Fish. Technol. (1978) 15, 125–128

Utilization of Trash Fish for Human Consumption: III Studies on the Development of Fish Pickle from *Nemipterus japonicus*

T. C. CHANDRASHEKAR, T. M. RUDRASETTY, P. T. LAKSHMAN REDDY and C. ASWATHNARAYANA

University of Agricultural Sciences, College of Fisheries, Mangalore-575 001

A method for the preparation of fish pickles from a lean variety of fish namely pink perch *(Nemipterus japonicus)* is described. Dipping the fish in 10% sodium chloride solution containing 6% acetic acid before pickling, was found desirable for retaining the meaty texture of the product. The product has no fish smell or flavour and has a shelf life of more than six months at ambient temperatures and scored very well in organoleptic tests.

Pickling is a traditional method of preservation of fish in India. A variety of fish pickles with vinegar and spices are produced and marketed in Germany, North European countries, China, Japan, Philippines and several other countries (Borgstrom & Paris, 1965; Stansby, 1963; Tanikawa, 1971). In India a few spiced and pickled products like "padda" and "mollei" from seer and "Colombo cured pickle" from oil sardines and mackerels are prepared on a domestic scale. A considerable quantity of Colombo cured fish used to be exported to Ceylon (Nicholson, 1930). Although some work has been done in India on the preparation and preservation of pickles from fatty fishes like sardine and mackerels (Rao & Nair, 1950; Vasavan & Verma, 1959; Rao & Valsan, 1962; Balachandran & Muraleedharan, 1975; Devadasan *et al.,* 1975), feasibility of preparing spiced pickles from lean varieties of fish suited to our tastes seems to have not been reported. The present paper reports the preparation of a spiced pickle from a lean variety of fish.

Materials and Methods

Pink perch *(Nemipterus japonicus)* a non-fatty, low-priced fish available in large quantities on the west coast of Karnataka was used for pickling. Other raw materials like vinegar, spices and salt of good quality were purchased from the local market. The fish was dressed, washed in running water, filleted and cut into sizes suitable for pickling. The pieces were then dipped in 10% brine containing 6% acetic acid for one minute and were taken out and drained. The required quantities of spices and other ingredients except chilly powder, turmeric, pepper, vinegar, salt and preservatives (Table 1) were mixed and fried in refined oil at 180°C for 2 to 3 minutes. The chilly powder, turmeric and pepper powders were added at this stage, followed by vinegar, pre-treated fish and salt, taken out from the flame and mixed thoroughly. After cooling for 5-10 minutes, sodium benzoate and ascorbic acid were added, mixed and packed in sterilized glass bottles, closed with screw type plastic caps and stored at room temperature.

Moisture, titratable acidity and sodium chloride were estimated according to A.O.A.C. methods (1950). Alpha amino nitrogen was estimated by the method of Pope & Stevens (1939). Total volatile nitrogen (TVN) and trimethylamine (TMA) were estimated on a trichloroacetic acid extract by the micro-diffusion method of Beatty & Gibbons (1936). Free fatty acids were determined by the method of Dyer & Morton (1956). pH was measured using an Elico pH meter.

Microbiological examinations for total plate counts of *E. coli,* faecal streptococci, coagulase positive staphylococci and aerobic and anaerobic spore formers were carried out using the standard media recommended by American Public Health Association (1966).

Organoleptic evaluation was carried out by a taste panel consiting of 20 experienced members. Pickle was served to the members of the panel after two weeks of maturation and were asked to record their observations for colour, texture, flavour and taste in a proforma. The grades given for each of the above characteristics were excellent, good, acceptable and not acceptable. These studies were made use of for standardisation and final acceptance of the product.

Results

The preliminary experiments to determine the acetic acid level to be used for getting the desired texture and pH showed that the lower the levels of acid used along with 10% salt, the longer will be the time required to get the desired texture and pH. While 1% acetic acid and 10% salt took 8 h to impart the desired texture and pH, 6% acetic acid and 10% salt took only 1 minute. When the acetic acid level was kept constant at 6% and the percentage of salt was varied from 1 to 12, the samples which had 6% acid and 9 to 11% salt were better than those receiving lower and higher levels of salt, the meat getting harder in texture and more salty with higher salt levels and *vice versa* with lower levels. So, the optimum levels of acid and salt mixture for the pre-treatment of fish were found to be 6% and 10% respectively, which composition was used in the subsequent experimental studies.

