COMPARATIVE STUDY BETWEEN NUMBER OF ISOLATED BACTERIAL FROM RAW WATER AND WATER PRODUCED IN FACTORIES

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Abstract

The study was investigated the bacteriological contamination in Tigris River raw water and Tap water in Bagdad city from different area as Rashidiya, Kadhimiya, Shawaka and Salhia regions while the Tap water from Al-Hurriya region, the results showed The results were revealed the fecal coliform and members of the The Enterobacteriaceae was most prominent bacteria in the studied area and and gram positive bacteria as well While the results reported the isolated bacteria was less in Tap water also the current study isolated pathogenic bacteria as *Aeromona hydrophila*, *Pseudomonas aeruginosa* , salomenall spp, and some isolated that cause UTI as *P.vulgaris* and *P. mirabilis*. However, the results showed the bacteria count was higher in the areas compared in Tap water but the area 2 was recorded the highest count 952+0.432 With significant differences between other area at $p \leq 0.05$ while in Tap water was 271+0.46. The study were revealed the fecal coliform and members of the The Enterobacteriaceae was most prominent bacteria in the studied area and and gram-positive bacteria which attributed to the factories and hospitals in the studied area are thrown into the Tigris River.

Keywords: Raw water, Tap water, Bacteria count, pathogenic bacteria

Introduction

God said in the Qur'an, that God made from water every living thing, meaning that the origin of all living things is from water, it is a vital factor for all known forms of life and has a major role in the health of living organisms in general and human health in particular. drinking water define is water that is clean enough for humans to drink. Water pollution has become a feature of modern life, and to stay healthy, drinking water must be clean and healthy. There are many studies on the extent of contamination of drinking water. Anochie and his colleagues 2018 found through a bacteriological examination of six brands of drinking water produced in different regions of Nigeria that showed varying degrees of bacterial load, in another study in Dharan municipality, Nepal, it was found that tap water was 100% and bottled water was 87.5% contaminated with heterotrophic bacteria (Pant *et al*., 2016).In a recent American study, the shotgun metagenomic analysis technique was used that determines the microbial content, and this technique can identify microbes that do not appear in different culture methods in drinking water from different sources, and this study showed that the dominant bacteria species were from phyla *Actinobacteria* and *Proteobacteria* and the genera *Propionibacterium, Salmonella*, and *Alishewanella*, and the studied samples did not show contamination with faecal bacteria i.e., *Escherichia coli* or enterococci (Brumfield *et al*., 2020).Access to safe drinking water is a basic human right. In general, the current civilization has adopted methods of filtration and disinfection to treat drinking water, which greatly reduced the rates of death or disease

(Cutler and Miller 2005). Various disinfectants such as chlorine have been used to purify water from microorganisms but this treatment causes the emergence of strains resistant to these disinfectants (Shi *et al*., 2013). Moreover, bacteria can grow uncontrolled in the biofilm bacteria form in the water pipes during delivery and this can cause the spread of different types of bacteria, which leads to potential health problems for humans in addition to other negatives of these organisms which cause spoiling of taste and colour or causing potential human hygiene problems Water pollution is one of the important contemporary problems that the world faces in general as a result of water pollution with various wastes that may be pathological as a result of contamination with sewage wastes, which cause the spread of many in addition to toxic industrial waste harmful to human health(Fish *et al*., 2017). Drinking water safety and quality are perennially significant public health issues (Hrudey and Hrudey, 2007 ; Reynolds *et al*., 2008). Human or animal activities inside that body of water or within its watershed can have an impact on the quality of the raw water. A UNICEF report estimates that 800 million people in Asia and Africa lack access to clean drinking water. As a result, many people now experience a variety of ailments (Tanwir *et al*., 2003). However, the main causes of illness incidence and prevalence worldwide are limited availability, poor quality, and sanitary conditions (WHO 2004). Water contamination has frequently been linked to the spread of germs that cause diseases like *Vibrio*, *Salmonella*, bacterial and parasite dysentery, and acute infection diarrheal *E. coli* (Fobes *et al.,* 2002). Hence, the aim of this study was to determine the extent of contamination of drinking water from various sources in Baghdad city.

