CMFRI
bulletin 42
Part Two

DECEMBER 1988

NATIONAL SEMINAR ON SHELLFISH RESOURCES AND FARMING

TUTICORIN

19-21 January, 1987

Sessions II-VI

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

75. LOSS OF NUTRIENTS DURING CANNING OF CLAMS AND MUSSELS

Chinnamma George and K. Gopakumar
Central Institute of Fisheries Technology, Cochin 682 029

ABSTRACT

Shellfish play a vital role in India's economy and the industry based on processing of the meat of mussels and clams has immense possibility to develop in future because of the abundant availability of this highly nutritious raw material. The influence of pre-process ice storage on the quality of the canned product prepared from the clams, *Villorita cyprinoides* has been studied and chemical and organoleptic aspects of the canned material prepared out of clams stored upto nine days under ice was reported. The results showed that the product prepared from material iced upto three days was acceptable with respect to colour, odour and flavour.

Quantities of nutrients lost during different stages of canning such as initial boiling, blanching and sterilisation have been worked out. Loss of soluble nitrogenous constituents was maximum at the blanching stage.

INTRODUCTION

Mussels and clams have attracted the attention of man from pre-historic times because of their sedentary habits and easy accessibility. The main objective of canning is to get a product that may be stored for a considerable length of time at ambient temperature at the end of which it will be tasty and safe to eat. Gangal and Magar (1967) studied the product quality and loss of nutrients in canned crab meat treated with anti-oxidants. Balachandran and Nair (1975) reported the methods that could be employed for canning clams and mussels in oil.

Hardy (1953) gave an account of the processing of minced razor clam meat and utilisation of clam juice as a filling medium or separately canned as clam juice, nectar or clam broth. Korobkina et al (1970) studied the loss of weight, nitrogenous compounds, vitamins and minerals occurring during canning of black sea mussels pre-processed as boiled frozen blocks.

The present paper deals with studies on suitability of ice stored clams for canning, nutritional loss at different stages of processing of clams, standardisation of the processing conditions to get good quality canned clams and mussels and examination of the canned products.

MATERIAL AND METHODS

The clams *Villorita cyprinoides* collected from Cochin backwaters were allowed to starve in clean water for a day and then kept in chlorinated water (5 ppm) for further two hours.

For the studies on suitability of ice stored clams for canning the selfpurified clams were stored in an insulated ice box in direct contact with ice (1:1 ratio). At regular intervals material was released for canning. Shellon clams were boiled in water for two minutes, drained and the meat was shucked out. The meat was blanched in 7% brine for 3 minutes, drained and cooled. The material was packed in cans and filled with hot brine (2% sodium chloride plus 0 1% citric acid) leaving some head space (10 cms). The cans were exhausted for 10 minutes in steam and seamed immediately. They were heat processed under 0.703 kg/cm² for 20 minutes, cooled, washed and the surface wiped dry.

In order to evaluate the loss of nutrients at different stages of processing samples of meat and cooking medium were withdrawn at each stage and analysed.

The method followed for canning of mussels was similar to that of clams with slight modification (1) blanched in 5% brine for 5 minutes and (2) heat processed for 30 minutes at 0.703 kg/cm².

The cans were examined for external defects if any and vacuum and cut open. Brine was drained out as completely as possible by inverting the can over a funnel for 10 minutes. The meat was examined for organoleptic characteristics and the minced meat and brine were analysed for chemical parameters.

Moisture, protein lipid and sodium chloride were estimated according to the procedures o A. O. A. C. (1975). The estimation of water soluble nitrogen was made by digesting an aliquot of the water extract with concentrated sulphuric acid followed by kjeldhal distillation method. Non-protein nitrogen determinations were made on the trichloracetic acid extracts of the muscle by the kjeldhal method. Free alpha amino nitrogen was estimated by the method of Pope and Stevens (1939). Glycogen was estimated by the method of Van de Kleiy (1951), ribose by the method of Mejbaum (1939) and phosphorus (Pi) by the procedure of Fiske and Subbarow (1925).

The organoleptic quality of the canned products was judged by the taste panel of the Institute according to the Official Methods of A. S. T· M. (1968).

RESULTS AND DISCUSSION

The analytical data of the canned products prepared from clams ice stored upto 9 days are presented in Table 1. The moisture content of the finished product ranged from 72.44 to 69 69%. Free alpha amino nitrogen content in the muscle and the filling brine (2% salt) showed a gradual increasing trend as the days of icing advanced i. e., 24.3 to 80.0 mg% in meat and 26.5 to 72.6 mg% in brine. The organoleptic qualities showed that the products prepared from material iced upto three days were graded as fair with respect to colour, odour and flavour,

TABLE 1. *Chemical and organoleptic characteristics of canned products prepared from fresh and ice stored clams*

Pre-process ice storage days	Moisture %	F & NH_2N		Organoleptic qualities				Score
		Muscle mg%	Brine mg%	Colour	Texture	Odour	Flavour	
0	72.44	24.3	26.5	Good	Soft and firm	Good	Good	8
2	72.40	26.0	19.3	,,	,,	,,	,,	7
3	70.37	69.8	47.1	Fair	Slightly tough	Fair	Fair	6
5	69.29	73.9	65.4	,,	,,	F-P	F-P	5
7	70.03	82.1	65.3	,,	,,	,,	Poor	3
9	69.69	80.0	72.6	F-P	,,	Poor	Bittor	2