A number of trials with different combinations of spices were tried and the products after maturation were presented to the panel. A suitable combination of spice mixture which scored well with most of the panel members is shown in Table 1.

The proximate composition of *Nemipterus japonicus* used for the experiment is given in Table 2. The results of chemical analyses of the product, carried out over a period of six months of storage are shown in Table 3. During the period of storage the moisture content decreased by 7% and the pH after initial use for the first 30 days dropped from 5.1 to 4.9. Free fatty acids content which was originally at 0.3% steadily increased during storage. Titratable acidity also rose from 0.17 to 0.82% in 120 days and decreased thereafter. Sodium chloride increased from 4.7 to 19.9% (DWB) in two weeks and further to 31.24% by 150 days of storage. Alpha amino nitrogen, which was very low initially, increased consistantly over the period of storage, showing sudden increases after 15 and 120 days of storage. While the increase of total volatile nitrogen (TVN) was steady over the period of storage, the trimethylamine nitrogen content (TMAN) showed a spurt after 90 days increasing from 3.92 to 7.0 mg/100g.

Table 1. *Standard recipe used in the preparation of fish pickle*

Ingredients	Percentage
Fish (treated)	53.33
Salt	10.00
Chilly powder	6.66
Turmeric powder	0.20
Mustard powder	0.50
Garlic (fresh)	4.33
Asafoetida	0.13
Green chilly (fresh)	2.50
Ginger (fresh)	1.50
Pepper powder	0.66
Menthya (powder)	0.16
Ground nut oil	8.16
Lemon pieces (fresh)	5.20
Vinegar (white, distilled)	6.00
Sodium benzoate	0.05
Ascorbic acid	0.30

The samples examined after processing and during storage showed no presence of *E. coli,* faecal streptococci and coagulase positive staphylococci. However aerobic spore formers were encountered in all the samples. Molds were observed only towards the end of the storage period (after 180 days), which was probably due to external contamination taking place during sampling from the bottles. Other bottles which were not opened for sampling remained well even after six months of storage. The total counts were in the range of 3000-4000/g after six days of processing and 2–3 million at 180 days of storage. However, anaerobic spore formers were found to be absent.

The results of organoleptic evaluation of the standardised product are shown in Table 4. While the product scored very well till 150 days of storage, it fell thereafter due

Table 2. *Proximate composition of Nemipterus japonicus*

Moisture %	Protein %	Fat %	Ash %
75.19	17.92	2.64	4.23

Table 3. *Storage characteristics of fish pickle*

Frequency of test days	pH	Free fatty acid (as oleic acid) %	Titratable acidity (as acetic acid) %	Moisture %	Nacl (DWB) %	∝-amino nitrogen mg/100g	TMAN mg/100g	TVN mg/100g
Initial	5.1	0.30	0.17	57.00	4.74	19.82	2.38	9.80
15	5.5	1.51	0.60	56.50	19.96	20.06	3.64	10.64
30	5.4	4.00	0.66	53.00	24.25	128.33	3.47	16.52
60	5.0	4.30	0.52	50.00	20.12	137.60	3.92	20.72
90	5.4	4.62	0.72	52.21	23.12	140.00	3.92	21.00
120	4.9	5.21	0.82	53.41	28.37	147.85	7.00	27.44
150	4.8	5.39	0.61	50.00	31.24	269.27	6.72	25.70
180	4.9	5.30	0.61	51.66	31.05	246.20	...	32.20

to loss of flavour, texture and taste and by 190 days, it became unacceptable due to the appearance of mold growth.

Discussion

While attempting to prepare a traditional type of spiced fish pickle, the advantages of other methods like the use of acetic acid and vinegar for preservation and flavouring, have also been made use of in the present method. The addition of acetic acid or vinegar, has the additional advantage of removing the fish smell in the product, apart from acting as a preservative. In the traditional type of pickles prepared from fresh lemon and mangoes, the main preservatives are the salt and organic acids provided by the fruits. Since the fish do not contribute any such acids, it becomes essential to use some organic acid to provide the necessary texture and flavour to the product, in addition to bringing down the pH to the required level. While citric acid can be used for this purpose, it was thought better to use acetic acid (vinegar) instead, as it can also check the fishy odour in the product. However, a small percentage of fresh lemon pieces were also included in the recipe, as it can improve the flavour of the pickle in a better way than by acetic acid. While the traditional pickle needed a minimum of 18 to 20% salt for good preservation, the same had been cut down in the present process to around 12% due to the addition of ascorbic acid, vinegar and sodium benzoate.