Material and methods

Samples Collection and Studied Areas

Water samples were collected from four different areas located on the Tigris River, which are Al-Rashidiya, Al-Kadhimiya, Al-Shawaka, and Al-Salihiya. These areas are famous for the presence of sewage treatment, hospitals, and factories that throw their waste into the river. Samples were taken from different locations of the river for a period of one month, which is March of the year 2022 at ten o'clock in the morning. In addition, a sample of potable water was taken from a residential area known as the Al-Atifiyya at the Al-Karkh side of Baghdad city for comparison purposes.

The samples were collected in sterile glass containers with a capacity of 250 ml and the samples were numbered from 1-5, respectively then transferred to the laboratory immediately after collection and in an ice cork container to provide low temperatures to preserve the microbial content and for the purpose of conducting laboratory tests on them within six hours.

The Bacteriological Parameters.

The samples were collected in clean sterilized glass bottles of 250 mL Drinking water samples from areas (Rashidiya, Kadhimiya, Shawaka and Salhia) also taken in sterilized bottles of 250 mL capacity. Forty 200 mL tap water sample were also taken from the houses of Al-Atifiyya region after the sterilization of house faucet. These five samples were numbered from No. 1 to No. 5. respectively, all these bottles were closed carefully and transported to the laboratory on ice, and kept at 4°C, and processed within 6 hrs. All bacteriological analyzes were performed according to the standard method for the examination of water and wastewater [Baird et al.,2012]. Coliform species were determined using the standard coliform fermentation technique, which included presumptive, confirmed, and completed tests, Whereas, pathogenic enteric bacteria were identified using the VITEK® 2 technique to identify each isolate.

Total coliform, fecal *E. coli*, and *Pseudomonas aeruginosa* was determined by means of standard coliform fermentation technique including presumptive, confirmed, and completed tests [WHO,1996]. For identification of other pathogenic enteric bacteria different dilutions of water samples from different sources were spread on Nutrient agar, Macconkey agar, blood agar, eosin-methylene blue agar (EMB), and Thiosulfate citrate bile sucrose agar (TCBS) medium. The plates were incubated

overnight at 37°C, and after incubation, cultures were examined for distinct colonies.analyzed morphological classification an biochemical studies for distinction and selective media (Giuliano *et al*., 2019) and confirmation diagnosis by VITEK® 2.

Results and discussion

The results were revealed the fecal coliform and members of the The Enterobacteriaceae was most prominent bacteria in the studied area and and gram positive bacteria as well While the results reported the isolated bacteria was less in Tap water as in table 1 also the results showed the bacteria count was higher in the areas compared in Tap water but the area 2 was recorded the highest count 952+0.432 With significant differences between other area at $p \leq 0.05$ while in Tap water was 271+0.46 as in figure (1).

Table (1): The bacteria isolated from the studied areas

Area 1	Area 2	Area 3	Area 4	Tap water
P.aurginosa	*E.cloacae*	*P.vulgaris*	*Salmonalla spp*	*K.pneumoniae*
S.aureus	*E.coli*	*K.pneumoniae*	*E.coli*	*E.coli*
E.cloacae	*P.vulgaris*	*E.feacalis*	*P.aurginosa*	*P.aurginosa*
E.coli	*K.pneumoniae*	*Lactobacillus*	*P. fluorescens*	*P.vulgaris*
P.vulgaris	*A.hydrophila*	*C. freundii*	*S.aureus*	*P. mirabilis*
K.pneumoniae	*S.aureus*	*S.aureus*	*Klbsella*	*E.cloacae*
E.feacalis	*E.feacalis*	*E.feacalis*	*P.mirablis*	*Lactobacillus*
Lactobacillus spp	*E. aerogenes*	*E.coli*	*Streptococcus spp*	*E.aurginosa*
C.freundii	*C. freundii*	*Streptococcus spp*	*E.feacalis*	
P. mirabilis	*Streptococcus spp*	*E.cloacae*	*P.aurginosa*	
Streptococcus spp	*P.aurginosa*	*E. aerogenes*	*C.freundii*	

