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Microbiological contamination in reverse osmosis water supply chain: An assessment of microbial quality from production to consumption among hostel students in University of Jaffna

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Background and objective: Reverse Osmosis (RO) treatment is widely used to provide microbiologically safe drinking water in areas with poor groundwater quality, such as the Jaffna Peninsula in Sri Lanka. However, the risk of secondary microbial contamination after treatment remains a concern, particularly in decentralized systems. This study aimed to assess the microbial quality of RO-treated water along the supply chain and identify associated storage and hygiene factors among hostel students through a structured questionnaire survey.

Methods: Fifty water samples were collected from four points: production sites (immediately after RO treatment), storage tanks at production sites, distribution tanks used by suppliers, and 5-liter bottles stored in student hostels. Microbial analysis was performed using the membrane filtration technique to detect Total Coliforms and *Escherichia coli* as contamination indicators. A structured questionnaire was administered to 280 students to gather information on water usage frequency, storage duration, container cleaning practices, and satisfaction with water quality. Data were analysed using SPSS, and associations were tested using Pearson's correlation, with $p < 0.05$ considered statistically significant.

Results: RO-treated water met microbiological standards at production points; however, contamination was frequently detected in storage and end-use samples; 45% of end-use samples exceeded SLS limits for Total Coliforms, and 20% showed TNTC (>2000 CFU/100 mL). Occasional *E. coli* contamination was also found. Among students, 50.4% and 30.4% used RO-treated water always and frequently (at least once daily), respectively. Only 47.1% cleaned containers weekly, 18.9% monthly, and 15.4% never cleaned them. Most students (68.6%) obtained water from third-party distributors, and 30.4% stored water for 3–5 days at room temperature. A weak negative correlation ($r = -0.147$, $p < 0.05$) was observed between satisfaction with water quality and perceived changes in taste, odour, or appearance.

Conclusion: The study demonstrated that RO-treated water met standards at production but was subject to significant secondary contamination during storage and end-use. Improper handling, infrequent cleaning of containers, and prolonged storage were major contributing factors. These findings highlight the need for improved post-treatment handling, regular container maintenance, and awareness programs for students and distributors to ensure safe RO water consumption in hostel settings.

Keywords: RO-treated water, microbial contamination, storage conditions, hygiene, student hostels, Jaffna