

Distribution of Salmonella Serotypes in Fish in Retail Trade in Kochi

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This study assesses the prevalence of salmonella and the distribution of different serotypes in fresh as well as frozen fish in retail trade in Cochin. 5.76% of the 156 fresh fish and 8.66% of the 127 frozen fish samples were found to be contaminated with Salmonella. The 32 strains of salmonella isolated belonged to 16 different serotypes and these included a few very rarely occurring serotypes like *S. adelaide*, *S. barendrup*, *S. chingola*, *S. cerro*, *S. nchanga*, *S. oslo* and *S. mbandaka*. Three serotypes namely, *S. barendrup*, *S. emek* and *S. adelaide* were isolated from fresh as well as frozen fish samples, and others were isolated from either fresh or frozen fish samples.

Salmonellosis is an important food-borne disease and accounts for the majority of all outbreaks of such disease where the causative agent is identified (Anon, 1988). Over 2000 salmonella serotypes are known today and in India more than 160 serotypes have been isolated from various sources (Iyer & Srivastava, 1989). The isolation of salmonella serotypes from various sources has been reported by several workers in India, and the pattern of Salmonella serotypes in India has been reported by the National Salmonella and Escherichia Centre, Kasauli (Nath *et al.*, 1966 & 1970; Saxena *et al.*, 1980 & 1983). Recently the occurrence of Salmonella in meat has been reported by Bachhil & Jaiswal (1988), and in fishery products by Iyer & Srivastava (1989). The present study was undertaken to assess the prevalence of Salmonella and the distribution of different serotypes in fresh as well as frozen fish in retail trade in Cochin.

Materials and Methods

Samples of fresh and frozen fish of different species were collected from retail market and cold storages in Cochin respectively during 1985 - '87.

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The samples were brought to the laboratory under aseptic conditions and were analysed immediately as per AOAC (1975) methods. The isolated strains were tested for morphological and biochemical characteristics as per standard methods (Harrigan & McCance, 1976). The strains were serotyped at the National Salmonella and Escherichia Centre, Central Research Institute, Kasauli (India) following the methods of Edwards and Ewing (1972) and Cowan (1972).

Results and Discussion

The morphological and biochemical characteristics of the Salmonella strains isolated from fresh as well as frozen fish are presented in Table 1. All the strains showed characteristics typical of Salmonella species. The distribution of different Salmonella serotypes in fresh and frozen fish are given in Tables 2 and 3 respectively.

Nine out of the 156 fresh samples (5.76%) and 11 out of the 127 frozen fish samples (8.66%) were found to be contaminated with Salmonella. The incidence of Salmonella in fresh fish was more in grey mullet and Pallikora (12.5%) followed by tilapia (11.1%), sardines (10%) and kilimeen (9.09%). In the case of frozen fish, the incidence of Salmonella was more in pearl spot (14.28%) followed by black pomfret (13.04%),

Table 1. Morphological and biochemical characteristics of *Salmonella* strains isolated from fish

Test	Typical reaction of <i>Salmonella</i> spp.*	Percentage of strains showing the reaction
Gram reaction	-	100
Shape	Short rods	100
Motility	+	100
Triple sugar Iron Agar		
a) Slant	Alk	100
b) Butt	Acid	100
c) H ₂ S	+	100
d) Gas	+	62.5
	-	37.5
Lysine Iron Agar		
a) Slant	Alk	100
b) Butt	Alk	100
c) H ₂ S	+	25
	-	75
Urease	-	100
Indole	-	100
Fermentation of		
a) Glucose	AG	100
b) Lactose	-	100
c) Sucrose	-	100
d) Dulcitol	AG	100
e) Salicin	-	100
Citrate utilization	+	100
M. R.	+	100
V.P.	-	100
Malonate utilization	-	100
Ornithine decarboxylase	+	100
Gelatin liquefaction	-	100
Nitrate reduction	+	100
Phenylalanine deaminase	-	100
Oxidase	-	100
Lysine decarboxylase	+	100

* Serological identification of *Salmonella*, Nov. 1977. Difco Laboratories, Detroit, Michigan, U.S.A..

Key: Alk. Alkaline reaction; AG. Acid and Gas

Total Number of strains tested=32

horse mackerel (12.5%), seer (7.69%) and silver pomfret (5.55%). The maximum number of eight serotypes were isolated from three different samples of grey mullet, followed by 4 serotypes from two different samples each of sardine and tilapia and 2 serotypes from one sample each of kilimeen and Pallikora. In the case of frozen fish only one serotype each was isolated from the positive samples. 21 strains belonging to 11 different serotypes were isolated from fresh fish and 11 strains belonging to 8 different serotypes from frozen fish. In the case of fresh fish, the most prevalent serotype was *S. virchow* and *S. weltevreden*, having been isolated from three different species of fish. Similarly, in the case of frozen fish *S. cerro* was the most prevalent serotype, being found in three different species of fish. 32 strains belonging to 16 different serotypes were isolated in total, and the source-wise distribution of different serotypes is presented in Table 4.

