

Quality of Shrimps Landed in Different Fish Landing Centers of Tuticorin, Tamil Nadu

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A comparative study on the quality of shrimps landed in four fish landing centers (Therespuram, Punnakayal, Tuticorin fishing harbour and Tharuvaikulam) of Tuticorin region was investigated. The shrimps collected from the landing centers scored an overall sensory score of > 7.0 out of 10.0. Most of the shrimps (80%) collected had TMA-N content more than 5 mg%. TVB-N content of only 40% of the shrimps exceeded the limit of 30 mg%. Indole was higher than $3.1\mu\text{g}/100\text{g}$ in all the samples, but within $25\mu\text{g}/100\text{g}$. The total bacterial load of 75% of shrimps were within the acceptable level of 10^5 cfu/g . Total and faecal coliforms and *E. coli* counts of shrimps of Therespuram were quite high. *Staphylococcus aureus* counts were high in shrimps of Punnakayal. *Vibrio parahaemolyticus* counts were almost similar in all the samples. *V. cholerae*, *Salmonellae* and *Listeria monocytogenes* were absent in all the shrimp samples examined. The shrimps landed in Tharuvaikulam had a better quality when compared to the shrimps landed in the other three fish landing centers.

Key words : Shrimps, landing center, sensory, biochemical, microbiological, quality

Shrimps are the most important items among the seafoods that are exported from India. It is a difficult task to preserve the freshness of raw material, when there is a long time gap between harvesting and processing.

Matches (1982) and Reilly *et al.* (1986) studied the effect of temperature abuse on shrimp quality and decomposition by measuring indole and total volatile base nitrogen. Microbiological and biochemical changes, which occur when shrimps are iced insufficiently and improperly stored at elevated temperature, was reported by Zuberi and Qadri (1992). Jeyasekaran *et al.* (1996) reported the incidence of *Listeria* spp., particularly *L. monocytogenes* in seafoods landed in Mangalore.

Tuticorin region on the east coast of India has about 19 seafood processing plants, which export a substantial quantity of frozen shrimps. Since raw material

quality determines the quality of final product, the present study was undertaken with an aim of assessing the quality of shrimps landed in different fish landing centers of Tuticorin.

Materials and Methods

Shrimps were obtained from four fish landing centers (Therespuram, Punnakayal, Tuticorin fishing harbour and Tharuvaikulam) of Tuticorin, Tamil Nadu and they were given a code of I, II, III and IV. A total of 24 shrimp samples comprising six from each fish-landing center was analysed in triplicates for the quality. Shrimps procured were immediately placed in sterile polythene bags and kept in insulated boxes containing ice and brought to the laboratory within half an hour for analysis. Fresh flake ice was used for icing shrimp samples during transportation from the site of sampling to the laboratory. All chemicals used for analyzing the quality of shrimps were of analytical

grade or guaranteed reagent, supplied by reputed firms. Insulated boxes having a capacity of 13.5 l with a drain valve were used for icing and transportation of shrimps.

Sensory characteristics and overall acceptability of shrimps were assessed by a panel of six experienced members on the basis of 10-point scale described by Reilly *et al.* (1987). Biochemical quality of shrimps was tested by estimating Total volatile base nitrogen (TVB-N), Trimethyl amine nitrogen (TMA-N) and Indole. The TMA-N and TVB-N contents were determined by the methods of Beatty and Gibbons (1937) using microconway dishes. Indole was determined by AOAC (1995) method.

Shrimps were analyzed for total bacterial load (TPC), total coliforms, faecal coliforms, *E. coli* and *Staphylococcus aureus* and human pathogens such as *Salmonella*, *Vibrio cholerae*, *V. parahaemolyticus* and *Listeria monocytogenes*. The shrimps, which were brought in the insulated boxes, were aseptically removed, peeled and weighed separately in sterile containers. To one part of shrimp, nine parts of diluent (physiological saline) was added and homogenised in a sterile homogeniser. Dilutions were made from shrimp homogenate and appropriate dilutions were selected for enumeration. The isolation and identification of bacteria were done as per APHA (1976) methods. The identification of the isolates was as per the methods described by EIC (1995a).

Appropriate dilutions of shrimp homogenate were spread plated onto Plate Count Agar (PCA) and incubated at 37°C for 24 to 48 h and the colonies were counted and reported as total bacterial load (TPC). MPN technique was used to determine the level of total coliforms, faecal coliforms and *E. coli* in shrimp samples. Shrimp homogenate was transferred to Lauryl sulphate tryptone broth (LSTB) tubes and incubated at 37°C for 24 h for the estimation of total coliforms. Samples from positive LSTB tubes were further transferred to EC broth tubes and

incubated at 44.4 ± 0.5 °C for 18-24 h for estimating faecal coliforms. Samples from positive EC broth tubes were streaked onto Eosine Methylene Blue (EMB) agar plates and incubated at 37°C for 24 to 48 h for estimating *E. coli*. Typical colonies were subjected to biochemical tests for final confirmation.

