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Research Article

ASSESSMENT OF MICROBIAL QUALITY IN WATER, SEDIMENT AND FISH TISSUE- A HEALTH CONCERN APPROACH IN LOTIC FRESHWATER BODY, AMBARAMPALAYAM RIVER, TAMILNADU, INDIA

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ABSTRACT

The objective of the present study is to assess the microbial contamination in water, sediment and fish of lotic water body, Ambrampalayamriveras it is observed a direct and indirect disposal of wastewater, agricultural drainage and domestic wastes into the water body. Samples to be analysed were collected from the sites exposed to incidental waste disposals. The core composition of bacterial communities consisted of *Aspergillusfusarium, Aspergillusniger, Aspergillusflavus, Enterobacter cloacae, Bacillus subtilis, Shigellasp, Escheria coli, Vibrio cholera, Pseudomonas sp, Aeromonashydrophila, Aspergillusflavus, Cladosporium* and *Rhizopus* were identified in water, sediment and fish samples of Ambarapalayam river. Minimum count of *Aspergillusflavus, Cladosporium and Rhizopus* are recorded in the water samples. *Rhizopus*was recorded minimum level in the analysed fish sample. *Enterobacter cloacae, Bacillus subtilis*, *Shigella*sp, *Vibrio cholera* and *Pseudomonas* sp. are recorded minimum in study site during the study period in the analysed sediment samples. Among the microbial community estimated the higher recorded was total faecal coliform count 172×10^9(MPN/g); 150×10^9(MPN/g);128×10^9(MPN/g) in fish, water and sediment respectively. The site selected for analysis were observed to be contaminated with high rate of total faecal coliform and total fungal count in fishand water followed by sediment which is an indicator of to spot getting spilled with untreated pollutant both directly and indirectly. Thus the present study confirms that the prime lotic water body of PollachiTaluk, Ambarampalayam village is slowly getting degraded due to high range of pollutant mixing into it which in turn will bring ill effects to public inhabiting in and around to the people who use this water and fish for consumption.

INTRODUCTION

Water is, literally, the source of life on earth. The global fresh water scenario is very much alarming. According to the World Health Organization, 2006 reports, it is mentioned that approximately 36% of urban and 65% of rural Indians were without access to safe drinking water and by the year 2025, however, 48 countries are expected to face shortages, affecting more than 2.8 billion people, especially India. The quality as well as the quantity of fresh water and their sources are deteriorating globally as a result of rapid urbanization, population growth and industrialization. Most of pollutants are discharged into the environment every day so water pollution is a cosmopolitan problem that needs urgent attention and prevention (Osman, 2007). Next to water, sediments are one of the possible media in aquatic monitoring since they are also responsible of nutrients and pollutant transportation in aquatic environment.

Many fresh water invertebrates possess sediment as food source and can be susceptible to bioaccumulation of pollutants which could potentially threaten the health of many species at top of the food chain, especially fish the major consumer of invertebrates followed by humans who were the major consumer of fishes (Wright and Mason, 1999). Man being the top carnivore in this food system consume fish as it is a very good source of protein and fish protein is supposed to be cheapest. Like in other organisms, certain pollutants are not destroyed by humans, instead, they tend to accumulate in the body and can be stored in soft and hard tissues such as liver, muscles and bone and threaten the health of humans and can elevate the growth of microorganisms.

In addition river inflows contribute many pollutants, thereby tending to induce ecological and hygienic problems (Wang *et al*., 2007). Moreover these pollutants may also introduce pathogens into the aquatic environment that could lead to the

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death of aquatic food organisms such as fish. Water bodies in populous countries like India have become reservoirs of antimicrobial-resistant pathogenic microbes due to the haphazard use of them by accumulation of faecal contamination through point as well as nonpoint sources. Higher the level of indicator bacteria, greater the level of faecal contamination and greater the risk of water-borne diseases (Pipes, 1981). A wide range of pathogenic microorganisms can be transmitted to humans via river water contaminated with faecal material. The bacteriological examination of water has a special significance in water body studies. It provides a direct measure of the deleterious effect of pollution on human health. On the other hand, over lacks of people in and around the study area directly or indirectly depend on water for various purposes such as agriculture, fishing, transportation and recreation. As a result, water-related diseases are very common in the study area, particularly amongst the young children. The primary goal of determining the bacteriological quality of these essential medias via., water, sediment and fish is to assess the public health risks emanating from the use of the contaminated water . So the present study was framed to assess the microbiological quantity of the river water, sediment and fish during the study period (July 2017 - Dec 2017) collected form Ambarampalayam River, PollachiTaluk, Coimbatore Rural District which would provide information for background levels of disease causing pathogens in water, sediment and fish species of the river and enable the effective monitoring of both environmental quality and the health of the organisms inhabiting the riverine ecosystem.

