Fishery Technology
1997, Vol. 34(2) pp : 21 - 25

Biochemical and Microbiological Quality of Smoked *Channa punctatus* available in Manipur

H. Lilabati, N. Bijayanti and W. Vishwanath
Department of Life Sciences, Manipur University
Canchipur - 795 003, Manipur, India

A comparative study on the biochemical and microbiological quality of the smoked freshwater snakehead (*Channa punctatus*) of Manipur (A) and smoked *Channa punctatus* brought from other states (B) has been made. 'A' has more smoky odour, higher reconstitution property, total protein, lipid, ash, NPN, pH than that of 'B'. Total bacterial (TBC) and fungal (TFC) counts were higher in 'A'. While 'A' did not have coagulase positive *staphylococcus* and faecal *Streptococci*, the two were detected from 'B'. In both the samples, E. *coli* and *Salmonella* were not detected. *Xanthomonas* and *Penicillium* sp. were dominant in 'A' and *Bacillus*, *Micrococcus* and *Aspergillus* sp. in 'B'.

Key words : Biochemical, Microbiological quality, smoked *Channa punctatus*

The people of Manipur depend mainly on fish meat for their animal protein requirement. Smoked fishes are widely used in vegetable curry preparation. Among such fishes, smoked cured *Channa punctatus* is very commonly used for household consumption. As fish production of Manipur does not meet the demand of the growing population, large amounts of smoked fishes are purchased from the neighbouring state of Assam.

In Manipur, smoking of *C. punctatus* is done by spreadig the fish on a wire tray and then exposed to flame briefly to burn the skin. The process is repeated after turning the fishes upside down. Then the fishes are exposed to smoke evoked from burning paddyhusk from a distance of about 30 cm below for about 2-3 h at 70-80°C. In Assam also, similar technique is followed. However, after smoking the fishes are exposed to sunlight for a long time to reduce moisture content.

There are several reports on the biochemical composition (Nair, 1985, Cutting, 1962, Bhuiyan *et al.*, 1986; Singh *et al.*, 1990) and microbiological quality (Graikoski 1973; Vander Brock, 1948) of smoked fishes. But information on the quality of smoked fishes of this region is scanty. Hence the present work was undertaken to compare the biochemical and microbiological quality of *C. punctatus* smoked in traditional Manipuri style and smoked *C. punctatus* brought from the other states.

Materials and Methods

250 g of the smoked fishes were sampled aseptically from each of the 5 randomly selected venders. The muscles were taken, pooled together and used for different analysis. Such sampling were done weekly in the months of January to March, 1995. For biochemical analysis, fish muscle was used and for microbiological analysis, whole body was used.

Colour, texture and odour of the fishes were judged by a panel of seven judges which include 2 students, 2 research scholars and 2 teachers of the department and 1 smoked fish seller. Colour was recorded based on simple visual estimation, and texture, by applying pressure by fingertips. Odour was adjudged by smelling the sample and were recorded in a 3 point hedonic scale as good, medium and poor. Reconstitution property was assessed as percentage of water imbibed by 100 g of the sample soaked in 400 ml of water for a period of 3½ h as described by Valsan (1975).

Total nitrogen (TN), pure protein nitrogen (PPN), non protein nitrogen (NPN), moisture, lipid and ash were determined according to AOAC (1975). TN was estimated by Kjeldahl technique from moisture free samples. PPN was the nitrogen content of TCA precipitate of the samples and NPN by subtracting the values of PPN from those of TN. The values of total protein and pure protein were obtained by multiplying the corresponding values of nitrogen by conversion factors (Osborne & Voogt, 1978). Total volatile base nitrogen (TVBN) and free fatty acid (FFA) were determined as per the method of Morris (1959) and pH values were measured using a pH meter (Valsan, 1975).

Enumeration of total viable bacteria, total fungi, coliform number and detection of pathogenic bacteria, viz. *Salmonella, E. coli, Staphylococcus aureus* and faecal *Streptococci* were done as per the procedure of APHA (1976).

TPC was enumerated on plate count agar, TFC on acidified potato dextrose agar (PDA), coliform number on brilliant green lactose bile (BGLB) broth, *E. coli* on eosine methylene blue (EMB) agar after enriching in EGLB broth, *Salmonella* on brilliant green agar (BGA after enriching in selenite cystine broth (SCB), *Staphylococcus aureus* on Baird Parker agar (BPA) following treatment with egg yolk and tellurite and Streptococci on KF agar containing triphenyl tetrazolium chloride.

The suspected pathogenic bacterial colonies were further tested using the methods of APHA (1976) and Kiss (1984), Bacteria were identified based on Buchanan and Gibbons (1974) and fungi, on Gilman (1957) and Ellis (1971, 1976).