TABLE 2a. *Analytical values of clam muscle of different stages of processing*

	Moisture g%	Protein g%	W.S.N. mg%	N.P.N. mg%	F.α-NH_2N mg%	Fat DWB g%	Salt content g%	Yield I g%	Yield II g%
1. Raw muscle	84.03	8.4	308	140	86.8	9.8	—	16.2	—
2. Boiled muscle	74.93	13.3	140	126	46.2	11.3	—	7.29	45.0
3. Blanched muscle	73.92	16.08	112	119	30.8	10.1	4.47	5.84	36.04
4. Heat processed muscle	74.56	15 05	154	142	30.8	9.75	1.74	5.94	36.66

TABLE 2b. *Analytical values of liquid medium at different stages of processing of clam muscle*

	T. N. mg%	N. P. N. mg%	F.oC NH_2N mg%	Salt content g%
1. Boiling solution	319.1	265.2	136.96	—
2. Blanching solution	175.4	100.5	35.20	3.08
3. Filling solution	222.3	140.5	19.0	2.92

Note: TN — Total nitrogen; WSN — Water soluble nitrogen; NPN — Non-protein nitrogen F.α-NH_2N — Free alpha amino nitrogen; Yield I — On the basis of whole weight Yield II — On the basis of raw muscle weight

after which the colour changed to dull white to brown and texture to tough with bitter taste.

The loss of nutrients at different stages of processing such as initial boiling, blanching and sterilisation is indicated in Table 2. Moisture content was reduced from 84.03 to 74.92% on boiling the shellon clams and the protein and fat contents showed corresponding increase in boiled meat. Water soluble nitrogen, non-protein nitrogen and free alpha amino nitrogen decreased in boiled meat. Nitrogenous constituents leached out in appreciable quantities into the boiling water, blanching brine and filling brine. Maximum loss was during the initial boiling stage as the shell liquor constituents also contribute to this loss (Chinnamma 1984). Loss of nitrogen at different stages of processing are 319, 175 and 222 mg%; non-protein nitrogen 265, 100 and 140 mg% and free amino nitrogen 137, 35 and 19 mg%. Water soluble nitrogen and non-protein nitrogen in the muscle at the last stage indicated some increase probably due to the peculiar nature of the clam muscle proteins (Anon 1976; Chinnama George 1984) which might have degraded to simpler compounds.

The results indicated that a greater proportion of water soluble constituents are lost during the canning operation of clam muscle.

Table 3 gives an account of the analytical data of the canned mussel. The loss in weight during sterilization was only 1.2% and the soluble constituents lost in brine (filling

TABLE 3. *Examination of canned mussel* Perna viridis *in brine*

Can Exterior and interior	Good
Sensory evaluation	
a) Colour	Good
b) Smell	Good
c) Texture	Soft and firm
d) Flavour	Good
e) Nature of brine	Slightly cloudy
f) Score	8
Biochemical parameters	
a) Reduction in weight during sterilisation	1.3 %
b) Moisture	74.66%
c) Protein in meat	19.94%
d) Protein in brine	2.90%
e) Free alpha amino nitrogen in brine	40.5 mg%
f) Phosphorus (Pi) in brine	22.1 mg%
g) Glycogen in brine	129.7 mg%
h) Ribose in meat	116.4 mg%
i) Ribose in brine	176.3 mg%

um) were protein 2.9%, free alpha amino nitrogen 40.5 mg%, phosphorus (Pi) 22.1mg%, glycogen 129.7 mg% and ribose 176 3 mg%. This is in agreement with the results obtained for canned crab meat (Chinnamma George 1984).

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Central Institute of Fisheries Technology for the facilities provided for carrying out this work. Our sincere tanks are due to Dr. T. K. Govindan, Kumari. K.P. Leelamma and Shri. K. Balakrishna Pillai for the help rendered while carrying out this work.

REFERENCES

ANON. 1976. Enzymes, proteins and lipids. Annual Report of the Central Institute of Fisheries Technology, 21.

A.O.A.C., 1975. Official Methods of Analysis of the Association of Official Analytical Chemists, pp. 417, 15-16, 310 311.

A. S. T. M., 1968. Manual on Sensory Testing Methods, A. S. T. M. - E - 10 of the American Society for Testing Materials, STP, 434.

BALACHANDRAN, K. K. and T. S. UNNIKRISHNAN NAIR 1975. Diversification in canned fishery products, Canning of Clams and Mussels in oil. *Proceedings of the Symposium on Fish Processing in India*, Mysore, 49.

CHINNAMMA GEORGE. 1984. Bio-chemical changes associated with processing of shell-fishes and flavour constituents of body meat and claw meat of crab. Ph. D. Thesis of the Cochin University of Science and Technology.

FISKE, C. H. AND Y. SUBBAROW. 1925. Calorimetric determination of phosphorus. *J. Biol. Chem.*, 66 : 375.

GANGAL SHARAD and N. G. MAGAR. 1967. Canning and storage of crab meat. *Food Technol.*, 21 : 397.

HARDY, E. 1953. Canning Mollusks. *World. Fish. Abst.*, 37.

KOROBKINA, G. S., E. N. DANILOVA and N. N. KALININA. 1970. Effect of processing on the nutritive value of mussels. *Comml. Fish. Abst*, 23 (10) : 13.

MEJBAUM, W. Z. 1939. Z. Physiol. Chem, *258* : 117., Cited by Umbrie, W. W., R. H. Burris and J. F. Stauffer. In : Manometric techniques, 1959, p. 274. Burris and J. F. Stauffer. In : Manometric techniques, 1959, p. 274. Burgess, Pub. Co. Minneapolis, 15, Minn.

POPE, C. G. AND M. F. STEVENS. 1939. The determination of amino nitrogen using a copper method. *J. Biochem.* 33 : 1070.

VAN DE KLEIY, B.J. 1951. Rapid determination of glycogen in tissues. *Biochem. et. Biophy Acta;* 481 : 2-