Prevalence and Biochemical Characterization of Bacteria Isolated from some River/Canal Bank Water Sources, Door of Transport Vehicles and Shop Counters of Western UP and Uttrakhand area in India

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Aim of the present study is prevalence and biochemical characterization of bacteria isolated from some River/Canal bank water sources, door of transport vehicles and shop-counters. Water samples from river/canal bank water sources and swab samples from door of transport vehicles and shop-counters were collected and analyzed for the load of pathogenic microorganism and possible disease potentials of these sources to prevent possible disease outbreak for the inhabitants. The results of study presents water samples collected from River/Canal bank contains the total aerobic bacterial counts ranged between 21×10^5 to 16.6×10^6 per ml, while on the door and seat handles of public transport vehicles and frequent public use shop counters the total bacterial counts ranged between 18×10^4 to 17.5×10^5 and 21×10^4 to 11.3×10^5, respectively. All of these were within the range of a high risk specified by WHO. In addition, There was a high correlation between water isolates with fecal isolates of different sources both in their culture characteristics as well as biochemical profiling which implies that the different sources might have been contaminated with mixed contaminants instigate from human as well as animal excreta. Forestalling of deterioration of water quality and pathogenic diseases transmission to humans via contaminated and improperly cleaned surfaces require community health superintendents, sanitary officers and Environmental Protection Board as well as private organizations to educate the population on personal and environmental hygiene.

Key Words: River/Canal bank water, Shop counters, Bacterial contamination.

1. INTRODUCTION

In the environment microbes are found everywhere and constitute a major part of ecosystem. In the atmosphere, they live either freely or as parasites [1]. The increasing incidence of epidemic outbreaks of certain diseases and its rate of spread from one community to the other has become a major public health concern [2,3].

Across the world rivers are considered the main water resources for domestic, industrial and agricultural purposes [4]. Major factors affecting microbiological quality of surface waters in India are discharges from sewage, open defecation and runoff from informal settlements [5].

Every day billions of citizens use public transport systems to commute from one place to another. Planes, trains, buses or taxis, these transport methods are essential to many people's lives for travel. With so many of us relying on public transport, trains are often overflowing, buses used to turn passengers away, and it can be difficult to flag down a free taxi [6]. With increased volumes of passengers comes a higher risk of spreading microbes, especially when we consider just how many touch points there are within these vehicles. Door handles, seat handles and covers, and more, can all be touched in quick succession by many different commuters. Public transport provides the perfect environment for harmful bacteria to thrive, which have a great importance to the risk of human health.

However, the risk of disease transmission through microbes is determined by the frequency of site contamination and exposure; level of pathogen excreted by the host; likelihood of transfer of the infectious agent to a susceptible individual; virulence of the organism; immuno-competence of the persons in contact; the practice of control measure such as disinfectant use and personal hygiene [7]. Consequently, users can hardly wash their hands after usage, carrying the contaminants from such conveniences [8]. Although it is accepted that the infection risk in general community is less than that associated with patients in hospital, the yearly increases in food poisoning cases in which household outbreaks are a major factor, requires an assessment of the probable causes and sources [2].

So this study was designed to determine the level of pathogenic microbial load at river/canal bank water sources, door handle of transport vehicles and shop-counters and public awareness creation activities on water quality and sanitation together with requirements of community health superintendents, sanitary officers and Environmental Protection Board as well as private organizations to educate the population on personal and environmental hygiene in that particular area.

2. MATERIALS AND METHODOLOGY

Water samples were collected from the River/Canal bank water from different sites as given in Table 1 and swab samples from transport vehicles especially from buses and shop counters of adjacent city/towns taken for study.

Table: 1 Showing the area, latitude and longitude of sampling site

S. No.	Area	Latitude	Longitude
1	Ram Jhoola (UK)	30.1233645	78.3144626
2	Srikrishna ghat (UK)	29.9458072	78.1580972
3	Sarvanand ghat (UK)	29.97094	78.1804011
4	Gaughat (UK)	29.9456906	78.1642478
5	Kankhal (UK)	29.926281	78.146298
6	Mangalore (UK)	29.874858	77.889928
7	Khatauli (UP)	29.2904085	77.7316189
8	Sardhana (UP)	29.150012	77.6166547
9	Muradnagar (UP)	28.7618092	77.5242954
10	Masuri Canal (UP)	28.6906368	77.5575249
11	Hindon Mohan Nagar (UP)	28.6691565	77.4537578
12	Hindon Mourchery (UP)	28.6691565	77.4537578
13	Hindon Vaishali (UP)	28.705555	77.359444
14	Yamuna NZM	28.5948466	77.2491365
15	Yamuna Dwarikadhish Mathura (UP)	27.58058	77.700607
16	Khera Sujanpur Aligarh (UP)	27.9713024	77.7823973
17	Anoopshahr (UP)	28.3531775	78.2662797
18	Anoopshahr (UP)	28.3531775	78.2662797
19	Bulandshahr (UP)	28.3984223	78.8250456
20	Santpura Bulandshahr (UP)	28.406963	77.8498292
21	Sanota Bulandshahr (UP)	28.406963	77.8498292
22	Dehra Ghaziabad (UP)	29.1396816	78.5369806
23	Garh Mela (UP)	28.6236701	78.0538733
24	Brijghat (UP)	28.7613084	78.1416777
25	Brijghat (UP)	28.7613084	78.1416777