MATERIALS AND METHODS

Study Area: Pollachi is a taluk of Coimbatore Rural district of the Tamil Nadustate of India. It lies in the southern part of the Coimbatore city around 40 kilometres from downtown Coimbatore. This is the second largest town in the district after corporation of Coimbatore(Plate: 1). Owing to the proximity to the Western Ghats, Pollachi has a pleasant climate throughout the year. Pollachi is very popular for its markets, fresh vegetables and cattle. The Central part of Kerala totally depends upon the vegetables from Pollachi.

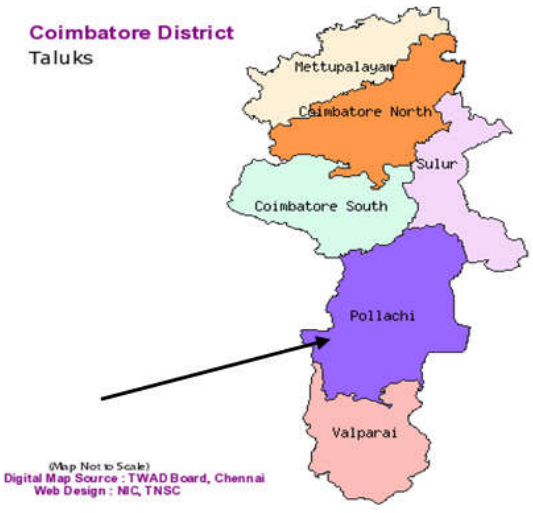


Plate 1 Map showing the study area located taluk

Sampling Area: Ambarampalayam village is located in PollachiTaluk of Coimbatore district in Tamil Nadu, India (Plate: 2). It is situated 8km away from sub-district headquarter Pollachi and 48km away from district headquarter Coimbatore. As per 2009 status, Ambarampalayam village is also a gram panchayat. The total geographical area of village is 426.18 hectares. Ambarampalayam has a total population of 3,794 peoples. There are about 1,052 houses in Ambarampalayam village.

Plate 2 Showing the sampling point

During the study period survey of the lotic water body Ambarapalyam river was made to fix the sampling locations. Based on the survey and certain selection criteria like nature of place, mixing of pollutants, usage of water, agricultural activities and other industrial wastes sampling station (Stn.1) was fixed. First week of every month from the selected site water samples were collected in the early hours at the surface of the lake (1-20cm) depth below the surface water at (6 a.m to 8 a.m) in the labeled poly ethylene sterilized bottles and placed in icebox to maintain the quality of parameters and within 24 hrs they were transported to laboratory for analyzing microbial parameters using standard method of APHA (2005) and WHO (2010).Fish sampling was also carried out in the selected station(Stn.1) from during the study period *viz*., by used gill nets, cast nets, and drag-nets with the help of local fishermen. 10% of total catch from each sampling stations were used for laboratory analysis. Collected fish(especially the fish fond of by local people) was labeled in polythene ice bags and brought to laboratory for further study. River bed soil sample was collected in polythene bag labelled and brought o lab for further microbial analysis.

Microbial Analysis in Water and Fish: 100 ml of water were collected in sterile glass ware containers with stoppers. The water samples were transported in ice packs and processed between 2- 3 hours after collection. The microbial load of the water samples was determined by performing tenfold serial dilution in test tubes containing sterile distilled water. The total viable count was determined using the pour plate technique cultured in duplicates. The plates were inverted to prevent condensation droppings from the lid into the agar and incubated in the incubator at 37^0C for 48 hours. All the glass wares such as petri dishes, conical flask, test tubes, beakers and bijou bottles etc. were thoroughly washed and sterilized at 121^0C for about 15-30 minutes in an autoclave. The inoculating loop was sterilized by flaming in the Bunsen burner until it turns hot. Similarly working surface was sterilized by

application of disinfectant solution (95% ethanol). Colonies were counted and expressed as colony forming unit per ml.

