 gives a chart of the species of fish used in experiment and Table 2 a quality comparison of the four species of salted-dried fish, two from freshwater and two from marine water, during storage. The salt content of fish is given in Table 3 while the maximum moisture content to inhibit halophilic bacterial growth in fish is tabulated in Table 4. Tables 5–8 give quality changes of fish during storage. The change in bacterial count and moisture content is given in graphic form in Figures 1 and 2 and the change in NaCl molality in dried fish is given in Figure 3.

In spite of the short duration of the experiment it was found that the storage shelf life of salted dried freshwater fish (Labeo and Butter cat fish) is much longer than that of salted dried marine fish (Leatherskin and Gizzard shad). The storage life of the marine fish is 51 days.

DISCUSSION

Pink bacterial growth could not be observed in the product from freshwater fish after 44 days of storage, in contrast to the marine fish which showed red bacterial growth within this storage period (Tables 2 and 5). This is probably due to the fact that freshwater fish are less likely to be contaminated with halophilic or salt-loving bacteria than marine fish. It may also be due to the salt used inland being possibly less contaminated with halophilic bacteria. It has been said that storage of salt in a dry atmosphere decreases the halophilic bacterial count though not to complete elimination. It has also

been claimed that storage of salt for 12 to 18 months would completely destroy the red bacteria (Subba Rao, 1969). Therefore a probable explanation is that the salt produced in salterns of coastal areas would take a longer time to reach inland freshwater fishing regions while the coastal areas would use this salt while still fresh.

White fungal attack was noticed in marine fish (Leather skin and Gizzard shad) after 44 days of storage while none was observed in the freshwater fish.

The water intake of dried marine fish was much higher than that of fresh water fish (Table 6). This was probably caused by the excessive application of salt on locally produced salted/dried products from marine fish. Another possible explanation is that the salt used in the coastal area, especially Mannar, in the salting of marine fish has higher calcium, magnesium and sulphate content to that used inland. These magnesium and calcium compounds are hygroscopic. Therefore common salt (sodium chloride) with these contaminants are termed inferior and not suitable in the processing of salted dried fish, as they cause an excessive uptake of moisture in the processed products.

Figure 3 presents changes in molality of sodium chloride during storage. The high molality of Butterfish in comparison to other fish may be due to the high fat content of the fish. Also halophilic bacteria is considered to grow in conditions where sodium chloride molality is below 9 (Waterman, 1976). Therefore to prevent halophilic bateria and also mould growth the sodium chloride molality of Labeo, Gizzard shad and Leatherskin should be increased either by minimizing the moisture content or by increasing the salt content. In the case of the marine species it is probably more economical to make an effort to reduce moisture content rather than to increase the salt content, as their salt content is already higher than the limit stipulated in the proposed Ceylon Standard, i.e. maximum 30%. However, for Labeo it may be probably better to increase the salt content so as to increase the molality of sodium chloride.

Conclusion

The storage life of salted dried fish from the two freshwater species is much longer than that from the two marine species (51 days).

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TABLE 1

SPECIES OF FISH USED IN EXPERIMENT

Scientific Name	*Common Name* — *English*	*Common Name* — *Sinhalese*	*Habitat*
Goniolosa manminna	Gizzard shad	Katu Goiya	Marine
Chorinemus lysan	Leatherskin	Kattava	Marine
Ompok bimaculatus	Butter cat fish	Valapotha	Freshwater
Labeo dussumieri	Common Labeo	Hirikanaya	Freshwater

TABLE 2

QUALITY COMPARISON OF SALTED DRIED FRESHWATER AND MARINE FISH DURING STORAGE

Quality Assessment		15 *Days of Storage*				44 *Days of Storage*			
Species		*Moisture* (%)	*TPC* (*log*)	*White fungus*	*Pink bacteria*	*Moisture* (%)	*TPC* (*log*)	*White fungus*	*Red bacteria*
Marine Fish	Leatherskin	45.8	—	Absent	Absent	54.3	4.7	Present	Absent
Marine Fish	Gizzard shad	45.7	—	Absent	Absent	44.5	5.5	Present	Present
Freshwater Fish	Butterfish	27.4	6.0	Absent	Absent	21.8	5.0	Absent	Absent
Freshwater Fish	Labeo	38.8	6.1	Absent	Absent	38.3	5.0	Absent	Absent

TPC — Total Plate (Bacterial) Count.

