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Fungi in Salted and Dried Fish of Kakinada Coast

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Aspergillus fumigatus, Aspergillus niger and *Mucor* were the common fungi in salted and dried fish at Kakinada coast; *A. niger* was the dominant fungi in rainy season. Time taken for growth of fungus to become visible was different in different types of salted and dried fish; it also varied with the season. Rapid growth of fungi was noticed in rainy season.

Key words : Fungi, salted and dried fish, Kakinada coast.

The quality of dry salted fish is adversely affected by the occurrence of fungi. Presence of different types of fungi in dried fish has been reported by several workers (Phillips & Wallbridge, 1976; FAO, 1982; Gupta & Samuel, 1985; CIFT, 1994); the dominant fungi in dried salted fish varied with the place. The commonly occurring fungi in the west coast of India are *Aspergillus* sp. including mycotoxin producing *A. flavus* and *A. ochraceus, Fusarium* sp., *Rhizopus* and *Mucor* (Ibid). Apart from contaminated salt and fish, other common sources of fungi are air and dust in and around fish processing plants, store rooms (FAO, 1982), contaminated coastal water and unhygienic onboard handling practices (Prabhakaran & Gupta, 1990). A survey on the presence of fungi in fish and fishery products available all along the Indian coastal disricts is yet to be completed. This paper reports the presence of different types of fungi in dried fish available at Kakinada coast.

Materials and Methods

Good quality dried fish free from visible fungi infection were brought to the laboratory from local salted fish processors. Each type of fish sample was divided into two parts. One part of sample was cut into small pieces and mixed asceptically; 5 g of mixed sample were transferred asceptically to 50 ml potato dextrose broth in a conical flask. After incubation for 3 days at 28±2°C, 0.1 ml innoculum was spread on potato dextrose agar (PDA) in 80 mm dia petri dish in triplicate; and incubated at 28±2°C for 5 days. Different types of fungal colonies appearing on the plates were isolated and transferred to PDA slants. After incubation for 5 days at 28±2°C, the slants were stored in refrigerator for purification and identification as per Pitt & Hocking, (1985).

The other part of the dried fish sample was stored in polyethylene tape woven bags at ambient conditions. Fungal infected samples identified by the above method were separated and the study on the storage characteristics was continued only with these samples. The moisture, sodium chloride and fat content of meat of fish samples and peroxide values of the fat in meat were

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estimated by standard methods (AOAC, 1975). Total volatile base nitrogen (TVBN) was determined from trichloro acetic acid extract of the meat by the micro-diffusion method (Conway, 1947), where TVBN evaporating from alkalinised sample in one chamber was absorbed by dilute acid in other chamber of the closed apparatus. Water activity of the meat of fish samples was measured from moisture sorption isotherms at different humidity levels for 48 h and the corresponding water activity (Ross, 1975). Quality of dry fish samples was rated by five experienced panel members every fortnight. Potato dextorse agar plate was exposed to air at field and laboratory for 30 min. and the different types of fungal colonies appearing on the plate were isolated and identified as mentioned earlier. Statistical analysis was conducted as per Snedecor and Cochran (1967).

Results and Discussion

Mullet (22-30 cm), seer (35-45 cm) and Indian salmon (25-30 cm) are fatty fish with 4 to 5% fat content. Jew fish (18-22 cm) is a lean fish with less than 2% fat content. Though there was no visible fungal colony in any of the dried market samples, the presence of different types of fungi (Table 1) in many samples were revealed after enrichment in potato dextrose broth and plating on PDA. Table 1 shows that the dominant fungus in salted and dried fish samples during summer and winter seasons was *Aspergillus fumigatus*, while *Aspergillus niger* was the dominant fungi in rainy season. Gupta & Samuel (1985) also reported athat *A. niger* infection was common in shrimp and anchovies during rainy season on Cochin coast. Slight variation in the types of fungi present among four types of fish samples was also noticed (Table 1). *Aeromycological* study showed that *A. fumigatus*, *A. niger* and *Mucor* were common air borne fungi at Kakinada.