E. coli most probable technique (MPN) was carried out in which 3 tubes containing 9 ml of MacConkey broth with an inverted Durham tube were inoculated with 1ml of sample water to give a dilution of 1:10; From this dilution, 1ml each was transferred to another 3 tubes of MacConkeybroth to give a dilution of 1:100; from this second dilution 1 ml was also transferred to another 3 tubes of MacConkey broth to give a dilution of 1:1000. All the tubes were incubated at 37^0C for 24-48 hours. The number of E. coli positive tubes was determined by MPN. Sub-culture was carried out until pure isolates were transferred onto Nutrient Agar slant in bijou bottles and kept in a refrigerator at 4^0C to serve as a stock culture for observation of morphological appearance and for the various biochemical tests (Cheesbrough, 2006) to determine the identity of the bacterial isolates with reference to Bargey's Manual of Determinative Bacteriology (Buchanan and Gibbons, 1974).

Microbial analysis in sediment: Five different test tubes were taken and 9 ml of sterile distilled water was added in four test tubes and 10ml of water was added in one test tube.1g of soil sample was collected from the river bundhs of Ambarampalayam River and was mixed in 10ml of sterile distilled water. 1ml of the suspension from the above solution was taken and added to 9ml of distilled water containing test tube.1ml of solution from 10^{-1} dilution was transferred into flask containing 9ml of distilled water to get dilution of 10^{-2} till 10^{-9} . The process was followed repeatedly to get a dilution of 10^{-9}. 100ml of solution each from 10^{-9} were taken and spread into three different petri plates containing nutrient agar medium. The petri plates were then incubated at 37^oC for 24hrs. The colonies were taken observed and counted.

Bacterial Enumeration*:* Water, sediment and fish muscle samples were diluted up to 10^{-9} dilution, 0.1ml of each dilution was inoculated in triplicate plates of 12 different specified media. After incubations all plates were incubate at 37^0C in the incubator for 48 hours. After the incubation different cultures were seen on the Petri plates. Counting was done for each plate. Different microorganisms were identified on the basis of their colour and growth. Microorganisms were selected for pure culture. Pure culture is obtained by streak plate method. Broth culture was prepared in the nutrient broth. Biochemical test was by the specific media. Results were interpreted and presented with standard units (Table.1).

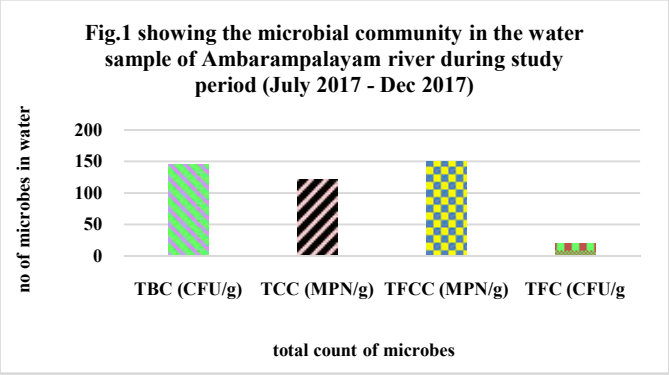
Table 1 Showing the Microbial enumeration of the collected samples during the study period from water, sediment and muscle of selected commercial edible fresh water fish species *Labeorohita* collected Ambrapalayam river during the study periodJuly-Dec-2017.

Parameters	Units	Water	Sediment	Fish
TBC	Cfu/g	145×109	102×109	163×10^9
TCC	MPN/g	121×109	118×109	132×10^9
TFCC	MPN/g	150×109	128×109	172×10^9
TFC	Cfu/g	20×109	38×109	42×10^9