N.B.—The presence or absence of white fungus and red bacteria is based on visual observation.

TABLE 3

SALT CONTENT AND INITIAL MOISTURE CONTENTS OF FISH

Species	*Salt Content* (*dry basis* %)	*Moisture Content* (%)
Marine fish		
Gizzard shad	33.3	48.9
Leatherskin	39.9	43.2
Freshwater fish		
Butter fish	23.8	31.9
Labeo	25.1	40.8

TABLE 4

MOISTURE LIMIT (MAXIMUM) THAT WOULD INHIBIT BACTERIAL GROWTH

Species	*Salt Content (%)*		*Maximum Moisture Content (%)*
	Dry Basis	*Wet Basis*	
Gizzard Shad ..	33.3 ..	17.0 ..	32.3
Leatherskin	39.9 ..	22.7 ..	43.1
Butterfish	23.8 ..	16.2 ..	30.8
Labeo	25.1 ..	14.9 ..	28.3

N.B.—Base of calculation :

$$\text{Moisture content} = \frac{\text{SW} \times 1{,}000}{\text{Molality} \times 58.5}$$

(SW = Salt content wet basis)

TABLE 5

QUALITY CHANGES DURING STORAGE OF SALTED/DRIED G. SHAD

Storage Period (days)	*Total Plate (No./gr.)*	*Moisture content (%)*	*Appearance*
9 ..	— ..	48.9 ..	—
19 ..	— ..	43.2 ..	—
26 ..	— ..	44.3 ..	—
34 ..	4.1×10^8 ..	40.4 ..	Tissue moist and soft. No fungal, bacterial or insect attack.
40 ..	— ..	45.2 ..	White fungal attack and slight pink bact eria on some fish.
51 ..	1.6×10^6 ..	44.3 ..	Tissue soft and moist. 50% pink bacteria and 30% white fungal attack. Fish discarded.

TABLE 6

QUALITY CHANGES DURING STORAGE OF SALTED/DRIED L. SKIN

Storage Period (days)	*Total Plate Count (No./gr.)*	*Moisture Content (%)*	*Appearance*
9 ..	— ..	43.2 ..	—
19 ..	— ..	47.7 ..	—
26 ..	— ..	51.2 ..	—
34 ..	7.9×10^3 ..	52.0 ..	Tissue very soft and moist. No fungal, bacterial or insect attack.
40 ..	— ..	54.3 ..	Slight white fungal attack mainly near head region.
51 ..	2.0×10^5 ..	54.4 ..	Tissue soft, mealy, off-odour. 100% fungal attack. Fish discarded.

TABLE 7

QUALITY CHANGES DURING STORAGE OF SALTED/DRIED BUTTER FISH

Storage Period (days)	*Total Plate Count (No./gr.)*	*Moisture Content (%)*	*Appearance*
9	—	31.9	—
15	1.1×10^6	27.4	—
23	4.5×10^4	43.4	Tissue moist. Certain parts more moist than others. No fungal, bacterial or insect attack.
30	3.3×10^6	28.6	Tissue hard in some parts and softer in others. Moisture oozing on tissue surface.
37	9.9×10^6	32.9	Tissue moist. Moisture, oozing and slimy on surface. No fungal, bacterial or insect attack.
44	1.0×10^5	21.8	Tissue moist, soft and oily. No fungal, bacterial or insect attack.
			Fish still in good condition.

