# Evaluation of Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit: A microbiological study

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## ABSTRACT

**Background:** The present study was conducted for evaluating Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit.

**Materials & methods:** Sample size for the present study was 225. Total number of 25 treated water samples and 200 Dialysate samples were analysedduring the time period of six months i.e from January 2022 to June 2022. Treated water samples were collected immediately past the water purification system (Reverse Osmosis) water tank and from Reverse Osmosis (RO) lines supplying the HD unit. From each haemodialysis machine, dialysate samples were obtained where dialysate exits the dialyzer in the HD unit. For treated water, the colony count/ml was determined by multiplying the number of colonies seen by 10. The number of colonies seen was multiplied by 1000 to get the colony count per ml of dialysate sample. The acceptable limits of bacterial contamination for Treated water and Dialysate were taken as less than 200 CFU/ml and less than 2000 CFU/ml respectively. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

**Results:** 173 out of 200 dialysate sample showed no positive for bacterial colony forming unity. 27 out of 200 dialysate sample showed positive growth for bacterial colony forming unit which were less than 50cfu/ml. 18 out of 25 treated water samples showed-negative growth. 7 out of 25 treated water samples showed positive growth for CFU.

**Conclusion:** Quality of dialysis water is dependent upon quantity of microbial contamination of untreated water, water purification techniques used and maintenance of water treatment and distribution systems.

**Key words:** Haemodialysis, Dialysate, Bacteriological

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## INTRODUCTION

The term dialysis is derived from the Greek words dia, meaning "through", and lysis meaning "loosening or splitting". It is a form of renal replacement therapy, where the kidney's role of filtration of the blood is supplemented by artificial equipment, which removes excess water, solutes, and toxins. Dialysis ensures maintenance of homeostasis (a stable internal environment) in people experiencing a rapid loss of kidney function i.e., acute kidney injury (AKI), or a prolonged, gradual loss that is chronic kidney disease (CKD).[1-3]

The incidence of renal replacement therapy (RRT) depends on the incidence and prevalence of conditions causing end-stage renal disease (ESRD), early diagnosis of chronic kidney disease (CKD), and measures to slow progression to end-stage renal disease (ESRD). ESRD disease burden is attributed to diabetes mellitus (45%) and hypertension (30%) besides rarer causes like polycystic kidney disease, obstructive uropathy, and glomerulonephritis. Women are at higher risk for CKD, while men have a higher risk of ESRD. There are three broad types of dialysis: Hemodialysis (HD), Peritoneal dialysis (PD) and Continuous renal replacement therapy (CRRT). [1-3] Contamination of water by microbes can cause biofilm formation in Haemodialysis (HD) system subsequently resulting in release of endotoxins. Once this biofilm is formed, it is tedious to remove it despite efforts of using regular disinfecting agents. Also at the same time, it exists as a constant source of endotoxins, peptidogycans and fragments of bacterial DNA that can cross the dialyser membrane and further act as stimulation for cytokine production and trigger elevation of acute phase reactants. Furthermore; acute intradialytic complications like fever, chills, hypotension, headache, nausea, cramps can occur as a consequence/sequel to this biofilm and its products. Studies also suggest evidence of a possible



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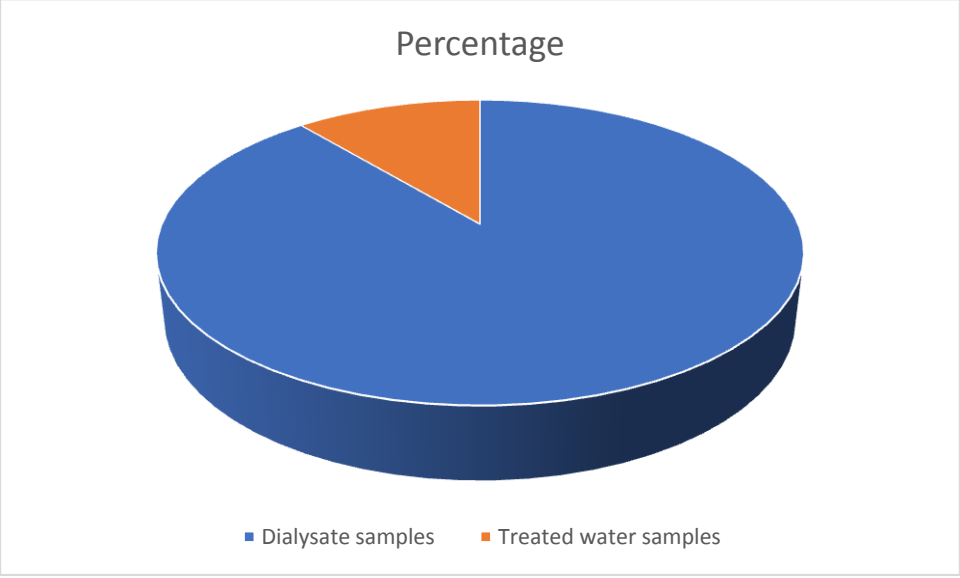
relationship between water contamination and long-term morbidity, β2 amyloidosis, atherosclerosis.[5-7]