3. SAMPLING AND CULTURING

A total number of 150 samples were collected includes 50 water and soil samples were collected from River/Canal bank, 50 samples from exposed surfaces of the door handles of public transport vehicles and 50 from exposed surfaces of shop counters. All samples were collected using full aseptic precaution. Water samples were collected in sterilized 15 ml capped plastic tubes (Tarson) while Samples from door handles of public transport vehicles and frequent public used shop counters were collected using the swab-rinse technique of the American Public Health Association as described by Reynolds [7]. Door handles and shop counters were swabbed with sterile, cotton tipped swab stick

moistened with sterile normal saline. It was then introduced into bijou bottles containing sterile peptone water, shaken, and loosely capped. The bijou bottles were covered with cellophane and transported in ice packs. The peptone water is the medium in which swab samples were thawed and cultured on different agar plates. This was to allow quick recovery of all organisms picked up in the samples. Then, the plates were incubated for 24 hours at 37^0 C.

4. IDENTIFICATION AND BIOCHEMICAL CHARACTERIZATION OF BACTERIAL CONTAMINANTS

Bacterial isolates were first differentiated by macroscopic examination of the colonies. The colonies were differentiated based on size, color, pigmentation, elevation, surface texture, margin, and lactose fermentation. Microscopic, motility and different biochemical tests were also carried out to further identify a range of bacterial isolates.

5. RESULTS AND DISCUSSION

The results of study presents water samples collected from River/Canal bank contains the total aerobic bacterial counts ranged between 21×10^5 to 16.6×10^6 per ml, while on the door and seat handles of public transport vehicles and frequently public used shop counters the total bacterial counts ranged between 18×10^4 to 17.5×10^5 and 21×10^4 to 11.3×10^5, respectively.

Table 2 : Comparative Analysis of preferred bacteria (*Streptococcus* sp., *Staphylococcus* sp., *Pseudomonas* sp., *E.coli* and *Klebsiella* sp.) in the study.

Bacterial isolates		**River/Canal bank**	**Bus Handle**	**Shop Counter**
Streptococcus sp.	*S. anginosus*	7	7	7
	S. pneumoniae	6	7	7
	S. bovis	7	5	5
Staphylococcus sp.	*S.aureus*	13	14	11
	S.epidermidis	7	4	6
	S.saprophyticus	8	22	31
Pseudomonas sp.	*P. aeruginosa*	11	3	5
	P. putida	6	5	7
	P. fluorescens	4	5	6
E.coli		8	9	10
Klebsiella sp.	*K. pneumoniae*	6	5	4
	K. ozaenae	4	2	4

Table 2 shows the different organisms isolated in the three study groups. *Staphylococcus* sp. was the most prevalent bacteria found in all groups.

