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Quality Profile of the Smoke Cured Freshwater Prawns Sold in Interior Markets of Western Orissa

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Smoke curing of fresh water prawn is an age-old practice prevalent in Orissa. In the present study different quality parameters of smoke cured freshwater prawns sold in interior retail markets of Orissa are reported. The bacteriological analyses of the smoked prawn samples revealed the occurrence of mesophilic aerobic bacteria (3.9 to 6.0 log cfu/g), fecal coliforms (2.78 to 5.9 log cfu/g), fecal streptococci (4.64 to 5.98 log cfu/g), staphylococci (4.20 to 6.72 log cfu/g) and coagulase positive staphylococci (4.36 to 4.78 log cfu/g). The average occurrence of total staphylococci was found to be 6.27 log cfu/g which is far beyond the permitted levels. The moisture contents of the samples varied from 8.43 to 14.95% with an average of 9.59%, fat content from 3.88 to 7.96% with an average of 5.35%, total volatile nitrogen 28.66 to 47.35 mg% with an average of 36.03 mg% and alpha amino nitrogen from 233.24 to 493.14 mg% with an average of 394.57 mg%. Among the samples studied, 41.66% contained miscellaneous fish and 50% had unwanted materials. One sample showed insect infestation also. Sensory evaluation studies on a 10-point hedonic scale revealed that the over all mean scores ranged from 5.38 to 7.07, with majority (75%) of the samples scoring 6 points. In view of occurrence of *S. aureus* in high numbers to an extent of becoming hazardous to human health, an overall quality upgradation of the smoked product is advocated.

Key words : Freshwater prawns, Orissa, market samples; Smoked cured; Quality profile

The freshwater sources of Orissa are replete with natural fish fauna and different kinds of natural materials are used as feed for fish. The freshwater prawn species, which are present in the rivers are *Macrobrachium malcolmsonii* (H. Milne Edwards), *Macrobrachium idae* (Heller), *Macrobrachium rude* (Heller), *Macrobrachium lamarrei* (H. Milne Edwards), *Macrobrachium lamarrei lamarrei* (H. Milne Edwards) *Macrobrachium dayanus* (Henderson), *Macrobrachium lendersonii, Caridina nilotica* (de Man) and *Caridina weberi* (de Man) (Behra & Rashid, 2003). Among the nine identified species of prawn *Macrobrachium malcolmsonii* is very much important due to its size and also fetches very high price while small sized prawns are either sold in the local market at cheaper price or preserved by drying and smoking (Prem kumar & Meena Kumari, 2003).

Smoke curing of freshwater prawn is an age-old practice prevalent in Western Orissa. This is one of the cheapest sources of animal protein available to economically under privileged people, especially those residing in hinterlands. The prawns harvested from different freshwater sources are smoke cured in domestic kilns. The products are usually disposed of within a week.

In tropical countries, annual losses of cured fish due to bacterial spoilage amount to two to three million tons (Clucas & Ward, 1996). This study has been attempted to gather data on the different quality aspects of smoke cured prawns processed and sold at different locations in Orissa and to improve the quality and shelf life of these products based on their physical, biochemical, microbiological and sensory characteristics.

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Materials and Methods

The smoke cured prawn samples were collected from four districts of western Orissa viz., Balangir, Bargarh, Jharsuguda and Sambalpur. The samples were collected from interior fish markets in sterile, self-locking polyethene bags. In each district, three active markets were chosen and the samples were collected randomly. Smoke cured prawn samples of 100 g lot collected from 10 sellers in the each market were pooled and a composite sample was prepared by mixing it thoroughly . Each of such composite sample was treated as one and sampling was done for various parameters.

Sampling for microbiological parameters was carried out immediately after bringing the sample to the laboratory. 10 grams of smoked prawn sample was weighed and cut into small pieces in aseptic condition. The cut pieces were aseptically homogenised with 90 ml normal saline in sterile conditions using mortar and pestle. Serial dilutions of the samples in same diluent were surface plated on plate count agar (PCA), violet bile salt glucose agar (VRBGA), streptococcal agar (KF) and Baird–Parker agar (BP) for the enumeration of mesophilic aerobes, faecal coliforms, faecal streptococci and staphylococci (ICMSF, 1978; Mossel *et al.*, 1978). Inoculated plates were incubated at 37^{0}C for 24-96h as the case may be and typical colonies formed on these media were counted and expressed as $\log_{10}$ cfu /g of the sample. Further, typical colonies of *Staphylococcus aureus* were subjected to coagulase test using rabbit plasma (Sanjeev & Surendran, 1996). For estimating the occurrence of coagulase positive *S. aureus,* typical colonies were isolated in proportional manner from Baird Parker agar plates and coagulase test performed for each isolate. From the percentage of positive isolates, the incidence of coagulase positive *S. aureus* was determined. Dehydrated media used in this study were from Oxoid (England) and Hi Media (India).

The moisture, fat and alpha amino nitrogen in smoked prawn samples were estimated following AOAC (1995) methods. The total volatile nitrogen (TVN) in the fresh and cured fish samples was estimated by the method of Conway (1947).

