EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 3
Issue: 5
304-308
Year: 2016

ENUMERATION OF TOTAL COLIFORM FAECEL BACTERIA AT TWO DIFFERENT FISH LANDING CENTRES OF TUTICORIN

Jenivi A.[*1], Sivakumar V.[2] and Sakthivel R.[1]

[1]Department of Biology, St. Joseph University in Tanzania – Arusha Campus, Arusha, Tanzania, East Africa.
[2]PG & Research Department of Zoology, V. O. Chidambaram College, Tuticorin, Tamil Nadu, India.

***Corresponding Author: Jenivi A.**
Department of Biology, St. Joseph University in Tanzania – Arusha Campus, Arusha, Tanzania, East Africa.

Article Received on 29/02/2016 **Article Revised on 20/03/2016** **Article Accepted on 11/04/2016**

ABSTRACT
The present investigation was aimed to explore the total coliform, Streptococcus aureus and faecel Streptococcus counts of the sea water from two selected fish landing stations of Tuticorin viz., Thirespuram and Sinthathirai matha kovil areas during 2007-2008. Formation of coliforms are analysed by standard procedure of MPN (Oblinger and Koburger, 1975) and IMVIC test (Poers and Latt, 1977). Enumeration of faecel coliform was detected by membrane filter technique (Bernasoni et al., 2006). The faecel streptococcal screening was carried out using multiple tube dilution method explained by Grasso et al., (2000). The results of two studied stations revealed that, station 2 encountered maximum Streptococcus aureus and faecel Streptococcus count in sea water [1400 MPN/100ml]. At station 1 and 2, maximum coliform count in sea water is 1600 MPN / 100 ml. The sediment samples at station 2 showed maximum total coliform counts [50 cfu / g]. The flesh of fin fish sample also showed invariably higher total coliform and fecal Streptococcus counts at station 2. The total coliform count of fish sample at both stations is recorded above the maximum permissible limit [5200 cfu /g]. Station 1 showed maximum Streptococcous aureus count in fish sample. Of the 2 stations studied, station 2 Sinthathirai matha kovil recorded maximum total coliform and faecel bacteria counts in water than the other station. Thus the results of present study is a preliminary account and it clearly indicates that a systematic study at these two important landing centres viz., Thirespuram and Sinthathirai matha kovil areas over the period of time during 2007-2008.

KEYWORDS: Coliform, Streptococcus aureus, Tuticorin, Enumeration, Systematic study.

INTRODUCTION
Microorganisms are intimately associated with the availability, the abundance and the quality of food for human consumption. Food items are easily contaminated with microorganisms in nature during handling and in processing. After it is contaminated food serves as a medium for the growth of microorganisms. Food may also carry pathogenic microorganisms if allowed to grow in certain food products, produce toxic substances that result in food poisoning when the food is ingested. These microorganisms can change the physical and chemical characteristics of the food and may also be responsible for food poisoning and food borne infections (Hema Ramanathan, 2010). Food poisoning is a term used to express any type of disease, illness or may affect after consuming food. The most serious type of food poisoning is bacterial food poisoning. The appearance of symptoms of food poisoning depends upon quantity, type and toxicity of the toxin. Symptoms can range from mild, moderate to serve and include abdominal cramps, nausea, vomiting, diarrhoea, fever and dehydration and in severe cases even in death. Every year more than 90 % cases of food poisoning are caused by Clostridum botulinum, C. profringens, Staphylococcus aureus, Salmonella sp, Bacillus cereus, Listeria monocytogenes, Campylo bactor, C. jejuni, Yerisinia entercolitica and enteropathogenic Escherichia coli. (Hema Ramanathan, 2010).

Bacteria are not randomly distributed in foods. A sample must be taken from true microbiological profile of the product. It is necessary to obtain sample from the discrete units like bags, drums, or cartons, maximum number of samples should be taken which can be composited for analyses. The microbial food examination provides information about the quality of the raw food (Neeraj Dilbaghi and S. Sharma, 2007). Seafood includes fresh frozen, dried, pickled and salted fish as well as various shell fish. Sea foods are contaminated by the environment in which they grow and various bacteria are involved in the spoilage, molds are the chief spoilage organisms on smoked fish. At higher temperature micrococcus and bacillus species involved in fish spoilage while at ordinary temperature, species of Escherichia, Proteus, Serratia sarcina and Clostridium are found.