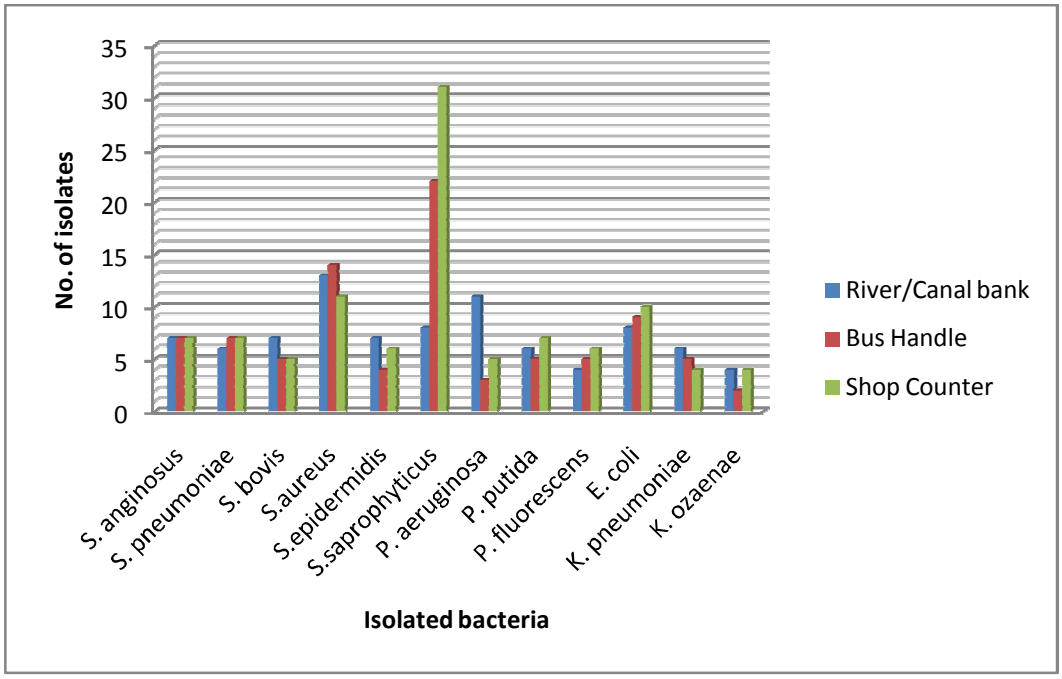

Fig. 2: Graphical representations of preferred bacteria in the study group.

In the present study, the results are shown in Figure 2. It shows that from the river/canal water samples 56% (28/50) isolates were *Staphylococcus* sp., followed by 42% (21/50) *Pseudomonas* sp., 40% (20/50) *Streptococcus* sp., 20% (10/50) with *Klebsiella* sp. and least contaminated with *E. coli* 16% (8/50), respectively. According to Alam *et al*. [9] the water of river Barak and its tributaries had been found to be largely polluted and bacterial isolates include 26.09% *Pseudomonas*, 21.74% *Staphylococcus*, 13.04% *E. coli*, 13.04% Sarcina, 8.69% Enterobacter, 8.69% Shigella, 4.35% Serretia, and 4.35% Klebsiella.

Of the buses, 80% (40/50) were contaminated with *Staphylococcus* sp., 38% (19/50) with *Streptococcus* sp., 26% (13/50) with *Pseudomonas* sp., 18% (9/50) with *E. coli* and least contaminated with *Klebsiella* sp. 14% (7/50), respectively, but in the similar study conducted by Augustino *et* al. [10] isolated and identified the following bacterial isolates from the different surfaces (restroom floor, toilet seat, toilet bowl, door handles in and out of the restroom, faucet handles and toilet flush handles) in the students' hostel toilets: *Staphylococcus aureus* (26.7%), *Escherichia coli* (36.7%), *Pseudomonas aeruginosa* (10.0%), *Proteus mirabilis* (6.7%), *Klebsiella pneumoniae* (11.7%) and *Streptococcus pyogenes* (6.7%) and the study is supported by Jonathan *et al.* [11] found 68% (27/40) *Staphylococcus aureus* and 63% (25/40) contamination with MRSA on buses. Shop counters were also contaminated with 96% (48/50) were contaminated with *Staphylococcus* sp., 38% (19/50) with *Streptococcus* sp., 36% (18/50) with *Pseudomonas* sp., 20% (10/50) with *E. coli* and 16% (8/50) with *Klebsiella* sp., and in another study samples from toilet door handles/knobs *Staphylococcus aureus* had the highest prevalence 30.1%, followed by *Klebsiella pneumoniae* 25.7%, *E. coli* 15.6%,

Enterobacter species 11.2%, Citrobacter species 7.1%, *and Pseudomonas aeruginosa* 5.9% while Proteus species had the least prevalence, 4.5% [12].

6. CONCLUSION

Results of this study are significant because river/canal water is the main source for drinking and domestic use to a large population in the sampling area. In conclusion, it is important to note that there is a high level of bacterial contamination as well as high level of prevalence of the bacterial contaminants and fits under its potential to cause epidemics. Results of the present study indicated that water in the particular area is contaminated with various pathogenic bacteria and unfit for drinking and other domestic purpose. Open defecation, poor drainage and dumping facilities of domestic wastes resulted in the deterioration of water quality in the study area.

Furthermore, from this study it can be noted that surfaces touched with hands (like door handles of transport vehicles carrying a large population from one place to another place and shop counters from where we purchase a lot of items for our daily purpose use) had the highest level of bacterial contamination. This is also acts as a good source of transmission of pathogenic diseases to humans via contaminated and improperly washed hands. The study showed that regular cleaning of the frequent public use sites and proper hand washing with soap and disinfectants may prevent the spread of pathogenic microbes.

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