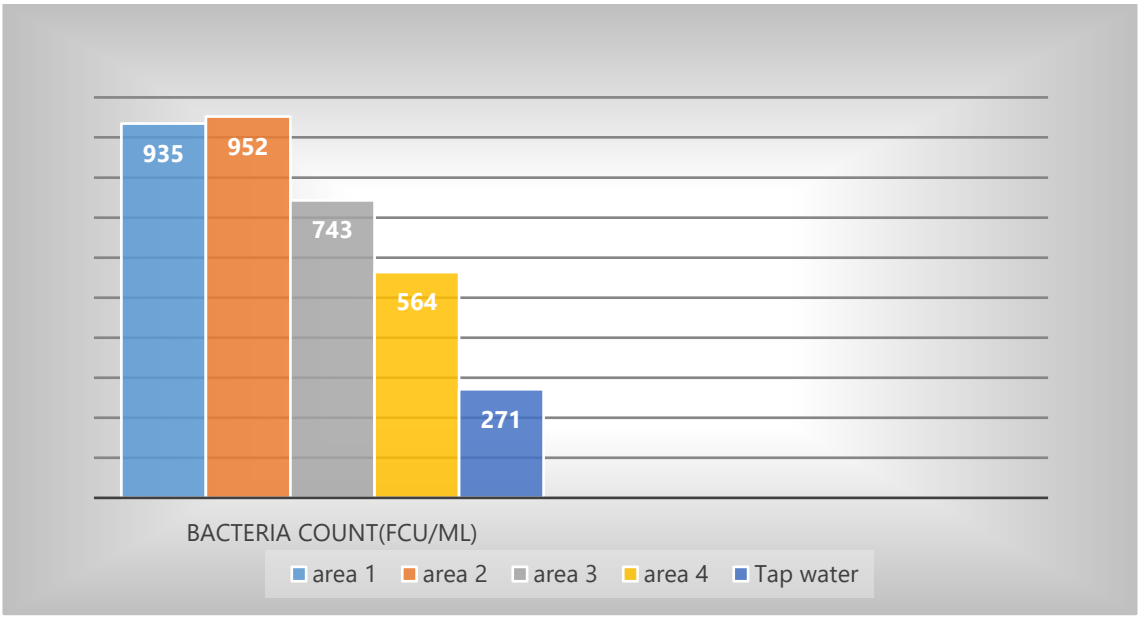

Figure (1): The Viable bacteria count in studied area

These findings were agreed with (Humudat et al.,2022) that showed that 44% of the tested samples for bacterial levels are higher than the maximum value of (100 CFU/ml) set out by the international standards also agreed with (Al-Bayatti et al.,2012)whose data indicated a high level of total viable bacterial counts in water of the 3 stations and were between (1–64 CFU/100 mL). These microbial findings indicate a non-efficient purification procedures in all stations studied. Also, these microbial counts were exceeding the international allowable levels especially in the Al-Karama station, while the total viable bacterial counts of the Tigris river (raw water) was between (468–9100 CFU/mL).

Moreover Abd Al-Kareem et al.,2015) found the distribution and seasonal variation of the Total Bacterial Count in the water of Tigris river and revealedThe results in this study revealed high level of TVBC at different season, in summer was the highest average value reach to 5331 CFU/100ml while in spring was the lowest average value reach to 2274 CFU/100ml during Autumn, also we notice raise of TVBC average value in winter.