Among the sixteen different serotypes of *Salmonella* isolated in the present study the isolation of *S. nchanga*, *S. chingola*, *S. richmond* and *S. oslo* from fresh fish, *S. mbandaka* and *S. cerro* from frozen fish and *S. braendrup* and *S. adelaide* from fresh as well as frozen fish is of great significance since these serotypes have so far not been reported from fish. *S. mbandaka* and *S. oslo* have been reported from human sources only (Saxena *et al.*, 1983; Anon, 1984 a,b, 1985 and 1986), *S. chingola*, *S. cerro*, *S. richmond*, and *S. nchanga* from human sources, sewage water frozen froglegs and lobster (Saxena *et al.*, 1980, 1983; Anon, 1984 a, b, 1985, 1986; Iyer & Srivastava, 1989) and *S. braendrup* from human sources and mussel meat (Anon 1984, Iyer & Varma, 1987). There are only very few reports of the isolation of *S. adelaide* in India (Anon, 1984 a&b). *S. emek* which was isolated from fresh as well as frozen fish have been reported earlier from poultry and fish (Saxena *et al.*, 1983)

Other serotypes of salmonella isolated in the present study like *S. barcilly*, *S. senftenberg*, *S. typhimurium*, *S. weltevreden*, *S. virchow* and *S. chester* have been reported in large numbers from

Table 2. *Distribution of Salmonella serotypes in fresh fish*

Fish	Number of samples Tested positive		Serotypes isolated
Grammullet (<i>Mugil cephalus</i>)	24	3	<i>S. chester</i> <i>S. richmond</i> <i>S. weltevreden</i> <i>S. oslo</i> <i>S. Chingola</i> <i>S. nchanga</i> <i>S. braendrup</i> <i>S. virchow</i>
Sardines (<i>Sardinella longiceps</i>)	20	2	<i>S. weltevreden</i> <i>S. oslo</i> <i>S. virchow</i> <i>S. bareilly</i>
Tilapia (<i>Tilapia mossambica</i>)	18	2	<i>S. weltevreden</i> <i>S. emek</i> <i>S. chingola</i> <i>S. nchanga</i>
Kilimeen (<i>Nemopterus japonicus</i>)	11	1	<i>S. adelaide</i> <i>S. virchow</i>
Pallikora (<i>Otolithus argenticus</i>)	8	1	<i>S. braendrup</i> <i>S. emek</i>
Others	75	0	-
Total	156	9	vide supra

various sources including fish (Saxena *et al.*, 1980 & 1983; Anon, 1984 a,b, 1985 & 1986, Iyer, & Srivastava, 1989; Bachhil & Jaiswal, 1988).

All the serotypes of *Salmonella* isolated in the present study have been implicated in human salmonellosis (Anon, 1978) and therefore the isolation of these serotypes from fresh as well

Table 3 *Distribution of Salmonella serotypes in frozen fish*

Fish	Number of samples Tested positive		Serotypes isolated
Pearl Spot (<i>Entroplus Suratensis</i>)	28	4	<i>S. braaendrup</i> , <i>S. adelaide</i> , <i>S. cerro</i> , <i>S. I. Rough strain</i>
Black pomfret (<i>Parastromateus niger</i>)	23	3	<i>S. cerro</i> <i>S. emek</i> , <i>S. mbandaka</i>
Seer (<i>Scomberomorus quattatus</i>)	26	2	<i>S. typhimurium</i> <i>S. cerro</i>
Silver pompret (<i>Pampus argentius</i>)	18	1	<i>S. braendrup</i>
Horse mackerel (<i>Megalaspis cordyla</i>)	8	1	<i>S. senftenberg</i>
Others	24	0	
Total	127	11	Vide supra

as frozen fish in the retail trade is of great significance from the point of view of health hazards. Eventhough the chances of getting infection by consumption of fish are rare since *Salmonella* is sensitive to heat, there are possibilities of cross contamination of other food items which are not subjected to heat treatment and thereby cause infection.