Another matter of concern regarding these dialysis fluids are qualitative and quantitative microbiological composition. It is crucial to screen the microbiological profile of dialysis water. Good quality water can help improve patient's quality of life and could possibly increase their survival rates.[7-8] Hence; the present study was conducted for evaluating Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit.

## MATERIALS & METHODS

The present study was conducted for evaluating Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit. Sample size for the present study was 225. Total number of 25 treated water samples and 200 Dialysate samples were analysed during thetime period of six months i.e from January 2022 to June 2022. Treated water samples were collected immediately past the water purification system (Reverse Osmosis) water tank and from Reverse Osmosis (RO) lines supplying the HD unit. From each haemodialysis machine, dialysate samples were obtained where dialysate exits the dialyzer in the HD unit. The sample ports were disinfected with alcohol and allowed to dry before collecting the samples. At each point of collection, the valve was opened and water allowed to flow for a minimum of 2 minutes at normal pressure and flow rate before the samples were drawn. Samples were collected using a "clean catch" technique to minimize potential contamination of the sample based on criteria described in previous in literature.[9]

**Graph 1: Distribution of samples**




## SAMPLE PROCESSING

For processing of samples in the present study, TGEA Agar plates were used. The samples were mixed by vortexing. 0.1ml of treated water samples were pipetted and placed on the centre of the plate. Dialysate samples were inoculated onto separate TGEA Agar plates using 1µl calibrated loop. The sample was spread with a cool alcohol flamed glass rod spreader onto the plate. The plates were incubated at 350C for 48 hrs.[9]

## INTERPRETATION

For treated water, the colony count/ml was determined by multiplying the number of colonies seen by 10. The number of colonies seen was multiplied by 1000 to get the colony count per ml of dialysate sample.The acceptable limits of bacterial contamination for Treated water and Dialysate were taken as less than 200 CFU/ml and less than 2000 CFU/ml respectively in accordance with the Govt of India guidelines for Haemodialysis described previously in the literature.[9]

## STATISTICAL ANALYSIS

All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

## RESULTS

In the present study, total number of 25 treated water samples and 200 Dialysate samples were analysed. Hence; total samples processed were 225. 173 out of 200 dialysate sample showed no positive for bacterial colony forming unity. 27 out of 200 dialysate sample showed positive growth for bacterial colony forming unit which were less than 50cfu/ml. 18 out of 25 treated water samples showed-negative growth. 7 out of 25 treated water samples showed positive growth for CFU.





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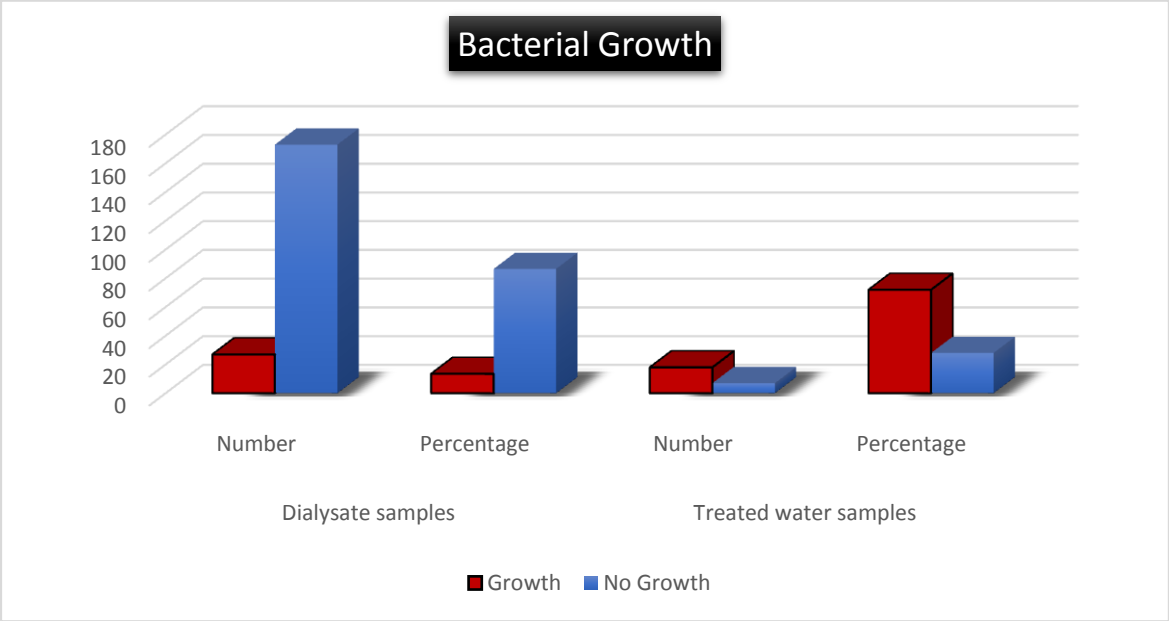
**Graph 2: Bacterial Growth**