Results and Discussion

Table 1 shows the length, weight, reconstitution and organoleptic properties of smoked fishes. Sample A has soft texture and more smoky odour than that of sample B. Reconstituion property of A (144.00 + 0.01%) is higher than that of B (123.00 + 0.23%) bacause of their texture and moisture content.

Table 1. Length, weight, reconsitution and organoleptic properties of smoked fish

Smoked *C. punctatus*	Length (cm)	Weight (g)	Reconstitution properties (%)	Organoleptic Texture	Properties of the fish Colour	Smoky odour
Manipuri style	11.6-13.00	12.6-17.35	144.00±0.01	Soft	Black	good
Imported from Assam	8.4-10.6	3.34-10.17	123.00±0.23	Hard	Black	Poor

Average for 12 samplings

Table 2. Biochemical composition of smoked fishes (in dry wt. basis)

Smoked *C. punctatus*	pH	NPN (%)	Total protein (%)	Pure protein (%)	Total lipid (%)	Moisture (%)	Ash (%)	TVBN (mg%)	FFA (% oleic acid)
Manipuri style	6.52 ±0.03	0.50 ±0.01	82.50 ±0.61	79.38 ±0.65	3.93 ±0.79	55.50 ±0.01	10.00 +0.02	38.00 ±3.00	7.34 ±0.01
Imported from Assam	6.30 ±0.13	0.36 ±0.07	77.05 ±0.10	74.80 ±0.47	3.60 0.48	5.71 ±0.01	9.41 +0.05	44.00 ±2.00	8.91 ±0.01

Mean ± SD for 12 samplings

Table 2 shows biochemical compositions of the fishes, pH, NPN, total protein, pure protein, total lipid, moisture and ash content of A and B. Sample A had higher pH value than B. All other values execpt TVBN and FFA were higher in sample A compared to sample B.

During hot smoking some liquid may be lost as drip along with soluble minerals, nutrients and non protein nitrogen from the body. Loss of mineral elements during processing is generally physical as liquid is discarded from the product (McCance & Shipp, 1933). In B, ash and NPN contents were low which may be attributed to loss of more water soluble minerals and non protein nitrogen from the muscle tissue during smoking process compared to that of A. In B, moisture content was very low. It may be related to the exposure of the smoked fishes of Assam to sun after smoking. Depending, on the smoking time, the amount of highly unsaturated fatty acid decreses (Taniguchi, 1988). Drying of lipids during various technological processing cause a substantial loss in the quality of more volatile fractions, such as methylesters and some short chain fatty acids (Colowick *et al.*, 1969).

Results on the study of micoflora of smoked fishes is presented in Table 3. TPC of A was log 7.57-9.31 and that of B was log 7.26-7.65. TFC of A was log 5.00-6.31 and that of B was log 4.63-5.00. Moisture plays important role in bacterial spoilage as lowering of moisture retards the spoilage of the fishes (Stansby, 1963). *Staphylococcus auras* and faecal *Streptococci* which were not detected in A were observed in B. The log counts were 1.30-2.45 and 0.00-1.65 respectively. It shows that B has some contamination/ improper handling during processing and preservation. Coliforms and pathogenic bacteria viz., *E. coli* and *Salmonella* were not detected in both the samples.

Table 3. Microflora of smoked fishes (log cfu g)

Sample	Total plate count of bacteria	Total plate count of fungi	*Staphylococcus aureus*	Faecal Strepto cocci
Manipuri style	8.92±0.67	5.96±0.35	ND	ND
Imported from Assam	7.41±0.18	4.83±012	2.00±0.37	1.30±0.44

Note : Coliforms, *E. Coli* and Salmonella were not detected in both the sample

Mean ± SD for 12 samplings; ND = Not detected

Results on the study of fungal flora of smoked fishes are shown in Table 4. Isolated fungal cultures of A were *Diplodia* sp., *Memnnoiella* sp., *Penicillium* sp., *Cladosporium* sp., *Aspergillus* sp., *Rhizopus* sp., Some white sterile mycelia (species which could not be identified as it does not form fruiting bodies in PDA

Table 4. Fungal flora of smoked fishes

Fungi	Sample A	Sample B
Diplodia sp.	30.06±3015	ND
Memnoiella sp.	26.03±2.70	ND
Penicillium sp.	40.17±3.33	20.95±2.29
Cladosporium sp.	12.28±1.50	ND
Aspergillus sp.	ND	73.37±4.41
Rhizopus sp.	ND	8.00±1.54
White sterile mycelia	6.09±1.67	ND
Unidentified	3.93±0.13	ND

ND = Not detected

Mean ±SD for 12 samplings

medium) and some unidentified sp,. The flora of B were *Penicillium* sp. and *Aspergillus* sp. The difference in the methods of smoking and their biochemical composition might be responsible for the difference in flora. Pevovarov *et al.* (1988) pointed out that processing caused considerable changes in the composition and counts of microflora on fish.