RESULTS AND DISCUSSION

Microbial community in river water, sediment and fish: Rivers, the most important water resource are unfortunately are being polluted by indiscriminate discharge of sewage, industrial wastes and toxic wastes generated by other human activities. Thus the rivers are always the victims of the negative impacts of urbanization. Most water bodies become contaminated due to incorporation of untreated solid and liquid waste. In recent years with unprecedented population growth and intensive agriculture, ground and surface waters are being exploited on increasing scales all over the country and water quality and safety have become major issues in public health. In India, river waters are mainly used to meet potable water needs of urban population and a number of studies on microbial quality of these waters have been extensively carried out by (Adewoye and Adewoye, 2013; Jithesh and RadhakrishnanPatila, 2015; Amosa *et al*.,2016; Khalid Hassan Real *et al*., 2017).The bacterial community composition in all of the samples on the genus level,their core composition of bacterial communities consisted of *Aspergillusfusarium, Aspergillusniger, Aspergillusflavus, Enterobacter cloacae, Bacillus subtilus, Shigellasp, Eschiceria coli, Vibrio cholera, Pseudomonas sp, Aeromonashydrophilia, Aspergillusflavus, Cladosporium* and *Rhizopus*. The microbial enumeration of the collected samples during the study period from water, sediment and muscle of selected commercial edible fresh water fish species *Labeorohita* collected Ambrapalayam river during the study periodJuly-Dec-2017 was presented in table.1.

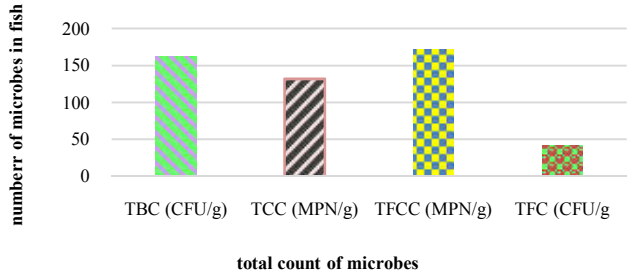
Microbes in Sediment: During the present study in the collected soil sample microbes like *Aspergillusfusarium, Aspergillusfumigatus, Aspergillusniger, Aspergillusfavus, Cladosporium, Rhizopus, Eschericeria coli, Aeromonashydrophilia* were identified to be maximum while *Enterobacter cloacae, Bacillus subtilis*, *Shigella*sp, *Vibriocholera* and *Pseudomonas* sp. are recorded minimum in study site during the study period in the analysed sediment samples. Total bacterial count (TBC) 102×10^9 (cfu/ g), 118×10^9 (MPN/g) of total coliform count, 128×10^9 (MPN/g) total faecal coliform count and 38×10^9 (cfu/g) total fungal count was quantified in the analysed sediment sample during the present study respectively. Among the microbial community estimated the higher recorded is total faecal coliform count 128×10^9 (MPN/g) and lowest is total fungal count 38×10^9 (cfu/g) in the sediment samples is shown in table.1; fig.3.



Microbes in Water*:* *Aspergillusfusarium*, *Aspergillusniger*, *Aspergillusflavus*, *Enterobacter cloacae, Bacillus subtilus, Shigellasp, E.coli, Vibrio cholera, Pseudomonas sp, Aeromonashydrophilia* are observed to be maximum level in the water samples while *Aspergillusflavus, Cladosporium and Rhizopus*, are recorded minimum level in

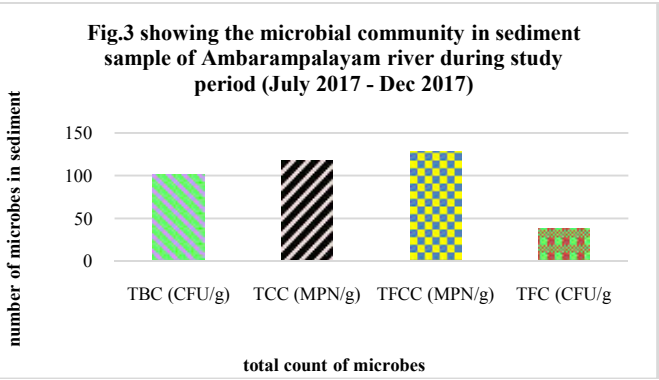
the water samples. In the present study from the analysed water sample the 145×10^9 (CFU/g) total bacterial count, 121×10^9 (MPN/g) of total coliform count, 150×10^9 (MPN/g) of total faecal coliform count, 20×10^9 (CFU/g) of total fungal count was recorded in the water samples. During the analysis the highest (150×10^9 (MPN/g)) of total faecal coliform count and followed by (145×10^9 (CFU/g)) total coliform count was recorded in the river water samples. The lowest ratio is total fungal count 20×10^9 (CFU/g) in the water table.1; fig.1.

