Studies on Depuration of Live Clams (*Villorita sp.*)

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Live clams collected from their natural beds were depurated by starving them in water. Water from their natural environment, potable water from municipal water supply and sodium chloride solution made up to the strength of natural brackishwater as well as all these chlorinated at 5 p.p.m level were used. The acid insoluble ash could be brought down to insignificant level by depuration in natural water for a period of 16–18 h. Bacterial quality of the meat also could be improved by this method. Chlorination of the system at the end of depuration further improves the bacterial quality of the meat.

Clams are filter feeders dwelling on the muddy/sandy bottom and therefore, their intestines are often loaded with mud and sand besides bacteria depending upon the bacterial quality of the environment. The gut contents impart a muddy flavour and grittiness to the meat if retained within. Therefore a cleansing operation to achieve depuration as well as elimination of bacteria is a very important step that should precede processing of clam meat.

The processed clam meat has emerged as an item of export in recent years. The details of export of processed clam meat is given in Table 1.

Table 1. *Export of processed clam meat from India**

	1981		1982	
	Quantity kg	Value Rs	Quantity kg	Value Rs
Pickle	1,600	28,212	9,192	61,416
Frozen	16,000	1,11,000	3,98,000	84,79,000
Canned	10,070	1,85,794	—	—

*Source: Marine Products Export Review, 1982. Marine Products Export Development Authority, Cochin

Nowak (1970) described the mechanism of purification of bivalves in water. Balachandran & Nair (1975) worked out the technology of canning clam meat and mentioned a method for depuration of live clams. Stroud (Torry Advisory Note No. 84) stated cleansing of oyster in recirculating seawater treated with U.V. light or in static water. Prabhu & Balachandran (1980) reported about the practice of holding clams in cages in clean areas in the sea in Canada. The present communication discusses results of experiments carried out to evolve an appropriate method for depuration of live clams.

Materials and Methods

Live clams (*Villorita* sp.) were collected from their natural beds in Vembanad Lake near Vaikom in Kerala and brought immediately to the laboratory, kept in water from the same area of collection. Water and bottom mud samples were separately collected in sterile bottles. Depuration was carried out in water from the habitat of clams, potable water, sodium chloride solution made upto the strength of water from natural habitat, as also all these chlorinated to 5p.p.m level. Effects of these different environments on mortality, bacterial quality, removal of sand and contents of glycogen in the meat were studied.

Moisture, crude protein, fat and acid insoluble ash were determined according to AOAC (1975) methods and glycogen by the method of Kleiy (1951). The viable plate count (TPC) was determined using tryptone glucose agar (TGA). The plates were incubated for 48 h at room temperature

(29 ± 1°C) and counts taken. Total coliforms were determined using .desoxycholate lactose agar (DLA, Difco), *Escherichia coli* using tergitol-7-agar (T_7) and MPN method using Mackonkey broth, faecal streptococci using KF agar and coagulase positive *Staphylococcus* using Baird-Parkar agar (FDA, 1973; Difco, 1971). Salmonella was detected by pre-enrichment in lactose broth followed by enrichment in tetrathionate broth. The tetrathionate broth was streaked on brilliant green sulphadiazine agar and incubated at 37°C for 24 h. Characteristic colonies were inoculated to tripple sugar iron agar (TSI) and cultures giving characteristic reaction were further identified biochemically and serologically (Calton, *et al.*, 1968).

Results and Discussion

Proximate composition of raw clam meat, its bacterial quality as well as the bacterial quality of water and bottom mud samples from the natural habitat of clams are given in Table 2.

Table 2. *Proximate composition of clam meat and bacterial quality of meat, water and mud samples*

	Raw meat	Water	Mud
Moisture, %	78.50	—	—
Fat, %	2.52	—	—
Protein, %	10.09	—	—
Ash, %	0.86	—	—
Acid insolubles, %	0.38	—	—
Glycogen, %	6.68	—	—
Total viable plate count	1.2 x 10^6/g	5.5 x 10^4/ml	9.06 x 10^3/g
Total coliforms	6.3 x 10^3/g	100/ml	25/g
E. coli	3 x 10^3/g	Not detected in 10^{-2} dilution	Not detected in 10^{-2} dilution
Streptococci	8.5 x 10^3/g	,,	,,
Coagulase positive *Staphylococcus*	Nil	Nil	Nil
Salmonella	Nil	Nil	Nil

Table 3. *Effect of depuration on bacterial quality and acid insoluble ash content*

	Raw clam meat		
	Before depuration	After depuration	Steamed and shucked meat
Total viable plate count/g	1.2 x 10^6	5.5 x 10^5	31.10^3
Total coliforms/g	6.3 x 10^3	3.5 x 10^2	50
E. coli/g	3 x 10^3	3.5 x 10^2	Nil
Faecal streptococci/g	8.5 x 10^3	5 x 10^2	Nil
Coagulase positive *Staphylococcus*/g	Nil	Nil	Nil
Salmonella	Nil	Nil	Nil
Acid insoluble ash, %	0.38	0.01	Nil

Table 4. *Quality of clam meat after overnight depuration (18 h) in different systems*