Shrimp homogenate was spread plated onto Baird Parkar Agar (BPA) and incubated at 37°C for 24-48 h for the estimation of *Staphylococcus aureus*. Typical colonies were counted, purified and further subjected to biochemical tests for final confirmation. Shrimp homogenate was spread plated onto Thiosulphate citrate bile salt sucrose (TCBS) agar plates and incubated at 37°C for 24-48 h and colonies were counted for the determination of *Vibrio parahaemolyticus*. Typical colonies were subjected to biochemical tests for confirmation. 25g of shrimp sample was aseptically taken and homogenised with 225 ml of alkaline peptone water (APW) and incubated at 37°C for 6 h for enrichment. A loopful of enriched sample was streaked onto TCBS agar plates and incubated at 37°C for 24-48 h for testing the presence of *V. cholerae*. After incubation, the plates were checked for colony morphology. Typical colonies were confirmed by subjecting them to different biochemical tests.

Shrimp (25 g) was taken aseptically and homogenized with 225 ml of Lactose broth and incubated at 37°C for 24 h for pre-enrichment. One ml of pre-enriched sample was transferred to 10 ml of selenite cystine broth and tetrathionate broth and incubated at 37°C for 24 h for selective enrichment. A loopful of enriched sample was streaked onto Bismuth Sulphite agar (BSA) and Xylose lysine deoxycholate (XLD) agar plates and incubated at 37° C for 24-48 h for the examination of *Salmonella*. After incubation, the plates were observed for typical colonies. Suspected colonies were later subjected to various biochemical tests for confirmation. Shrimp sample (25 g) was aseptically taken

and homogenised in 225 ml of *Listeria* Pre-enrichment broth and incubated at 37°C for 24 h for pre-enrichment. Ten ml of pre-enriched sample was transferred to 90 ml of University of Vermont I (UVM I) broth and incubated at 37°C for 24 h for primary enrichment. 0.1 ml of enriched sample from UVM I broth was transferred to 10 ml of UVM II broth and incubated at 37°C for 24 h for secondary enrichment. A loopful of secondary enriched sample from UVM II broth was streaked onto PALCAM (Polymyxin Aesculin Lithium chloride Ceftazidime Acriflavin Mannitol) agar and Modified McBride's *Listeria* agar (MMLA) plates and incubated at 37°C for 24-48 h for testing the presence of *Listeria monocytogenes*. After incubation, the plates were checked for typical colonies and the suspected colonies were further subjected to biochemical tests for confirmation.

Results and Discussion

Overall sensory score of raw shrimps collected from fish landing centers ranged from 7.5 to 8.8 (Table 1). Samples from IV fish landing center (Tharuvaikulam) recorded a higher sensory score. The samples obtained from the remaining fish landing centers were found to have an almost uniform overall sensory score. TMA - N content was estimated to be in the range of 1.57 ± 0.12 to 9.45 ± 0.35 mg% in the samples collected from the fish landing centers (Table 2). The TMA - N content of samples taken from fish landing centers were found to be above the maximum permissible level of 5 mg% (Montgomery *et al.*, 1970), except the samples from I fish landing center

(Therespuram). The samples from fish landing centers had a TVB - N content that ranges from 7.91 ± 0.29 to 41.72 ± 0.68 mg%. Matches (1982) observed that Pacific coast shrimp had a TVB-N level of 40 mg%. The TVB - N contents were within the limit of acceptability of 30 mg% (Montgomery *et al.*, 1970) in the shrimps collected from I and IV fish landing centers. Indole content was found to be in the range of 3.05 ± 0.60 to 6.93 ± 0.26 µg/100g in the samples collected from the fish landing centers. The indole contents of shrimps obtained from fish landing centers were above 3.1 µg/100g (Thomas and Iyer, 1994), except the sample from IV fish landing center. However, they were within the acceptability limit of 25 µg/100 g (Santoso *et al.*, 1992).

Table 2. Biochemical quality of shrimps landed in different fish landing centers

Fish landing centers	TMA-N (mg%)	TVB-N (mg%)	Indole (µg/100g)
I (Therespuram)	1.57±0.12	7.91±0.29	6.93±0.26
II (Punnakayal)	8.19±0.77	36.54±0.97	5.12±0.19
III (Tuticorin fishing harbour)	9.45±0.35	41.72±0.68	4.87±0.34
IV (Tharuvaikulam)	6.44±0.56	22.96±0.28	3.05±0.60

Total plate count of the shrimps was found to be in the range of $1.31 \pm 0.03 \times 10^5$ to $8.20 \pm 0.50 \times 10^6$ cfu/g (Table 3). The total bacterial load of the shrimps collected from fish landing centers were found to be above 10^5 cfu/g, except the samples from IV fish landing center. Most of the earlier reports also indicated that bacterial load in freshly landed tropical shrimps ranged from 10^3 – 10^5 cfu/g (Thampuran and Gopakumar, 1990; Zuberi and Qadri, 1992; Karunasagar *et al.*, 1985). The total bacterial load of the shrimps tested was almost higher than the standard limits (5.00×10^5 cfu/g) prescribed by EIC (1995b). MPN total coliforms of the shrimps were in the range of 172 to 1600/g, MPN faecal coliforms from 13 to 345/g. The total coliform counts of the shrimps collected from IV fish landing center was

