Processing of *Psenes indicus, Decapterus* sp. and *Stolephorus* sp. to Dried Product with Low Histamine and their Storage Characteristics

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Traditional dried products like whole sundried *Stolephorus* sp., whole salted sundried *Psenes indicus* and *Decapterus* sp. were found to contain frequently high levels of histamine in muscle. An attempt was made to reduce histamine level in these fish by using suitable processing techniques. It was found that histamine in whole unsalted sun dried fish > gutted unsalted sundried fish > whole salted sundried fish > gutted salted sundried fish. During storage at ambient temperatures (30 ± 10°C), histamine levels showed decreasing trends in case of dried *P. indicus* and *Stolephorus* sp., but was irregular in case of dried *Decapterus* sp.; TVBN showed increasing trend in all dried fish during the same period.

The problem of scombrotoxin poisoning is well known. Several workers (Kimata, 1961; Hardy & Smith, 1976; Askar *et al*, 1986; Morii *et al.*, 1988; Chakrabarti, 1991) reported the histamine content of numerous varieties of fish and fishery products. Incidence of histamine poisoning in mackerel, sardine, tuna etc. are known. Chakrabarti (1991) reported the presence of high level of histamine in dried products of some unconventional fish like *Psenes indicus, Decapterus* sp. and *Stolephorus* sp. available at Kakinda coast.

Hardy *et al.*, (1976) reported that histamine development in gutted mackerel was lesser than that in ungutted one during storage at 6-12°C. Yamanaka *et al.*, (1984) reported histamine in meat of sardine, saury pike, mackerel and tuna, increased rapidly during storage at 35°C. Morii *et al.*, (1988) stated that very high percentage of histamine forming bacteria are present in the viscera and skin of fish. The present work was to find out suitable processing conditions of *Psenes indicus, Decapterus* sp. and *Stolephorus* sp. to produce dried products with considerably less histamine content for safe human consumption.

Materials and Methods

Psenes indicus (9-12 cm), *Decapterus* sp. (9-12 cm) and *Stolephorus* sp. (8.5-10 cm) caught at Kakinda bay were brought to the laboratory from landing centre within an hour. Each variety was divided into four parts and each part was processsed in different ways as stated below:

1. The whole fish were washed thoroughly in clean water and spread on raised platforms for sun drying (40 ± 5°C; 50 ± 10% RH). The whole ungutted and sundried fish (DF_1) were stored at ambient temperatures (30 ± 10°C).

2. The whole fish were washed, gutted, beheaded and then washed thoroughly in clean water. The dresssed fish were dried in sun and stored as above (DF_2).

3. The whole fish were washed, dry salted (Salt:Fish, 1:5) and kept over night. After removing thick surface layer of salt by rinsing with little water, the salted fish were sun dried and stored as at 1 (DF_3).

4. The whole fish were washed, gutted, beheaded and dry salted (Salt:fish, 1:5) as at 3. The salted fish were then sun dried and stored as at 1 (DF_4).

Overall quality of dried fish was examined by a five member panel to observe the overall effect on quality of raw dried fish due to changes in texture, colour and flavour during storage. Stored samples were analysed monthly. Moisture and sodium chloride content in fish muscle and peroxide value of fat in fish muscle were determined by AOAC procedures (1975). Total volatile base nitrogen (TVBN) content in muscle was estimated by the Conway micro-diffusion method (Conway, 1950). Histamine content in muscle was determined by AOAC (1975) method where histamine is isolated by cotton acid succinate column and estimated colorimetrically (470 nm) by coupling with a diazonium salt.

Results and Discussion

Table 1 gives the proximate composition of the fishes used in the study. *Decapterus* sp. and *Psenes indicus* are seen to be fatty but *Stolephorus* sp. is a lean fish. Table 2 shows that the histamine formation took place during processing of fish to dried product. Sharp increase in histamine content of unsalted fish vis-a-vis salted fish indicated the presence of mesophilic non-halophilic histamine forming bacteria in these fishes. Morii *et al.*, (1988) stated that histamine found in the inner muscle of fish (5 mm deep from skin) might be mainly due to its diffusion from viscera and body surface which had high proportion of histamine forming bacteria. Apart from diffusion of histamine, the penetration of histamine forming bacteria into inner muscle of whole fish with gut was possible during sun drying by rupture of belly wall, which was inaccessible to drying. Table 2 also shows that gutted dried fish always contains less histamine than ungutted fish.

Table 1. *Proximate composition of fresh fish meat*

Fish	Moisture %	Protein %	Fat %	Ash %
Psenes indicus	74.5	18.92	3.62	1.4
Decapterus sp.	75.1	16.8	4.80	1.7
Stolephorus sp.	79.4	15.1	1.30	2.6

Table 2. *Changes in moisture, histamine and total volatile base nitrogen (TVBN) content in fresh & cured fish*

Fish	Parameters	Freshfish meat	Whole ungutted unsalted sundried (DF_1)	Beheaded gutted unsalted sundried (DF_2)	Whole ungutted salted sundried (DF_3)	Beheaded gutted salted sundried (DF_4)
Psenes indicus	Moisture, %	74.6-75.4	24-26	22-25	42-44	40-43
	Histamine, mg%	4.1-8.2	111-215	80-110	64-80	37-76
	TVBN, mg %	18.7-25.2	150-280	120-220	46-59	40-57
	Salt, %	-	-	-	14-16	13-15
Decapterus sp.	Moisture, %	75.1-76.6	16-20	25-27	38-41	40-42
	Histamine, mg %	4.5-9.1	120-248	70-130	46-78	40-62
	TVBN, mg%	14.5-28.6	180-353	155-319	89-171	49-123
	Salt, %	-	-	-	13-16	14-16
Stolephorus sp.	Moisture, %	78.8-79.4	12-16	10-13	31-34	29-32
	Histamine, mg %	7.5-11.7	20-90	19-45	4-15	4-9
	TVBN, mg %	8.1-18.4	151-212	108-190	50-151	45-90
	Salt, %	-	-	-	14-16	13-14

