

Reliability of *Escherichia coli* and Faecal Streptococci as Indicators of *Salmonella* in Frozen Fishery Products*

T. S. GOPALAKRISHNA IYER

Central Institute of Fisheries Technology, Cochin - 682 029

and

K. P. SHRIVASTAVA

Export Inspection Agency (Ministry of Commerce, Govt. of India), New Delhi-110 005

The results obtained in the present study suggest that *Escherichia coli* and faecal streptococci are of little value as indicators of the possible presence of *Salmonella* in frozen fishery products.

Fishery products, if they have to be certified fit for human consumption, must be free from pathogenic micro-organisms of enteric origin. Usually, it would be extremely hard and time consuming to isolate and identify all the pathogenic organisms from the samples drawn from each day's production. Hence the practice, which had been in vogue for many years and still continues, is to test for the presence of 'faecal indicator bacteria' and their presence in any product indicates the presence of certain other pathogens of intestinal origin. However, the value of faecal indicator bacteria as indices of pathogenic organisms in fish has recently been questioned (Liston, 1980; Hobbs, 1982; Mossel, 1982), and increasing amount of evidence shows that there is no good correlation between the two (Hobbs, 1983). It was, therefore, considered desirable to study whether there is any correlation between the presence of faecal indicator organisms and the enteric pathogens. The results obtained during the present study are discussed in this paper.

Materials and Methods

A detailed study on the incidence of certain bacteria of public health significance in some commercially important frozen fishery products involving 600 samples collected from

the processing factories at Cochin was carried out. Out of these samples, 24 typical cases have been selected for inclusion in this paper. Enumeration of total bacteria, *E. coli* and faecal streptococci was done as per the method given in Indian Standard Specifications (Joseph, 1979). *Salmonella* was detected according to the Official Methods of Analysis (AOAC, 1975).

Results and Discussion

Table 1 details the total bacterial counts and the number of faecal streptococci and *E. coli* in the 24 *Salmonella* - positive samples. Out of these 24 *Salmonella* - positive samples, seven (nos. 1-7), mostly fish and shrimps, did not contain either *E. coli* or faecal streptococci and 10 (nos. 8-17) contained faecal streptococci in low numbers (less than 250/g in 80% of the cases) but no *E. coli*, sample no. 14 being a typical example of the isolation of *Salmonella* where the total bacterial count was as low as 724/g. The remaining 7 *Salmonella*-positive samples (nos. 18-24) showed the presence of both faecal streptococci and *E. coli*.

The presence of *Salmonella* in the absence of faecal indicator bacteria indicates that there is no correlation between the occurrence of the two in a sample, although it is traditionally assumed that the presence of *E. coli* and faecal streptococci in a food product indicates the possible presence of intestinal

*Formed part of the Ph.D. thesis of the first author approved by the University of Kerala.

Table 1. *Total bacterial count and the incidence of E. coli and faecal streptococci in Salmonella-positive samples of fishery products*

Serial No. of samples	Type of products	Total bacterial count/g	Faecal streptococci/g	<i>E. coli</i> /g
1	Frozen shrimps HL	3.1×10^5	0	0
2	Frozen shrimps HL	8.5×10^4	0	0
3	Frozen seer fish	8.2×10^3	0	0
4	Frozen seer fish	3.8×10^3	0	0
5	Frozen red snapper	8.4×10^4	0	0
6	Frozen cuttle fish	3.8×10^3	0	0
7	Frozen frog legs	6.2×10^4	0	0
8	Frozen shrimps HL	4.2×10^5	110	0
9	Frozen shrimps HL	1.5×10^5	210	0
10	Frozen shrimps PD	6.4×10^5	340	0
11	Frozen shrimps PD	9.2×10^5	550	0
12	Frozen lobsters HL	6.2×10^5	200	0
13	Frozen cuttle fish	1.1×10^6	133	0
14	Frozen frog legs	7.2×10^2	72	0
15	Frozen frog legs	6.0×10^4	60	0
16	Frozen frog legs	6.3×10^4	120	0
17	Frozen frog legs	9.4×10^3	154	0
18	Frozen shrimps PD	5.3×10^6	145	55
19	Frozen shrimps PD	3.1×10^5	210	70
20	Frozen seer fish	6.5×10^4	1000	10
21	Frozen seer fish	4.2×10^4	90	15
22	Frozen cuttle fish	4.7×10^4	510	85
23	Frozen cuttle fish	2.5×10^4	650	10
24	Frozen frog legs	5.1×10^4	1228	30

Each serial number represents only one *Salmonella* - positive sample of the concerned product. HL = headless shellon; PD = peeled and deveined; O = organism absent

pathogens such as *Salmonella*. The present study fully supports the observations of Liston (1980), Gilbert (1982) and Hobbs (1982, 1983) that the traditional faecal indicator bacteria are of little value as the indicators of the possible presence of pathogens.

However, this work does not, in any way, underestimate the significance of the presence of *E. coli* and faecal streptococci in fishery products as they are excellent indicators of hygienic standard of fish processing units.

Even in the cases where only faecal streptococci were present (nos. 8-17) or both *E. coli* and faecal streptococci were present (nos. 18-24) direct contamination of the material with faecal matter seems unlikely,

since in the case of most of the samples the number of the faecal indicator bacteria was significantly low and the results indicated that the contamination might have been caused by uncleaned utensils, water, ice and similar sources.

The isolation of *Salmonella* from a sample (no. 14) having a total bacterial count of 724 organisms/g only indicates that low bacterial counts do not always guarantee freedom from pathogens.

The results obtained in the present study suggest that *E. coli* and faecal streptococci are of little value as indicators of the possible presence of *Salmonella* in frozen fishery products.

One of the authors (T.S.G. Iyer) is thankful to Shri M.R. Nair, Director of Central Institute of Fisheries Technology, Cochin for his kind permission to publish this paper.

References

- AOAC (1975) *Official Methods of Analysis*. (Horwitz, W., Ed.) 12th edn., Association of Official Analytical Chemists, Washington
- Gilbert, R.J. (1982) in *Control of the Microbial Contamination of Foods and Feeds in International Trade; Microbial Standards and Specifications* (Kurata, H. & Hesselstine, C.W., Eds.) p. 105, Sailcon Publishing Company Ltd., Tokyo
- Hobbs, G. (1982) *Antonie Van Leeuwenhoek*, **48**, 619
- Hobbs, G. (1983) *Marker Organisms in Fresh Fish in Relation to Spoilage and Public Health*, TD 1755, Torry Research Station, Aberdeen, Scotland
- Joseph, A.C. (1979) in *Quality Control in Fish Processing*, Central Institute of Fisheries Technology, Cochin, India
- Liston, J. (1980) in *Advances in Fish Science and Technology* (Connell, J.J., Ed.) p. 151, Fishing News (Books) Ltd., London
- Mossel, D.A.A. (1982) *Microbiology of Foods - The Ecological Essentials of Assurance and Assessment of Safety and Quality*. 3rd edn., The University of Utrecht, The Netherlands