Coliforms are common inhabitants of the intestinal tract of human and animals. However, bacteria in this group are of both faecel and non-faecel origin. The organism is found in undisturbed soil and can be at high levels in faecel contaminated soil. With certain conditions they tend to die in the soil, but with proper nutrients and moisture, they can increase in numbers. Soil dust can disseminate coliform into the atmosphere. Rain carries the surface contamination from soil to streams, rivers or lakes. Coliforms are found on all types of plant material [foliage, roots and flowers], Klebsiella predominated in samples obtained from forest environments and from fresh farm produce (Duncan and Razzell, 1972). Coliforms are present on the feathers of live poultry and the hide, hoofs and hair of other animals upon slaughter the organisms can contaminate the meat from these sources or from intestinal leakage during evisceration. Shell fish grown in polluted areas concentrate the organisms. So that they are contaminated at higher levels than those present in water. As the most common members of this group are the colon Bacillus or Escherichia coli. All lactose fermenting enteric bacilli were called coliforms bacilli. Proteus bacilli are widely distributed in nature as saprophytes, being found in decomposing animal matter in sewage in manure soil and in human and animal faeces. They are opportunistic pathogens, commonly responsible for urinary and septic infections often nosocomial.

Numerous investigations were made on the occurrence and survival of enteric pathogens and coliform bacteria in sea water (Zobell, 1941; Pearson, 1955; Green berg, 1956; Terry, 1956) and many public health agencies have established coliform standards for marine waters under their jurisdiction. However, except for a single report by Nusbaum and Garver (1955) who briefly mentioned that 24 million coliforms per gram of wet mud in the vicinity of an out fall discharging into San diego bay. The presence of faecel coliform in aquatic system fishery product and other sources is considered as an index of sanitary quality and as indicator of pollution. After the pioneering effort of Escherich (1885), faecel coliforms have been increasingly used as indices of water quality in sanitary microbiology and form a measure of human encroachment and interferences. The presence of coliform organisms in a given environment has been attributed to the influxes of allochthonous bacteria from waste water drainages (Morrison and Fair, 1966; Weidner et al., 1969; Evans and Owen, 1972; Carney et al., 1976) the use of total coliform as indicator, as the indicators of health hazard water. Studies on distribution of faecel indicator organisms in tropical environment are noteworthy (Ludwig, 1975; Raveendran et al., 1978). The use of bacteria as faecel indicator at fish farms was studied by Niemi & Taipalinen (1982). With this knowledge, the present study was carried out to know the total coliform bacteria from two fish landings areas of Tuticorin viz., Thirespuram and Sinthathirai matha kovil using water, sediment and fish samples.

MATERIALS AND METHODS

Description of the study areas

In Tuticorin, different fish landing centres are available. Among them Therespuram [Station 1] and Sinthathirai matha kovil [Station 2] are highly polluted with sewage water. In these two areas, the town sewage is directly let into the sea water and sea water looks almost black in colour with pungent smell. So these two important areas are selected for the present study.

Collection of samples

- Water samples were collected with the aid of presterilized glass bottles. Samples were collected by immersing the bottle to at least 15 cm depth and the sample collected in the direction opposite to current flow. In areas where no current flow exists, a current flow was artificially created.
- Sediment sample was collected by employing a core sample and the central portion of the sediment was transferred with the aid of a sterile spatula into a sterile polythene bag and sealed air tight.
- Fish samples [Sardinella sp] were collected from the landing place, transferred into a sterile bag and stored immediately in iced condition.

Analysis of coliform

Nutrient agar slant culture of three samples viz., sediment, water and fish were prepared. From nutrient agar slant culture loop full culture inoculated into sterile phenol red lactose broth with durhams tube respectively and incubated at 37°C for 48 hrs. Formation of coliforms are analysed by standard procedure of MPN (Oblinger and Koburger, 1975) and IMVIC test (Poers and Latt, 1977).

Enumeration of faecel coliform and Streptococcus

Enumeration of faecel coliform was detected by membrane filter technique (Bernasoni et al., 2006). The faecel streptococcal screening was carried out using multiple tube dilution method explained by Grasso et al., (2000).

RESULT

1. Sediment sample

Coliform bacteria

From the result it is obvious that station 1 showed maximum total coliform count [50 cfu/g] during Apirl 2008 and minimum count of 10 cfu / g during December 2007, May and June 2008. Station 2 showed maximum total coliform count [70 cfu /g] during Apirl 2008 and the minimum count of 10 cfu /g during May and June 2008 (Table 1).

Streptococcus aureus

From the result it is noted that station 1 showed maximum total S. aureus [180 cfu/g] during December 2007 and the minimum count of 10 cfu /g during January, February, May and June 2008. Station 2 also showed maximum total S. aureus count [40 cfu/g] during Apirl 2008 and the minimum count of 10 cfu/g during January, February and Apirl 2008 (Table 1).