Table 3. *Changes in histamine content, and TVBN content in muscle and peroxide value (PV) of fat in muscle of different dried Psenes indicus during storage at ambient temperature (30 ± 10°C)*

Storage period, months	Histamine, mg %		TVBN, mg %		PV, milli equiv O_2/kg of fat	
	DF_3	DF_4	DF_3	DF_4	DF_3	DF_4
0	64.2 ± 2.21	37.1 ± 2.03	46.6 ± 1.21	40.8 ± 1.18	17.5 ± 0.51	51.3 ± 0.41
1	44.1 ± 2.01	28.1 ± 1.92	125.6 ± 1.61	85.4 ± 1.28	25.1 ± 1.28	27.5 ± 0.65
2	24.2 ± 1.84	20.0 ± 1.81	134.9 ± 1.64	121.6 ± 1.78	29.5 ± 0.71	34.6 ± 0.74
3	20.1 ± 1.73*	18.1 ± 1.52	151.2 ± 1.85	144.9 ± 1.81	13.4 ± 0.36	17.6 ± 0.44
4	-	15.2 ± 1.16*	-	165.1 ± 1.92	-	14.4 ± 0.39

*Poor overall quality

Table 4. *Changes in histamine content and TVBN content in muscle and peroxide value (PV) of fat in muscle of different dried Decapterus sp. during storage at ambient temperatures (30 ± 10°C)*

Storage period, months	Histamine, mg %		TVBN, mg %		PV, milli equiv O_2/kg of fat	
	DF_3	DF_4	DF_3	DF_4	DF_3	DF_4
0	78.1 ± 2.51	40.5 ± 2.21	89.5 ± 1.31	49.2 ± 1.24	12.3 ± 0.33	10.1 ± 0.28
1	63.5 ± 2.33	45.5 ± 2.24	140.7 ± 1.78	120.5 ± 1.65	14.5 ± 0.39	15.0 ± 0.42
2	48.1 ± 2.18	38.0 ± 2.14	192.5 ± 1.98	178.9 ± 1.98	25.5 ± 0.58	26.8 ± 0.61
3	68.2 ± 2.38*	34.1 ± 2.11	257.5 ± 2.23	197.8 ± 2.01	20.2 ± 0.58	28.2 ± 0.63
4		52.1*		231.2 ± 2.15		22.1 ± 0.59

*Poor overall quality

Hardy *et al.* (1976) and Morii *et al.* (1988) reported similar results in mackerel. Table 2 shows that histamine formation in unsalted *Stolephorus* sp. is very high but histamine formation in salted *Stolephorus* sp. even with gut is considerably less in comparision with other salted fish under study. The faster penetration of salt in the body of *Stolephorus* sp. due to their thin skin and small size might be responsible in controlling the growth of histamine forming bacteria quickly.

Total volatile base nitrogen in unsalted dried fish (Table 2) was very high in comparison to salted dried fish indicating the arresting of growth of putrefactive bacteria in the presence of common salt.

Tables 3, 4 & 5 show the changes in dried fish during storage at ambient temperature. Whole salted dried fish had shorter storage life than gutted and salted dried fish. Histamine levels in dried *Psenes indicus* and *Stolephorus* sp. decreased during the period of storage; but did not show any uniform trend in dried *Decapterus* sp. Similarly Yamanaka *et al.* (1984) reported decreasing trend of histamine content in skipjack and big eye tuna, but irregular trend of histamine content in saury pike, during long storage at 35°C. Tables 3 and 4 show that

Table 5. *Changes in histamine content and TVBN content in muscle of different dried Stolephorus sp during storage at ambient temperature (30 ± 10°C)*

Storage period, months	Histamine, mg %		TVBN, mg %	
	DF_1	DF_3	DF_1	DF_3
0	89.5 ± 2.48	15.1 ± 0.96	185.1 ± 1.95	146.5 ± 1.71
1	75.8 ± 2.41	8.0 ± 0.69	195.2 ± 2.02	149.6 ± 1.82
2	70.8 ± 2.35	7.8 ± 0.65	201.9 ± 2.11	149.8 ± 1.85
3	68.7 ± 2.31	6.5 ± 0.71	207.6 ± 2.14	150.5 ± 1.91
4	60.2 ± 2.25	5.0 ± 0.61	209.1 ± 2.18	155.5 ± 1.89
5	65.1 ± 2.28	4.5 ± 0.58	212.8 ± 2.16	166.1 ± 1.93
6	57.8 ± 2.21*	4.2 ± 0.51	225.6 ± 2.21	168.2 ± 1.95
7		4.0 ± 0.58*		174.8 ± 1.98

*Poor overall quality

peroxide values in gutted fish were always slightly more than that in ungutted fish. The higher rate of formation of hydroperoxide in gutted fatty fish may be on the basis of greater surface area exposed to air (Hardy *et al.*, 1976).

The conventional dried products viz. whole salted sundried *Decapterus* sp., whole salted sundried *Psenes indicus* and whole unsalted sundried *Stolephorus* sp. could be upgraded by adopting suitable processing techniques. The results show that by gutting and salting of *Psenes indicus, Decapterus* sp and *Stolephorus* sp. before sundrying, cured and dried products with relatively low histamine content can be prepared.

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