TABLE 8

QUALITY CHANGES DURING STORAGE OF SALTED/DRIED LABEO

Storage Period (days)	*Total Plate Count (No./gr.)*	*Moisture Content (%)*	*Appearance*
9	—	40.8	—
15	1.6×10^6	38.8	—
23	6.5×10^4	34.7	Tissue hard of good quality. No fungal, bacterial or insect attack.
30	1.8×10^5	40.8	Tissue hard in very good condition.
37	5.0×10^6	39.2	Tissue hard. Moisture oozing slightly from surface. No fungal, bacterial or insect attack.
44	1.0×10^5	38.3	Tissue hard. Slightly moist and sticky on surface. No. fungal, bacterial or insect attack.
			Fish still in good condition

Fig. I. CHANGE IN MOISTURE CONTENT DURING STORAGE

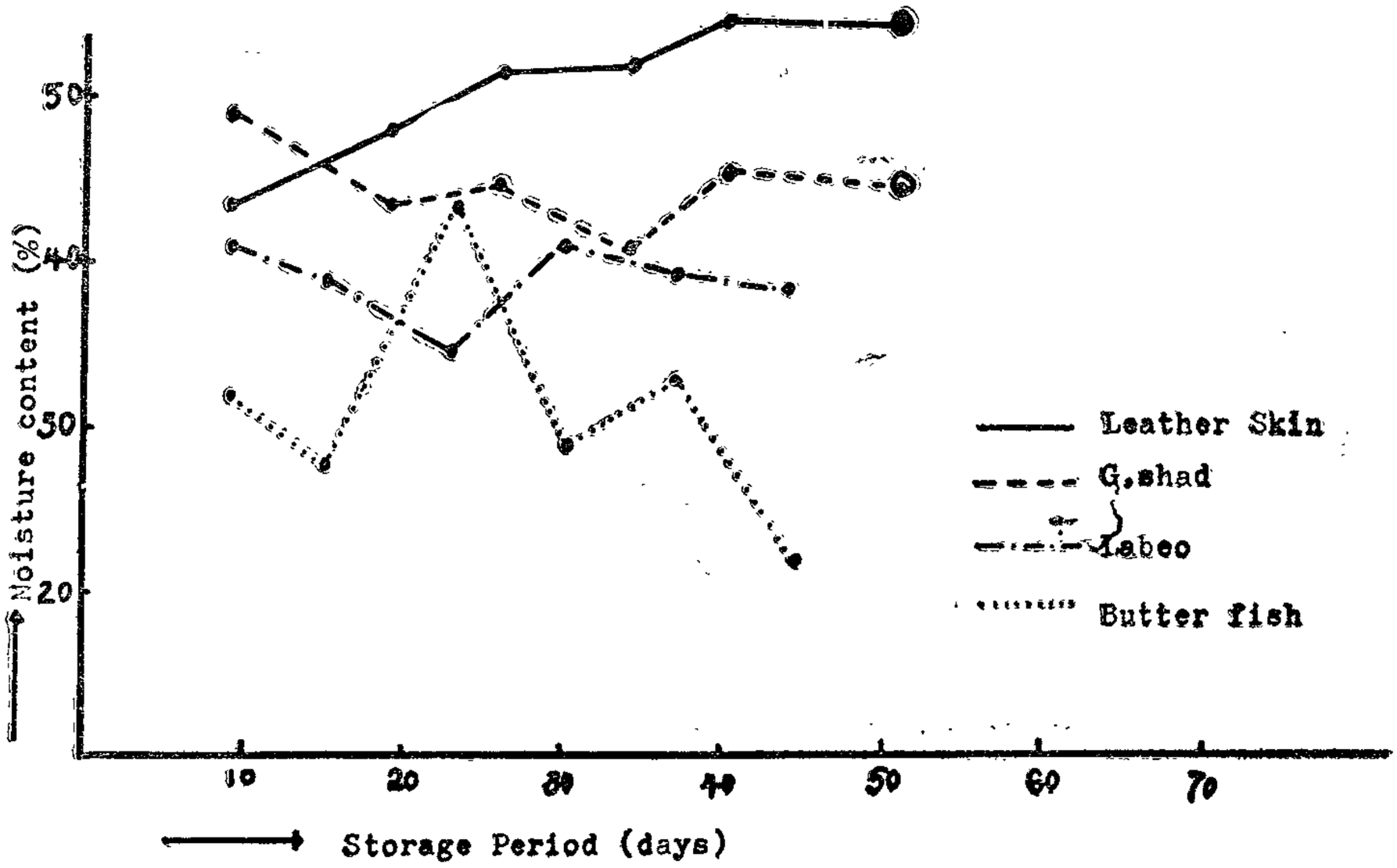
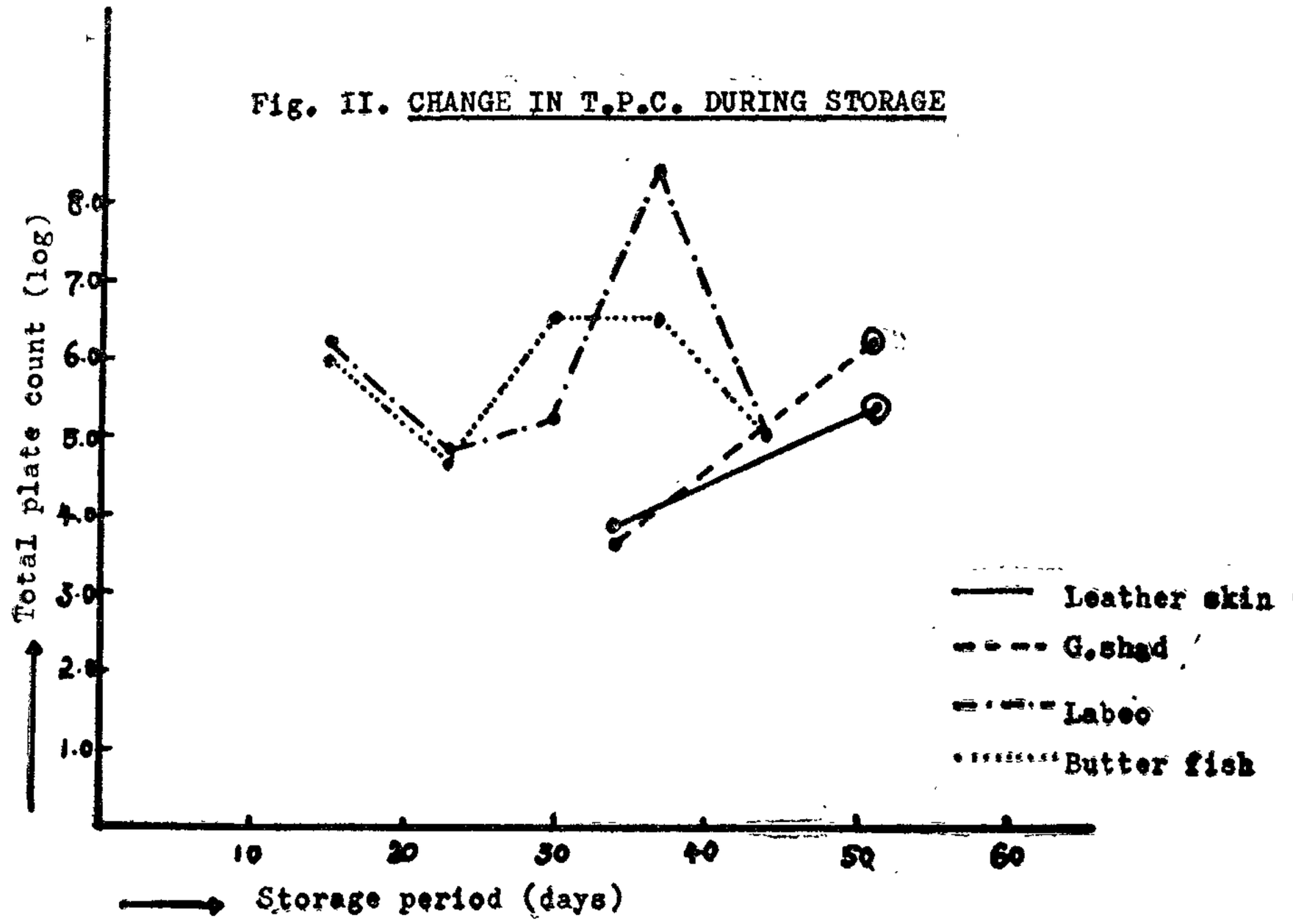