The use of trimethylamine nitrogen (TMAN) and total volatile nitrogen (TVN) values, as criteria for judging the spoilage of fish pickle has been considered to be of no practical significance as recorded by the previous researchers (Nicholson, 1930). Our observations also show that TMAN values do not correlate with the organoleptic evaluation. However, the TVN values appear to be well around the acceptable limits set for fish products (30 mg/100g)

The fairly high values recorded in respect of alpha amino nitrogen, are understandable, since the effect of salt and acid on the albumins and globulins of fish proteins are well

Table 4. *Organoleptic evaluation of fish pickle*

Duration of storage days	Colour	Texture	Flavour	Taste	Remarks
15	Excellent	Good	Excellent	Good	Nil
30	Excellent	Good	Excellent	Good	Nil
60	Excellent	Good	Excellent	Good	Nil
90	Good	Good	Good	Good	Nil
120	Good	Slightly soft	Good	Good	Acceptable
150	Good	Soft	Good	Good	Acceptable
180	Acceptable	Disintegration of meat	Acceptable	Acceptable	Slight loss of flavour and taste but acceptable
190	Acceptable	Disintegration of meat	Not acceptable	Not acceptable	Spoiled

documented (Zaitsev *et al.*, 1969). In the absence of reports and standards on the free fatty acid content of pickles prepared from fish, it is difficult to say whether 5.2% FFA obtained for this product is high or low. However, the fact that the product was acceptable to the panel even at 180 days of storage (FFA 5.3) and no rancidity could be detected organoleptically at this stage, goes to show that FFA values may not be of much use in detecting the spoilage of pickles.

The authors wish to express their sincere thanks to Dr. N. P. Patil, Director of Research, University of Agricultural Sciences, Dr. N. L. Lahiry, Professor and Head of the Department of Fish Processing Technology and Prof. H. P. C. Shetty, Director of Instruction, College of Fisheries, Mangalore for their keen interest in the study and facilities provided. The financial help given to this project by the Indian Council of Agricultural Research is gratefully acknowledged.

References

American Public Health Association (1966) *Recommended Methods for the Microbiological Examination of Foods.* New York

AOAC (1950) *Official Methods of Analysis* (Henry A. Lepper, Ed.), Association of Official Agricultural Chemists, Washington

Balachandran, K. K. & Muraleedharan V. (1975) *Fish. Technol* **12,** 145

Beatty, S. A. & Gibbons, W. E. (1936) *J. biol. Bd. Can.* **3,** 77

Borgstrom, G. & Paris, C. D. (1965) in *Fish as Food* (Georg Borgstrom, ed) Vol. 3, pp 301–397, Academic Press, New York and London.

Devadasan, K., Muraleedharan, V. & George Joseph, K. (1975) *Fish, Technol.* **12,** 157

Dyer, W. J. & Morton, M. L. (1956) *J. Fish. Res. Bd Can.* **13,** 569

Nicholson, F. A. (1930) *The Preservation and Curing of Fish,* Govt. Press, Madras

Pope, C. G. & Stevens, M. F. (1939) *Biochem. J.* 33, 1070

Rao, S. V. S. & Valsan, A. P. (1962) *Proc. Indo-Pacif. Fish. Coun.* **10,** Technical Paper II

Rao, S. V. S. & Nair, M. R. (1950) *Indian J. Fish.* 5 A, 320

Stansby, M. E. (1968) *Industrial Fishery Technology,* p. 333, Reinhold Publishing Corporation, Chapman and Hall Ltd., London

Tanikawa, E. (1971) *Marine Products in Japan* p. 338 Koesisha-Kosiekaku Company, Tokyo

Vasavan, A. G. & Verma (1959) *Curr. Sci.* **28,** 53

Zaitsev, V., Kizevetter, I., Lagcinov, L., & Makarova, T., Minder, L. & Podesevalov, V. (1969) in *Fish Curing and Processing,* pp. 250-251, MIR Publishers, Moscow