Table 1. Sensory quality of shrimps landed in different fish landing centers

Fish landing centers	Sensory scores*
I (Therespuram)	7.65
II (Punnakayal)	7.50
III (Tuticorin fishing harbour)	7.60
IV (Tharuvaikulam)	8.80

* Overall sensory scores out of a total of 10.00

Table 3. Microbiological quality of shrimps landed in different fish landing centers

Fish landing centers	TPC (cfu/g)	Total coliforms (MPN /g)	Faecal coliforms (MPN /g)	<i>E. coli</i> (MPN/g)	<i>Staphylococcus aureus</i> (cfu/g)	<i>Vibrio parahaemolyticus</i> (cfu/g)
I	$8.20 \pm 0.50 \times 10^6$	1600	345	345	8.56×10^4	4.35×10^4
II	$2.59 \pm 0.13 \times 10^5$	172	92	26	8.85×10^5	7.40×10^3
III	$1.31 \pm 0.03 \times 10^5$	348	33	11	6.00×10^4	6.15×10^4
IV	$4.60 \pm 0.60 \times 10^4$	49	13	5	7.45×10^4	4.00×10^3

I – Therespuram, II – Punnakayal, III – Tuticorin fishing harbour, IV - Tharuvaiikulam

found to be below MPN 100/g and the samples from other fish landing centers were high. Jeyasekaran *et al.* (1990) have reported that the MPN total coliforms of shrimp samples collected from Mangalore fish landing center was 240/g and in the present study, the maximum total coliform count recorded was 1600/g. The faecal coliforms of the shrimp samples collected from fish landing centers ranged from MPN 13 to 345/g. Jeyasekaran *et al.* (1990) have reported MPN faecal coliform counts of 11 to 240/g in freshly caught penaeid shrimps collected from Mangalore fish landing center. MPN *E. coli* in shrimps was found to be in the range of 5 to 345/g. *E. coli* was found to be within the permissible level of MPN 20/g (EIC, 1995b) in the shrimps collected from II, III and IV fish landing centers and samples from I fish landing center had higher counts. Jeyasekaran *et al.* (1990) reported that raw shrimps from Mangalore fish landing center had a MPN *E. coli* in the range of 0.60 to 240/g, whereas in the present study, it ranged from 26 to 542/g. Thus, it is clear from the results that the total and faecal coliforms and *E. coli* were lower in IV fish landing center followed by III, II and I fish landing centers.

The occurrence of *Staphylococcus aureus* in the shrimp samples was in the range of 6.00×10^4 to 8.85×10^5 cfu/g. The *Staphylococcus aureus* counts of shrimps collected from fish landing centers were found to be very high ($> 10^4$ cfu/g). The higher incidence of *S. aureus* in shrimps from fish landing centers might be due to poor

handling by the fishermen and fish merchants. *S. aureus* counts in shrimps were higher than the limit (100/g) prescribed by EIC (1995b). The occurrence of *Vibrio parahaemolyticus* in the shrimps was in the range of 4.00×10^3 to 6.15×10^4 cfu/g. The occurrence of *Vibrio parahaemolyticus* in shrimps collected from fish landing centers was found to be in the range of 10^3 and 10^4 cfu/g. The results are similar to the findings of Karunasagar *et al.* (1985) who reported that raw shrimps landed in the Mangalore fish landing centre had *V. parahaemolyticus* counts of 10^2 to 10^4 /g. *V. cholerae*, *Salmonella* and *Listeria monocytogenes* were found to be absent in all the samples tested. However, Varma *et al.* (1989) reported the incidence of *V. cholerae* in fish and fishery products including shrimps collected from Tamil Nadu and Kerala coasts. Dalsgaard *et al.* (1995) also reported that *Salmonella* was not recovered from shrimps tested in Thailand. The findings of Iyer and Shrivastava (1992) supported the results of the present study that the incidence of *E. coli* in seafoods did not always indicate the presence of pathogens such as *Salmonella*. However, Jeyasekaran *et al.* (1996) reported the incidence of *L. monocytogenes* in raw shrimps collected from Mangalore fish landing center.

Thus, it is clear from the results that the total bacterial load, total and faecal coliforms and *E. coli* were quite high in the shrimps collected from I fish landing center (Therespuram) when compared to that from the other three fish landing centers. This

might be due to the mixing of sewage from Tuticorin town through the Buckle channel running in the same area. Shrimps collected from IV fish landing center (Tharuvaikulam) exhibited lower total bacterial load, total and faecal coliforms and *V. parahaemolyticus* counts than the others, which showed that the microbial quality of the shrimps landed in the Tharuvaikulam fish landing center was good.

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