Table 1: Total coliforms, S. aureus and faecel Streptococcus count of sediment sample

Months 2007-2008	Total coliform bacteria count		Total Streptococcus aureus bacteria count		Total faecel Streptococcus bacteria count	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
December	10	20	180	20	260	60
January	20	30	10	10	10	10
February	20	30	10	10	20	10
March	40	60	20	30	50	60
April	50	70	20	40	60	80
May	10	10	10	30	50	60
June	10	10	10	40	20	60

Note: Station 1: Thirespuram; Station 2: Sinthathirai matha kovil

2. Water sample

Coliform bacteria

From the result it is evident that station 1 recorded the maximum total coliform count [1600 MPN/ 100 ml] during April and June and the minimum of 2 MPN / 100 ml was recorded during December 2007, January and February 2008 (Table 2).

Streptococcus aureus

From the result it is evident that station 1 recorded the maximum total S. aureus count of 1200 MPN / 100 ml during June 2008 and the minimum of 0 MPN / 100 ml were recorded during December 2007, January and February 2008. Station 2 also showed the maximum total S. aureus count 1400 MPN / 100 ml during June 2008 and the minimum of 0 MPN / 100 ml was recorded at station 2 during February 2008 (Table 2).

Faecel Streptococcus

Station 1 recorded the maximum total faecel Streptococcus count of 1200 MPN / 100 ml during Apirl 2008 and the minimum of 0 MPN / 100 ml were recorded during February 2008.

Station 2 also showed the maximum total faecel Streptococcus count of 1400 MPN /100 ml during April and minimum 0 MPN /100 ml were recorded during February 2008 (Table 2).

Table 2: Total coliforms, S. aureus and faecel Streptococcus count of water sample

Months 2007-2008	Total coliform bacteria count		Total Streptococcus aureus bacteria count		Total faecel Streptococcus bacteria count	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
December	2	100	0	40	10	80
January	2	11	0	6	10	12
February	2	2	0	0	0	0
March	1200	1400	400	500	800	900
April	1600	1600	800	700	1200	1400
May	1200	1400	400	800	1100	1300
June	1600	1600	1200	1400	300	1200

Note: Station 1: Thirespuram; Station 2: Sinthathirai matha kovil

3. Fish sample

Coliform bacteria

Station 1 showed the maximum total coliform count of 5200 cfu /g during February 2008 and the minimum total coliform count of 10 cfu / g were during February 2008 and the minimum total coliform count of 10 cfu/g was during June 2008 (Table 3).

Streptococcus aureus

From the result it is evident that at station 1 the maximum total S. aureus count of 8000 cfu / g was during May 2008 and the minimum total S. aureus count of 10 cfu/g was recorded during June 2008. Station 2 also showed maximum total S. aureus count of 4400 cfu/g during February 2008 and the minimum total S. aureus count of 10 cfu/g during June 2008 (Table 3).

Faecel Streptococcus

Station 1 showed maximum total faecel Streptococcus count [3600 cfu / g] was recorded during June 2008. Station 2 also showed maximum total faecel Streptococcus count [3800 cfu/g] during February 2008 and the minimum total faecel Streptococcus count of 10 cfu/g during June 2008 (Table 3).

Table 3: Total coliforms, S. aureus and faecel Streptococcus count of fish sample

Months 2007-2008	Total coliform bacteria count		Total Streptococcus aureus bacteria count		Total faecel Streptococcus bacteria count	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
December	90	120	30	50	60	110
January	50	90	60	40	90	70
February	5200	5300	4800	4400	3600	3800
March	1500	2000	2200	3200	2000	2500
April	1600	2100	1800	1200	1600	1000
May	150	200	8000	1000	1200	1400
June	10	10	10	10	10	10