Table 5 shows results on the study of the bacterial flora of smoked fishes. Bacterial genera identified from A were *Bacillus, Staphylococcus, Micrococcus, Xanthomonas* and some unidentified sp. and those identified from B were *Bacillus, Aeromonas* and *Micrcoccus.*

Table 5. Bacterial flora of smoked fishes

Bacteria	Sample A	Sample B
Bacillus	11.94±1.62	45.90+3.41
Staphylococcus	7.92±0.78	ND
Aeromonas	ND	4.90+0.44
Micrococcus	23.48±1.33	41.13+2.62
Xanthomonas	24.17±2.99	ND
Unidentified	21.67±2.44	ND

ND = Not detected

Mean ± SD for 12 samplings

According to Graikoski (1973), the bacterial spoilage in smoked fish is mostly due to the nonspore forming rod, which survives smoke processing or introduced during handling of fish products. But in the present investigation nonspore forming rod was only *Aeromonas* observed in B. Most of the bacteria isolated from both the samples were Gram positive. *Xanthomonas* spp. are generally plant pathogens (Buchanan & Gobbon, 1974). Its prsence in the samples of present study might be due to the utilization of plant materials while smoking.

In both the smoked samples, protein contents were high. TPC of A was very high which may be related to its higher moistue content. Thus attempts may be made to reduce the moisture content so as to improve the microbial quality of the fish. As microorganisms readily propagate in the fishes, proper sanitary care should be taken during and after processing of the fishes.

The authors are grateful to Indian Council of Medical Research (ICMR), New Delhi (Scheme No.5/9/92-HR) for financial assistance.

References

AOAC (1975) *Official Methods of Analysis*, 12th Edn. Association of Official Analytical Chemists, Washington DC

APHA (1976) *Compendium of Methods for Microbiological Examination of Foods* (speak, M.I., Ed.) American Public Health Association, Washington

Buchanan, R.E. & Gibbon, N.E. (1974) *Bergy's Manual of Determinative Bacteriology*, 8th Edn. Williams & Wilkins Co., Baltimore

Bhuiyan, A.K.M.A., Ratnayake, W.M.N. & Ackman, R.G. (1986) *J. Fd. Sci.* **51**, 327

Cutting, C.L. (1962) *General Principles for Smoke Curing of Fish,* Dept. Sci. Ind. Res. Gt. Brit. Food Inv. Leaflet No. 13, H.M. Stationary office, London

Colowick, S.P. & Kalpan, N.O. (1969) *Methods of Enzymology,* Vol. 14 Academic Press, New York

Ellis, M.B. (1971) *Dermaticeous Hypomycetes,* CMI, Kew, Surrey, England

Ellis, M.B. (1976) *More Determaticeous Hypomycetes,* CMI, Kew, Surrey, England

Graikoski, J.T. (1973) in *Microbial Safety of Fishery Products.* (Chichester, C.O. & Graham, H.D., Eds.). Academic Press, New York, USA

Gilman, J. C. (1957) *A Manual of soil Fungi,* The Iowa State University Press, Iowa, USA

Kiss, I. (1984) *Testing Methods in Food Microbiology* (Kiss, I. Ed.), Elsevier Amsterdam Oxford, New York, Tokyo

McCance, R.A. & Shipp. H.L. (1933) *Med Res. Council* (Brit). Spc Rept Ser No. **187**, 146

Morris, B.J. (1959) *The Chemical Analysis of Food and Food Products.* D van Nostrand Co. Princeton, New Jersey, USA

Nair, R.B. (1985) in Harvest & Post *Harvest Technology of fish* SOFT(I). Technol. Cochin p 528

Osborne, D.R. & Voogt, P. (1978) *The Analysis of Nutrients in Foods.* Academic Press, New York

Pcvovarov, Y.P., Lincvich L.S., Gracheva, M.M., podyascncv, S.V. Sazonova, L.P. 988 *'Gigiena i sanitariya,* No. 8, 18

Stansby, M.E. (1963) in *Industrial Fishery Technology* (Stansby, M.E. & Robert, E. Eds.) Krieger Publ. Co., Hunlington, New York

Singh, M.B., Sarojnalini, C. Vishwanath, W. (1990) *Food Chemistry,* **36**, 89

Taniguchi, A. (1988) *Bull. Jap.Soc. Fish.* **54**, 869

Vander Brock, C.J.H. (1948) *Central Inst. Voedingson derzock.* T.N.O. Utrecht Mededel. Publ. No. 72

Valsan, A.P. (1975) *Proc. Symp. Fish. Processing Industry in India,* Association of Food Scientists and Technologists (India) and Central Food Technological Research Institute, Mysore, p 77