## DISCUSSION

Water is the main component of the human body and, without any doubt, of all living organisms. However, various microorganisms present in water can cause diseases in humans, leading to infectious, toxigenic and parasitic processes. In view of the environmental degradation caused by the high rate of pollution as a result of the ecological imbalance on the planet, and because water is an essential element to life, active environmental management and a greater control of the quality of water resources are required. In the case of water contamination, patients with chronic renal failure are more susceptible than the general population due to the dialytic treatment to which they are submitted, but the prognosis and future of these patients have undergone marked modifications with the latest technology employedwhen compared to the survival of the general population. The water used in the hemodialysis process should be recognized as a vital product since its direct user is certainly an immunocompromised individual who is susceptible to any opportunistic process. Although microorganisms are known to grow in certain fluids associated with dialysis equipment, microbiological contamination has not been taken seriously in the projects of systems developed for dialytic therapy.Water treatment system adopted by hemodialysis servicesshould be constantly monitored to respect the maximum levels of contaminants permitted, thus guaranteeing the health of the patient.[7- 10]Hence; the present study was conducted for evaluating Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit.

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pretreatment samples, while endotoxin production was detected in 100% of the samples. In post-treatment samples, heterotrophic bacteria were detected in 66.6% of the samples and endotoxins in 33.3%. The microorganisms identified in unit B were Burkholderia cepacia, Alcaligenes xylosoxidans, Pseudomonas aeruginosa and Stenotrophomonas maltophilia. In unit C Flavimonas oryzihabitans, Ralstonia pickettii and Burkholderia cepacia were identified. A significant correlation was observed between the presence of endotoxins and the physicochemical characteristics of water such as turbidity and conductivity.[11]

The positive impact on the microbiological quality of dialysis patients through the progressive implementation of state-of-the-art technological strategies was conducted in another previous study conducted by Bolasco P et al. Following on better microbiological, quality controls of dialysis water and improvement of procedures and equipment, a drastic improvement of microbiological water quality was observed in a total of 945 samples. The main aim was to introduce the use of microbiological culture methods as recommended by the most important guidelines. The microbiological results obtained have led to a progressive refining of controls and introduction of new materials and equipment, including two-stage osmosis and piping distribution rings featuring a greater capacity to prevent biofilm adhesion. The actions undertaken have resulted in unexpected quality improvements. Dialysis water should be viewed by the nephrologist as a medicinal product exerting a demonstrable positive impact on microinflammation in dialysis patients.[12]Oumokhtar B et al, in another study, evaluated the chemical, microbiological quality and antimicrobial resistance of bacteria isolated from water and dialysate in a public HD center.Fourteen per cent of the isolates were resistant to three or more antibiotics. All resistant bacteria belong to the genus of Pseudomonas, 80% were resistant to tetracycline and to co-trimoxazole, 30% to ceftazidime. No colistin and imipenem resistance was observed. They concluded that to avoid a health risk due to bacterial contamination, an adequate system for water treatment, disinfection of the hemodialysis system and microbiological monitoring of the water and dialysate are necessary.[13]

## CONCLUSION

Under the light of above obtained results, it can be concluded that quality of dialysis water is dependent upon quantity of microbial contamination of untreated water, water purification techniques used and maintenance of water treatment and distribution systems. Hence; there is an urgent need for regular monitor the quality of water used in HD units.

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