Note: Station 1: Thirespuram; Station 2: Sinthathirai matha kovil

DISCUSSION

Coliform and faecel bacteria organisms have been used as indicators of sanitary quality of water for over 70 years (Siva Kumar et al., 1986; Edberg et al., 1989). Of the 2 stations studied, station 2 Sinthathirai matha kovil recorded maximum total coliform and faecel bacteria counts in water than the other station. This higher total coliform and faecel bacteria counts could probably due to the mixing of larger quantity of untreated sewage with open sea from the fishing hamlet. Siva Kumar et al., (1986) recorded that the improper sanitary facility and night soils from the open latrine are the prime reason for very high counts of total coliform from Porto novo water. Presumptive coliforms were isolated & identified from 306 samples of the 341 samples collected from five northern states of India by Ranteke et al., (1992) identified 12.4 % of the isolates contained E. coli & 32.6 % of Acromonas and the present study agrees well with the above findings. Station 2 shows that total coliform and faecel bacteria counts were above the maximum permissible level of 1600 MPN /100 ml respectively in water sample (Indian Standard for water sample is 10500 / 1991 reaffirmed 1993 – BIS 2005). This higher level of total coliform count recorded above the maximum permissible limit at station 2 well-illustrated that the unhygienic conditions of this area, mixing of sewage and open lavatory system. Edberg et al., (1990) and Olson et al., (1991) have also reported the high level of coliform count due to lack of proper sanitation and mixing of sewage in water sources.

Kazunari Ogawa et al., (2005) reported that the number of coliform organism decreased rapidly from estuaries to offshore and at deeper layer and that the appearance of coliform types varied. They also reported in natural sea water, Escherichia coli is poor by self-purification or antibiosis action of sea water but it shows that this organism decreased mainly because of their starvation caused by lack of nourishment. The present study showed that coliform bacterial counts are higher at station 2 sediment; this may be due to the reason that in the bottom deposits the coliform bacteria probably survives longer as physiologically varied forms when suitable nutrients were supplied Lopez – Torres et al., (1988).

The incidence of total coliform in fin fish [Sardinella sp] examined and affirmed a certain degree of bacteria pollution at the two station since coliform do not constitute the indigenous flora of these coastal organism . The occurrence of total coliform in fin fish and shell fish were earlier reported by Panduranga Rao and Gupta (1978), Premjith (1979), Iyyer and Pillai et al., (1971) and Siva Kumar et al., (1986). It is interesting to note that the entire sample examined from two different stations concealed coliform and faecel bacteria. This might be due to the unhygienic handling practices and unclean transportation. It is also observed that the fisherman usually washes the baskets full of fish catch in the coastal water before being transported to market. The level of total coliform and faecel bacteria counts are also above the maximum permissible level prescribed [22 cfu /g - IS 2003] comparatively station 2 shows high incident of coliform and faecel Streptococcus in fin fish samples than station 1 showing high polluted nature of the area. The finding has revealed that unhygienic handling practices and poor sanitation are well pronounced at both stations.

In the present study coliform bacteria colonies were more in number at station 2 & this could be due to the entry of Buckle canal which carries the corporation sewage & empties its content at this station. At station 1 the coliform bacteria count recorded was less & this could be reason that the sewage water is diluted at this station. In tropical considerable morbidity & mortability have been reported due to frequent epidemics of gastroenteritis which may be very well prevented if the waste is treated & let into the sea (Ranteke et al., 1992). In the present study higher coliform bacterial species recorded and the sediments of station 2 could be due to the enrichment of nutrients by sewage and let this studies accuses well which finding out.

CONCLUSION

The present finding has exposed that unsanitary management performs and deprived sanitation are fine obvious at both the stations. The present study is a preliminary account and it clearly indicates that a systematic study at these two important landing centres over the period of the time.