Table 1. Seasonal variation of fungi in salted and dried fish

Fish	Fungi in different seasons		
	March-June (Summer)	July-Oct. (Monsoon)	Nov.-Feb. (Winter)
Gutted salted and sun dried mullet (*Mugil cephalus*)	*Aspergillus fumigatus*	*A. fumigatus*	*A. fumigatus*
Gutted, salted and sun dried jew fish (Sciaenid)	*Mucor*	*A. niger*	*A. niger*
Split salted and sun dried Indian salmon (*Polynemus* sp.)	*Aspergillus fumigatus*	*A. niger*	*A. fumigatus*
Split salted and sun dried (*Scomberomorus guttatus*)	*Aspergillus niger*	*A. niger*	*A. fumigatus*

Sodium chloride content in the meat of salted and dried mullet, jew fish, Indian salmon and seer was 11.7-14.1, 10.3-11.4, 13.2-15.6 and 13.2-14.5% respectively. Tables 2, 3 & 4 show that the time taken for growth of fungal colony to visible range was different in the four types of samples and it also varied with the season. During storage in the rainy season visible fungal colonies appeared quickly in large numbers on all types of samples. Rao *et al.* (1962) reported that fungal growth was a major cause of spoilage at all levels of relative humidity above 70%. Table 2 shows the considerable loss of moisture from all types of meat during storage in summer. This decreased the water activity to some extent, but it was still well above the limit required to stop fungal growth. Visible fungal colony appeared late on

Table 2. Changes in selected parameters of dried fish during storage in summer (March-June) 31±3°C, 60±20% RH

Sample & Parameters	Days, storage 0	30	60	75	90
Gutted salted sundried Mullet					
Moisture, %	43.4 ±2.1	28.3 ±1.6	24.9 ±1.1	23.8 ±1.1	22.6 ±1.4
Water activity*	0.915	0.845	0.830	0.820	0.815
TVBN mg%	117.7 ±5.1	150.1 ±6.8	191.6 ±8.1	234.2 ±8.9	263.1 ±10.1
Visible Fungal colony	Nil	Nil	+	+	+
Gutted salted sundried Jew Fish					
Moisture, %	40.3 ±1.8	27.3 ±1.6	24.2 ±1.4	23.6 ±1.6	22.3 ±1.1
Water activity*	0.885	0.835	0.825	0.815	0.810
TVBN, mg%	116.1 ±3.1	145.6 ±4.2	181.3 ±5.6	210.0 ±4.8	253.5 ±9.1
Visible Fungal colony	Nil	+	+	+	+
Split salted sundried Indian Salmon					
Moisture, %	45.5 ±2.4	25.6 ±1.5	21.1 ±1.3	21.6 ±0.8	20.2 ±1.0
Water activity*	0.920	0.815	0.800	0.795	0.790
TVBN, mg%	140.1 ±5.1	165.6 ±6.4	227.6 ±8.6	235.2 ±7.5	276.1 ±8.8
Visible Fungal colony	Nil	Nil	Nil	Nil	+
Split salted sundried Seer					
Moisture, %	46.4 ±1.8	36.3 ±1.6	32.8 ±1.3	30.1 ±1.4	29.2 ±1.1
Water activity*	0.890	0.850	0.840	0.835	0.830
TVBN, mg%	123.0	165.1	224.9	256.3	285.1
Visible Fungal colony	Nil	Nil	Nil	+	+

+ = a few scattered colonies; ++ = many isolated colonies; * mean value of four determinations

Table 3. Changes in selected parameters of dried fish during storage in Monsoon (July-October) 28±2°C, 85±15% RH