Fig. II. CHANGE IN T.P.C. DURING STORAGE



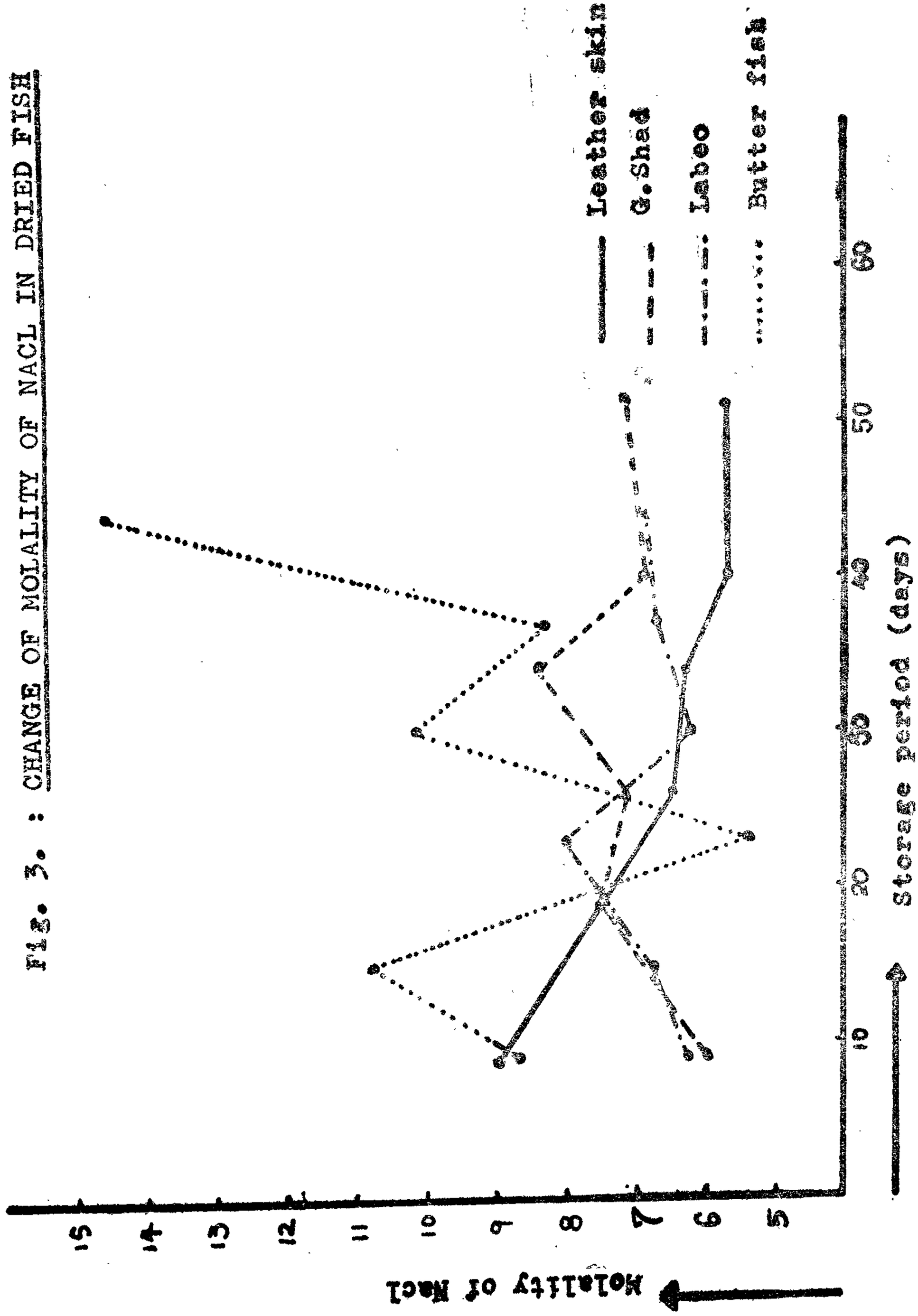


Fig. 3. : CHANGE OF MOLALITY OF NACL IN DRIED FISH

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