Table 4. Source-wise distribution of *Salmonella* serotypes in fresh and frozen fish

Serotypes	Antigenic structure	Number of strains isolated from							Total	
		Grey mullet	Fresh fish	Kili-meen	Palli-kora	S. pom-fret	Pearl spot	Frozen fish		
		Tilapia	Sardines					Seer B. pom-fret	Horse mackerel	
<i>S. adelaide</i>	35:f, g:-	..	..	1	..	..	1	..	..	2
<i>S. bareilly</i>	6,7:y:1,5	..	1	..	..	..	..	..	..	1
<i>S. braendrup</i>	6,7:e,h,e,n,z15	1	..	..	1	1	1	..	..	4
<i>S. cerro</i>	18:z4,z23:-	..	..	..	..	..	1	1	..	3
<i>S. chester</i>	4,12:e,h:e,n,x	1	..	..	..	..	..	..	..	1
<i>S. chingola</i>	11:e,h:1,2	1	2	..	..	..	..	..	..	3
<i>S. emek</i>	8,20:g,m,s:-	..	1	..	1	..	..	1	..	3
<i>S. mbandaka</i>	6,7:z10:e,n,z15	..	..	..	..	..	..	1	..	1
<i>S. nchanga</i>	3,10:1,v:1,2	1	1	..	..	..	..	..	..	2
<i>S. oslo</i>	6,7:a,e,n,x	1	..	1	..	..	..	..	..	2
<i>S. richmond</i>	6,7:y:1,2	1	..	..	..	..	..	..	..	1
<i>S. senftenberg</i>	1,3,19:g,s,t:-	..	..	..	..	..	..	..	..	1
<i>S. typhimurium</i>	4,5,12:i,1,2	..	..	..	..	..	..	..	..	1
<i>S. virchow</i>	6,7:r:1,2	1	..	1	..	..	..	..	..	3
<i>S. weltevreden</i>	3,10:r:z6	1	1	..	..	..	..	..	..	3
S.I. Rough strain -y:-		..	..	..	..	..	1	..	..	1
Total		8	5	4	2	2	1	2	3	32

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References

- Anon (1978) *Salmonella Surveillance Annual Summary* 1978 (Issued in 1981). U. S. Department of Health and Human Services, Public Health Service, Centres for Disease Control, Atlanta, Georgia, U.S.A.
- Anon (1984 a) *Salmonella Surveillance Bulletin*, No. 5, March 1984. National Salmonella and Escherichia Centre, Central Research Institute, Kasauli (H.P.), India
- Anon (1984 b) *Salmonella Surveillance Bulletin*, No. 8, Dec. 1984. National Salmonella and Escherichia Centre, Central Research Institute, Kasauli (H. P.) India
- Anon (1985) *Salmonella Surveillance Bulletin*, No.9, National Salmonella and Escherichia Centre, Central Research Institute, Kasauli (H. P), India
- Anon (1986) *Salmonella Surveillance Bulletin*, No. 10, National Salmonella and Escherichia Centre, Central Research Institute, Kasauli (H. P.), India
- Anon (1988) *Salmonellosis Control: the role of animal & product hygiene* - Report of a WHO Expert Committee Technical Report Series 774, WHO (1988), Geneva
- AOAC (1975) *Official Methods of Analysis* (Horwitz, W., Ed.) 12th edn. Association of Official Analytical Chemists, Washington.
- Bachhil, V. N. & Jaiswal, T. N. (1988) *J. Fd Sci. Technol.* **25**, 310
- Cowan, S. T. (1972) *Cowan and Steel's Manual for the Identification of Medical Bacteria*. Cambridge University Press, Cambridge
- Edwards, P. R. & Ewing, W. H. (1972) *Identification of Enterobacteriaceae*. 3rd edn. Burgess Publishing Company, Minneapolis.
- Harrigan, W. F. & McCance, M. E. (1976) in *Laboratory Methods in Food and Dairy Microbiology*, Academic Press, London.
- Iyer, T.S.G. & Varma, P.R.G. (1987) *Fish. Technol.* **24**, 138
- Iyer, T. S. G. & Srivastav. K. P (1989) *Fish. Technol.* **26**, 131
- Nath, M. L., Srivastav, J. B., Sethi, S. K. & Singh, J. (1966) *Ind. J. Med. Res.* **54**, 512
- Nath, M. L., Singh, J. & Bhandari, S. K. (1970) *Ind. J. Med. Res.* **58**, 1563
- Saxena, S. N., Ahuja, S., Mago, M. L. & Singh, S. M. (1980) *Ind. J. Med. Res.* **72**, 159
- Saxena, S. N., Mago, M. L., Bahu, I.N.R., Ahuja, S. & Singh, H. (1983) *Ind. J. Med. Res.* **77**, 10