Sample & Parameters	Days, storage 0	30	45	60
Gutted salted sundried Mullet				
Moisture, %	47.6 ±1.5	42.2 ±1.1	42.8 ±1.6	43.5 ±1.8
Water activity*	0.930	0.905	0.900	0.910
TVBN mg%	125.2 ±4.2	150.1 ±6.8	188.2 ±6.4	225.0 ±9.1
Visible Fungal colony	Nil	Nil	Nil	++
Gutted salted sundried Jew Fish				
Moisture, %	46.2 ±2.2	42.7 ±1.8	43.1 ±1.1	44.6 ±1.6
Water activity*	0.920	0.895	0.900	0.905
TVBN, mg%	112.2 ±6.1	138.2 ±5.2	185.2 ±8.3	210.6 ±7.6
Visible Fungal colony	Nil	Nil	Nil	++
Split salted sundried Indian Salmon				
Moisture, %	46.5 ±1.8	42.2 ±1.1	43.3 ±1.4	44.1 ±1.8
Water activity*	0.930	0.905	0.915	0.920
TVBN, mg%	115.4 ±3.1	144.4 ±5.5	192.6 ±6.3	234.2 ±7.8
Visible Fungal colony	Nil	Nil	+	++
Split salted sundried Seer				
Moisture, %	45.3 ±2.5	44.9 ±2.8	45.2 ±2.1	45.1 ±1.9
Water activity*	0.880	0.875	0.875	0.880
TVBN, mg%	161.7 ±5.4	171.1 ±6.8	196.3 ±8.8	265.1 ±15.2
Visible Fungal colony	Nil	Nil	+	++

+ = a few scattered colonies; ++ = many isolated colonies; * mean value of four determinations

Indian salmon probably because of the compositional differences among the four dried fish. Peroxide value did not show any regular trend during storage of fatty fish; it varied between 30.4 to 63.0 meq O2/kg fat. Fatty fish samples became highly rancid by 60 days during

Table 4. Changes in selected parameters of dried fish during storage in winter (Nov.-Feb.) 25±3°C, 75±15% RH

Sample & Parameters	Days, storage 0	30	60	75	90
Gutted salted sundried Mullet					
Moisture, %	44.1 ±1.4	39.1 ±1.2	37.5 ±1.1	35.1 ±0.6	34.4 ±0.8
Water activity*	0.917	0.890	0.885	0.880	0.870
TVBN mg%	100.3 ±2.6	126.6 ±3.2	151.3 ±4.6	168.1 ±5.2	182.1 ±8.4
Visible Fungal colony	Nil	Nil	Nil	+	+
Gutted salted sundried Jew Fish					
Moisture, %	45.0 ±0.8	40.2 ±0.6	39.5 ±0.5	38.3 ±0.6	36.1 ±1.1
Water activity*	0.910	0.885	0.880	0.870	0.865
TVBN, mg%	105.6 ±4.5	140.1 ±3.2	188.2 ±5.6	196.8 ±8.1	210.1 ±7.2
Visible Fungal colony	Nil	Nil	Nil	+	+
Split salted sundried Indian Salmon					
Moisture, %	44.5 ±2.1	38.4 ±1.6	36.6 ±1.4	32.4 ±1.4	30.6 ±1.1
Water activity*	0.915	0.860	0.860	0.845	0.840
TVBN, mg%	137.8 ±3.5	152.1 ±3.6	171.9 ±4.4	184.2 ±5.5	191.1 ±6.1
Visible Fungal colony	Nil	Nil	Nil	Nil	+
Split salted sundried Seer					
Moisture, %	42.6 ±1.5	38.8 ±1.3	38.3 ±1.1	36.8 ±1.3	35.1 ±0.9
Water activity*	0.870	0.855	0.855	0.850	0.845
TVBN, mg%	121.8 ±3.2	142.2 ±4.6	198.4 ±6.8	205.3 ±10.2	225.3 ±12.6
Visible Fungal colony	Nil	Nil	+	+	+

+ = a few scattered colonies; ++ = many isolated colonies;
* mean value of four determinations

summer and by 90 days during winter. Total volatile base nitrogen content in all samples showed increasing trend during storage in all seasons. Visible fungi colony was noticed much earlier in some samples before the TVBN values reached the maximum permissible limits for dried fish (Connell, 1975).

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