		Meat after depuration in different media					
	Raw meat before depuration	Water from natural habitat	Water from natural habitat, chlorinated at 5 p.p.m level	Potable water	Potable water chlorinated at 5 p.p.m level	Sodium chloride solution (1.03%)	Sodium chloride solution (1.03%) chlorinated at 5 p.p.m level
Total plate count/g	5.8×10^6	3.82×10^5	8.91×10^5	5.62×10^5	5.81×10^5	4.14×10^5	4.31×10^5
Total coliforms/g	3.8×10^4	2.19×10^3	7.06×10^3	4.74×10^3	5.03×10^3	3.89×10^3	3.48×10^3
E. coli/g	2.2×10^2	Nil	Nil	12	Nil	Nil	Nil
Faecal *Streptococci*/g	5.14×10^4	4.82×10^3	9.1×10^3	9.1×10^3	1.01×10^3	8.84×10^3	6.22×10^3
Coagulase positive *Staphylococcus*	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Salmonella	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Acid insoluble ash, %	0.34	0.012	0.024	0.056	0.094	0.015	0.026
Glycogen, %	6.68	5.9	5.6	5.6	5.2	4.0	5.0

Table 5. *Bacterial quality of clam meat after depuration and subsequent chlorination of the system*

	TPC	Total coliforms	*E. coli*	Faecal strepto-cocci	Coagulase positive *Staphylo-coccus*	*Salmonella*
Raw meat before depuration	5.8×10^6	3.8×10^4	2.2×10^2	5.1×10^4	Nil	Nil
After depuration	3.82×10^5	2.9×10^3	Nil	4.82×10^3	Nil	Nil
After depuration and chlorination	2.92×10^5	1.02×10^3	Nil	2.96×10^3	Nil	Nil

Live clams were depurated in clean water from the natural habitat filtered through a cloth. 100 kg of clams were kept in 60 *l* of water keeping a water column of 7.5 cm above clams. After 18 h, samples were drawn for estimation of acid insoluble ash and bacteriological examination of the raw shucked meat. Results are presented in Table 3.

The primary aim of depuration, namely, removal of sand and gritty matter is very well achieved by this starvation method. Besides, there is good improvement in the bacterial quality of the meat as well. Mortality of clams was not observed during this treatment. Therefore, it can be reasonably concluded that starvation in clean water from natural habitat is a good method for depuration of live clams.

Studies were also carried out an alternative depuration systems to find out their relative efficiency. Besides water from natural habitat, potable water from municipal water supply, sodium chloride solution made upto the strength of natural water as also the above chlorinated to 5 p.p.m level were used. The results are summarised in Table 4.

Live clams when in water remain with shell slightly agape. However when the water is chlorinated they remain tightly closed until such time that the chlorine disappears from the system. So until this period, no activity leading to depuration takes place. The extent of depuration achieved is the highest in water from natural habitat followed by chlorinated natural water. Upto a period of 24 h no mortality occurred in these systems whereas some mortality was observed in other media though negligible, the minimum being in sodium chloride solution. Acid insoluble ash content in the meat could be brought down to an insignificant level by depuration in natural water. The retention of glycogen which is the source of stored energy also was highest in this system. Therefore considering the overall merits, it can safely be concluded that the starvation in natural water for 18–24 h offers the best results of depuration.

Live clams were depurated in natural water for 24 h and then the system was chlorinated at 5 p.p.m level and maintained for 2 h. The bacterial quality of the meat in different stages is given in Table 5. Though depuration in chlorinated water offers no significant improvement in the bacterial quality of the meat, treatment with chlorine after depuration and holding the live animals in that system for 2 h show definite improvement in the quality of the meat. Therefore it follows that for achieving good results, live clams should be depurated in water from their natural habitat followed by chlorination at the end.

References

AOAC (1975) *Official Methods of Analysis* (Horwitz, W. Ed.) 12th edn. Association of Official Analytical Chemists, Washington

Balachandran, K. K. & Unnikrishnan Nair, T. S. (1975) *Proc. Symp. Fish Processing Industry in India,* p. 53, CFTRI, Mysore

Difco (1971) *Microbiological and Chemical Laboratory Procedures,* 9th edn. Difco Laboratories Inc., Detroit, Michigan

FDA (1973) *Bacteriological Analytical Manual for Foods.* Chapter XIX. *Examination of Shell Fish and Shell Fish Meats.* Division of Microbiology, Bureau of Foods, Food and Drug Administration, U.S.A.

Galton, M. M., Morris, G. K. & Martin, W. T. (1968) *Salmonella in Foods and Feeds,* U. S. Dept. of Health, Education and Welfare, U. S. A.

Kleiy, Van de (1951) *Biochem. Biophys Acta.,* 481

Nowak, W. S. W. (1970) *The Marketing of Shell Fish,* p. 110 Fishing News (Books) Ltd., London

Prabhu, P. V. & Balachandran, K. K. (1980) *Report of the Study Tour to U. K., Canada and Singapore. Cent.* Inst. Fish. Technol., Cochin.

Stroud, G. D. *Torry Advisory Note* No. 84, Torry Research Station, Aberdeen

Vijayan, P. K., Perigreen, P. A., Surendran, P. K. & Balachandran K. K. (1982) *Fish. Technol.* **19**, 25