The smoke cured prawns are usually found to carry other products such as miscellaneous fish (MF) and extraneous material (EM) which include fragments of fire wood used for smoking and small molluscans. The samples were screened for presence of these extraneous materials by sieving in standard sieve of 5mm. Insect infestation was tested by visual observation using a magnifying lense. The value was expressed as percentage by weight of the miscellaneous fish (MF) or extraneous material (EM) to 100g of smoked prawns.

The smoke cured prawns were also evaluated for overall acceptability by a panel of 13 experienced panelists using a 10 point Hedonic scale. The quality of smoke cured prawn samples obtained from different sources were assessed from the mean overall acceptability scores on source basis, assuming the Hedonic score "2" to be the lowest limit.

Results and discussion

The commercial smoke cured prawn samples collected from different fish markets of Western Orissa were assessed for physical, biochemical, bacteriological and sensory characteristics. A total of 12 pooled samples of freshwater prawns and one sample of marine prawn were studied during the period. Results of bacteriological analysis of smoked prawn samples obtained from different sources are shown in Table 1. TPC of individual samples of smoked freshwater prawns ranged from 3.90 to 6 log cfu/g of the samples. The smoked marine prawn showed a TPC of 3.6cfu/g. Fish or shellfish containing bacteria of the order of 8 log cfu/g are unfit for human consumptions (Almas, 1981) and majority of samples in the present study are

Table 1. Bacteriological analyses of smoke cured prawn samples from markets (Counts expressed in log cfu/gram)

Prawn samples	Total plate count (TPC)	Fecal Coliforms	Fecal streptococci	Total staphylococci	Coagulase Positive Staphylococci
1	5,15*	5,90	< 1	6,72	< 1
2	4,85	3,30	< 1	4,64	< 1
3	6,00	# < 1	5,98	6,68	< 1
4	5,04	< 1	< 1	6,62	< 1
5	5,78	< 1	< 1	4,30	< 1
6	4,72	< 1	< 1	4,60	< 1
7	4,28	< 1	4,64	4,20	< 1
8	4,53	< 1	< 1	5,86	< 1
9	4,92	< 1	5,11	5,75	< 1
10	5,95	< 1	< 1	6,11	4,36
11	3,90	2,78	5,26	6,72	4,78
12	,085	< 1	< 1	5,71	4,00
13*	3,60	< 1	< 1	6.41	< 1
Average	5.42	4.80	5.04	6.27	3.89

* Data presented are average of triplicate determinations.
# Wherever the bacteria are not detected, the results are shown as <1 log cycle, taking into consideration the sensitivity of the sampling method and media.
* *Marine prawn from estuarine sources.

within limits as proposed for cured fish (IS:2001) (Table 1). Enormous load of fecal coliforms was observed in 3 of 12 samples screened (25%). Occurrence of fecal streptococci was seen in four out of 12 samples (33.33%). Prasad & Seenayya (1998) also made similar observations. The mesophilic aerobic bacterial count of marine prawn caught from estuarine waters was 3 log cfu/ g and the product had negligible fecal coliforms and fecal streptococci (Table 1).

In the present study, staphylococcal count was very high ranging from 4.3 to 6.72 cfu/g with a mean value of 6.27 cfu/g and all the samples recorded high counts. Sanjeev & Surendran (1996) reported staphylococcal food poisoning due to consumption of fish and fishery products. The mean staphylococcal count in the present study is 6.27 log cfu/ g and is higher than the threshold level of 100 cells/ g and is potential health hazard (Bergdoll, 1979). The coagulase positive *Staphylococci were distributed* in 25% of the samples with an average occurrence of 3.89 log cfu/ g of the samples. Sporadic occurrence of staphylococci from a wide variety of environmental sources has been reported (Kloos *et al.*, 1992). Humans are the main reservoir of staphylococci and food is contaminated from food handlers or food handling surfaces and equipments. Being an osmo-tolerant bacterium, *S.aureus* is also able to survive and grow at low water activity environments (Jablonski & Bohach,2001) and hence its presence in smoked fish is quite expected.

Moisture plays an important role in the quality of smoke cured prawns. In the present study, the moisture content of all the samples ranged from 8.43 to 14.95% with average of 9.59% (Table.2). The fat content ranged from 3.88 to 7.96% with an average of 5.35%, total volatile nitrogen 28.66 to 47.35 mg% with an average of 36.03 mg% and alpha amino nitrogen from 233.24 to 493.14 mg% with an average of 394.57 mg%. High total volatile nitrogen values were reported to correlate with high bacterial activity (Vanderzant *et al.*, 1973). However, in the present study, the level of TVN in the

Table 2. Physical and biochemical quality of smoke cured prawn samples

Prawn samples	Moisture (%)	Fat (%)	Total volatile nitrogen (mg%)	Alpha Amino Nitrogen (mg%)
1	14.95	5.91	47.35	233.24
2	8.43	5.48	35.51	493.14
3	8.79	4.30	34.28	463.17
4	12.67	5.07	33.64	333.20
5	7.84	5.23	34.27	446.49
6	8.07	7.34	39.87	446.49
7	7.86	7.96	47.35	473.14
8	9.01	4.43	28.66	233.24
9	11.30	6.15	43.61	359.86
10	8.88	3.88	29.90	379.85
11	8.83	4.03	29.28	466.48
12	8.50	4.44	28.66	406.50
Average	9.59	5.35	36.03	394.57
Standard Deviation	2.22	1.30	6.96	89.72
13*	9.52	1.81	93.45	239.90

* Marine prawn from estuarine waters. Data presented are average of triplicate determinations

samples was far below the levels indicating poor quality.