REFERENCES

1. Bernasoni, C., Volponi, G., and Bonadonna, L., Comparison of three different media for the detection of E. coli and coliforms in water. Water Sci Technol, 2006; 54: 141-145.
2. Carney, J.F., and Colwell, R.R., Seasonal occurrence and distribution of microbial indicators and pathogens the Rhode of Colesa Peake Bay. App. Microbiol, 1975; 30: 771 -780.
3. Duncan, D.W., and Razzell, W.E., 1972. Klebsiella biotypes among coliforms isolated from forest environments and farm produce. Appl.Microbiol, 1972; 24: 933-938.
4. Edberg, S.C., Allen, M. J. Smith, D.B., and Kriz N.J., Enumeration of total coliform and Escherichia coli from source water by the defined substrate technology. Appl. Environ. Microbiol, 1990; 56: 366-369.
5. Edberg, S.C., Allen, M.J., Smith, D.B., National field evaluation of a defined substrate method for the simultaneous detection of total coliforms and Escherichia coli from drinking water. Comparison with presence absence techniques. Appl. Environ. Microbiol, 1989; 55: 1003-1008.
6. Escherich, T., Die Darmbacterian des Nengeborenen and Sandling .Fortschr. Med., 1885; 3: 515-522: 547-554.
7. Evans, M.R., and Owen, J.D., Factors affecting the concentration of faecel bacteria in land drainage water. J.Gen . Microbiol, 1972; 76: 474-485.
8. Grasso, G.M., Sammarco, M.L., Ripabelli, G., and Fanelli, I., Enumeration of E. coli and coliforms in surface water by multiple tube fermentation and membrane filter methods. Microbiology, 2000; 103: 119-125.
9. Greenberg, A.E., 1956. Survival of enteric organisms in sea water. U.SP.H.S. Pub. Health Repts, 1956; 71: 77-86.
10. Hema Ramanathan, 2010. Food Poisoning A threat to Humans. Marsland Press, New York, 11418, USA.
11. Indian standard for Drinking water sample IS 10500/1991 Reaffirmed – 1993.
12. Indian standard method of microbiological examination in IS 1622 Class 1981, Reaffirmed – 2003.
13. Iyyer, T.S.G., and Pillai, V.K., 1971. Distribution of coliform in fresh fishery product and environment. J. Food Sci. Technol, 1971; 8: 146 -147.
14. Kazunari Ogawa., Some factors affecting the survival of coliform bacteria in seawater. Journal of oceanography. Collection Earth and Environmental Science Springer Link, 2005.
15. Lopez – Torres, A.J., Prieto,L., Aazen, T.C., 1988. Comparison of the in situ survival and activity of Klebsiella pneumoniae and Escherichia coli in tropical marine environment microbes. Ecol, 1988; 15: 41-47.
16. Ludwig, H.F., 1975. Criteria for marine waste disposal in southeast Asia, In:Pearson, E.A and De Franja Frangipane ,E.,(ed). Marine Pollution Disposal Pergman Press, Oxford, 1975; 99 -108.
17. Morrison, S.M., and Fair, J.F., 1966. Influence of environment on stream microbial dynamics, Colorado State University, Hydrology Papers, 1966; 13: 21. Fork Coline, Colorado.
18. Neeraj Dilbaghi, and S. Sharma, 2007. Food spoilage, food infections and intoxications caused by microorganisms and methods for their detection.
19. Niemi,M., and Taipalinen, I., Faecel indicator bacteria at fish farms. Hydrobiologia, 1982; 86: 171 -5.
20. Nusbavam, I., and Garver, R.M., Survival of coliform organisms in pacific ocean coastal waters. sew. Indnst .wastes, 1955; 27: 1383-99.
21. Oblinger, J.L., and Koburger, J.A., Understanding and teaching the most probable number technique. J. milk food technol, 1975; 38(9): 540-545.
22. Olson, B.H., Clark, D.L., Milner, B.B., Stewart, M. H., and Wolfe, R.L., Total coliforms detection in drinking water: comparison of membrane filtration with coliert and coliquick. Appl. Enviro. Microbiol, 1991; 57: 1535-1539.
23. Panduranga Rao and Gupta, S.S., Enteropathogenic E. coli and other coliforms in marine fish. Fish .Technol, 1978; 15: 35-47.
24. Pearson, E.A., An investigation of the efficiency of submarine outfall disposal of sewage and sludge. State water pollution control board, Std. Serr. Agreement No .12 C-14, State of Colif, 1955; 258.
25. Powers, E., and Latt, T.G., 1977. Simplified IMVIC test. Appl. Environ. Microbiol, 1977; 34(3): 274-279.
26. Premjith, S., 1979. Studies on coliforms with special reference to E. coli in estuarine environment of Porto Novo M. SC., Thesis, Annamalai University, Tamil Nadu.
27. Ramteke, P.W., Pathak, S.P., and Bhattacherjee, J.W., Incidence of Aeromonas in total coliform. Indian J. Microbiol, 1992; 32: 193-196.
28. Raveendran, O., Gore, P.S., and Unnithan, R.V., Observation on faecel contamination of Cherai beach in Kerala .Indian J.Mar. Sci., 1978; 7: 128-129.
29. Siva Kumar, V., Thangaraj, G.S., Chandran, R., Lakshman Perumalsamy, P., and Ramamoorthy, K.,1986. Studies on faecel coliform in an Esturine environment of Porto Novo. Proc. Symp. Coastal Aqua culture, 1986; 4: 1330 -1338.
30. Terry, R.D., An annotated bibliography on bacteriology, oceanography and marine geology as they relate to the disposal of waste material into the sea. Allan Hancock Foundation, Univ .of Southern Calif, 1956; 112.
31. Weidner, R.B., Christenson, A.G., Wiebel, S.R., and Roebeck, G.G., Rural run off as a factor in stream pollution. J. Wat. Pollut. Contr. Feb, 1969; 41: 377-384.
32. Zobell, C.E., 1946. Marine microbiology. Chronica Botanica, Waltham Mess, 1946; 240.