Fig. 2 showing the microbial community of fish muscle sample of Ambarampalayam river during study period (July 2017 - Dec 2017)



Microbes in Fish muscle: *Aspergillusfusarium, Aspergillusfumigatus, Aspergillusniger, Aspergillusflavus, Cladosporium, Enterobacter cloacae, Bacillus subtilis, Shigellasp, E.coli, Vibrio cholera, Pseudomonas sp, Aeromonashydrophilia* are identified in maximum level in the fish muscle sample while *Rhizopus* is present in minimum level in the analysed fish sample. Total bacterial count 163×10^9 (CFU/g), total coliform count 132×10^9 (MPN/g), total faecal coliform count 172×10^9 (MPN/g), total fungal count 42 $\times10^9$ (CFU/g) were observed in the fish samples Table.1; fig.2. The highest total faecal coliform 172×10^9 (MPN/g) count and lowest 42×10^9 (CFU/g) total fungal count in the fish sample was recorded respectively.

Fig.3 showing the microbial community in sediment sample of Ambarampalayam river during study period (July 2017 - Dec 2017)



Thus from present microbial analysis highest microbial count was recorded in the fish. Next to fish muscle sample the maximum microbial load was recorded in water sample followed by sediment collected from Ambarapalayam river during the study period (July2017-Dec2017). Total faecal coliform count ratio is higher in all the samples (sediment, water and fish).The detection of total faecal coliform in the rivers provides strong evidence of pollution in the water from human activities and with faecal contamination originating from humans, ruminants and birds (Kirs *et al*., 2011). Residential housing located near the sampling sites and leaching of untreated wastewater from latrines into the groundwater system is a potential source of bacterial contamination. The presence of vibrio sp. in the fish can cause pathogenic infection to the consumer and *E.coli* has been associated with nosocomial outbreaks and considered as opportunistic pathogens. *Aspergillus* sp were found most of the time during study period and showed maximum level in the sediment, water, and fishes. The *Aspergillusfusarium* present in water, sediment and fish collected from study area may cause to the people deficient immune system. *Rhizopus* sp were obtained low counts in fishes. The most important microbial diseases transmitted through water are typhoid fever, paratyphoid fever, amoebic dysentery, bacillary dysentery, cholera, poliomyelitis and infectious hepatitis (Chaturvedi *et al*., 2008).

The main source of pathogens in water bodies is the faeces of humans and warm-blooded animals which enter the aquatic environments through the release of wastewater effluents (DallaVecchia *et al*., 2015), surface runoff and soil leaching. The concentration of these pathogens is susceptible to changes. This is critical in the tropics where climate change is expected to cause prolonged dry periods as well as intense rain events and flooding which can increase soil runoff, sediment transport (Easterling *et al*., 2000; Fauvel *et al*., 2016), washing out of faecal matter from latrines into drinking water supplies and subsequent contamination of groundwater and reservoirs (Wirmvem *et al*., 2013). Changes in land use activities (Viau *et al*., 2011; Uriarte *et al*.,2011), rainfall patterns and the behaviour of wildlife and domestic animals will exacerbate the problem by enhancing sediment and bacterial transport into streams (Strauch *et al*., 2014) during rain events. Rivers and streams are the main sources of water for domestic activities and agriculture and are also vulnerable to pollution from these activities. The recent outbreak of water-borne diseases such as water borne disease has prompted the need to seriously address the safety of available water for human consumption and domestic activities in Coimbatore. Communities may rely solely on river water for these purposes or use it to supplement their reticulated supply, especially in regions where water shortage is frequent during the dry season.

CONCLUSION

Life and river are closely integrated in most parts of India. The country depends on its river system for fishery, agriculture, navigation and even sanitation. From above mentioned results and according to analysis of the data, it is clear that the highest microbial count was recorded in the fish. Next to fish muscle sample the maximum microbial load was recorded in water sample followed by sediment collected from Ambarapalayam river during the study period (July2017-Dec2017). Total faecal coliform count ratio is higher in all the samples (sediment, water and fish). However, it is recommended to suggest a way forward in achieving proper management though effective planning for the conservation of this river in near future. Thus through this study the public and government are recommended to follow rules like: i) continual assessment on the levels of pollutants in the study area. ii) People should be strictly instructured i.e legally made aware not to dispose their civic waste in the water of Ambarampalayam river iii) Government

should pay attention to improve water quality of with special reference to heavy metals and microbes.

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