The results of composite quality of product obtained are depicted in Table 3. Among 12 fresh water prawns samples screened, 4 contained miscellaneous fish ranging from 0.47 to 3.44% in the samples. The miscellaneous fish were identified as *Xenontodon cancilla* (*Gourchana*-Oriya name), *Pama pama* (*Patharmundi*-Oriya name), *Rohitee cotio* (*Chilanti*-Oriya name), *Ambasis nama* (*Patponia*-Oriya name) and *Puntius* sp. Half of the samples contained extraneous material ranging from 0.14 to 3.13% in the samples. The composition of extraneous material were large mud particles, small sticks, snails and burnt particles of algae. Insects were noted in one sample. However, no visible damage was observed. Only one sample of marine prawn was obtained from estuarine sources,but it was free from miscellaneous fish, extraneous material and insect infestation.

The results of sensory evaluation of freshwater smoked prawns and marine prawn sample are shown in Table 4. The overall mean score of thirteen panelists of the products ranged from 5.38 to 7.07 and majority of the samples scores were at 6 level (75%) and same pattern continued for marine prawn also.

Table 3. Presence of miscellaneous fish and extraneous materials in smoke cured prawn samples (as %)

Prawn samples	Miscellaneous fish	Extraneous material	Insect Infestation
1	Nil*	2.74	-ve
2	Nil	Nil	-ve
3	Nil	Nil	-ve
4	Nil	Nil	-ve
5	3.44	3.13	-ve
6	Nil	Nil	-ve
7	0.47	2.49	-ve
8	Nil	Nil	-ve
9	Nil	Nil	-ve
10	4.05	0.14	+ve
11	1.32	1.52	-ve
12	1.32	1.56	-ve
13**	Nil	Nil	-ve

* Data presented are average of triplicate determinations** Marine prawn from collected from estuarine waters.

Table 4. Sensory evaluation of smoke cured prawn samples

Prawn samples		Sensory evaluation scores				
		Apperance	Odour	Texture	Taste	Average
1	Average[1]	6.50	6.42	6.31	6.58	6.45
	STD[2]	0.91	1.26	0.75	1.26	
2	Average[1]	6.98	7.03	6.65	6.73	6.85
	STD[2]	0.75	1.01	0.85	1.36	
3	Average[1]	5.85	6.42	5.92	6	6.05
	STD[2]	1.20	1.15	0.89	1.35	
4	Average[1]	6.23	6.08	6.04	6.87	6.31
	STD[2]	1.18	0.93	1.05	1.27	
5	Average[1]	6.42	6.27	6.19	6.58	6.37
	STD[2]	1.04	0.97	0.69	0.70	
6	Average[1]	7.15	6.88	6.19	7.38	6.9
	STD[2]	0.97	1.16	1.14	1.25	
7	Average[1]	6.92	7.07	6.88	7.42	7.07
	STD[2]	0.93	1.12	0.81	0.95	
8	Average[1]	6.81	6.31	6.46	6.62	6.55
	STD[2]	1.25	1.44	0.0366	1.28	
9	Average[1]	6.46	6.27	6.58	6.65	6.49
	STD[2]	1.03	1.48	0.81	1.07	
10	Average[1]	5.78	6.23	6.11	6.15	6.07
	STD[2]	1.29	1.15	0.77	0.88	
11	Average[1]	5.88	5.35	5.77	6	5.75
	STD[2]	0.82	1.44	1.01	1.41	
12	Average[1]	5.27	5	5.46	5.77	5.38
	STD[2]	1.17	1.31	1.39	1.42	
13**	Average[1]	6.88	6.15	6.58	5.96	6.39
	STD[2]	1.23	1.72	1.54	1.71	

The data of 1&2 represents the average and standard deviation of the sensory evaluation of 13 panelists who participated throughout the study.

** Marine prawn from estuarine waters. Results are average of triplicate determinations

The study indicated that the miscellaneous fishes that enter net during the harvest of prawns may be retained in the net and were carried along with the prawn for smoke-curing. The presence of such fish in the product indicated inadequate care taken in post harvest handling. The presence of high percentages of extraneous material showed that proper care was not taken during the smoking process. The level of insect infestation could be attributed to improper storage methods after product preparation prior to marketing. The results indicated the need for improvement in all quarters of post harvesting handling till the product reaches the consumer.

The present study stresses the need for improvement in post harvest handling of the smoked fish products in Western Orissa. In view of occurrence of *S. aureus* in high numbers to an extent of becoming hazardous to human health, an overall quality upgradation with respect to hygiene is advocated.

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