Ibrahim and his colleagues (2013) found the total viable count, total coliforms and fecal coliforms in different swim areas and months of sampling collection. These values ranged from 128-10000 cells/ml also Enteric bacterial isolates: Fecal coliform showed positive significant correlation with presumptive E. coli, Shigella, Salmonella and Proteus/Klebsiella, total Vibrio and P. aeruginosa . Our study showed total coliform (E. coli, Enterobacter spp., Klebsiella spp. respctivelly) were found to be the most prevalent organism isolates. Furthermore, it was observed Proteus spp. 80% of the sample, these results show that stream water sources had more contamination with wastewater.

However the results came in agreement with (Al-Bayatt et al.,2012)Microbial analyses included estimation of the number of total viable microbial counts, total coliform, total fecal E. coli and Pseudomonas aeruginosa, and other pathogenic bacteria that might be present in the water of the three stations and of the Tigris River, and also the tap water from Al-Shula houses. The results indicated that the types and proportions of various bacterial species isolated from different water sources were almost similar. Bacteriological analysis of water resources included total viable bacterial counts, total coliforms, total *E. coli,* and total *Pseudomonas aeruginosa*. Data in Table 2 indicate the presence of at least 14 species of bacteria belonging to the family Enterobacteriaceae and some other species belong to the family Pseudomonadaceae. The most common species were *E. coli* and *Pseudomonas aeruginosa.* The presence of these 2 species indicate that the drinking water are most probably contaminated with human and animal fecal.

Al-Dulaimi and Younes, (2017) found during evaluate the quality of potable water in Baghdad city in the AL-Doualya, AL-Muthada, Sama, Safa, AL-Furat, Nabue, AL-Rayan, Mazi, and Rahyek and found he obtained results show the presence of total coliform bacteria. This highlights the demand for further investigation of the type and source of these microorganisms dstrict 1 has the highest total coliform presence, with an average of 7 CFU/100 mL, which may be attributed to the large population in this district and extensive industrial activities.

The studies found pathogenic bacterial as *Aeromona hydrophila* and thus agreed with (Ashwak *et a*l.,2016) that found as all samples were bacteriologically examined by traditional methods for detection of Total coliform and other pathogenic bacteria. Thirteen isolate of Aeromonasspp were isolated and tested for its pathogenicity from the tap water in Baghdad city and salmonella spp that agrred with (Nama and Alsqr,2014) that isolated rom drinking water in some region of Baghdad city One of the most important indicators of contamination of drinking water with high risk pathogens is the presence of coliform bacteria [Bain *et al*.,2014]. The bacteriological analysis of drinking water focuses on the total numbers of live bacterial counts in the water and on the total number of coliform bacteria and fecal coliform bacteria in addition to the total number of Pseudomonas aeruginosa, the presence of several bacterial species of Enterobacteriaceae in drinking water of Baghdad city. Escherichia coli and P. aeruginosa were the most common. The presence of these two types of bacteria in drinking water likely indicates contamination of this water with human and animal feces, and this

could strengthen the hypothesis of the presence of pathogenic microbial factors that can be transmitted through human or animal feces (Al-Dulaimi,&Younes, 2017).

In order to evaluate the water quality of the selected samples from the different areas mentioned in the material and methods(Rashidiya as area 1, Kadhimiya as area 2, Shawaka as area 3and Salhia as area 4) , through tests for bacterial contamination of the water, for example, coliform bacteria and other bacteria polluting the water.The results showed that the coliform bacteria and members of the enterobacteriacea bacteria were the most prominent bacterial species frequency in the four different areas from which the samples were taken, and significant differences were found between the four samples were taken from the river with the tap water, where it was found that the highest total viable bacterial counts was in the Kadhimiya region, followed by the Rashidiya region, then the spines, and finally the Salhia region figure 1.

The continuous disposal of this untreated waste leads to the multiplication of these microbes, whether they are commensal, opportunistic, or pathogenic, which ultimately leads to serious risks and costs to public health, such as increasing diseases and increasing antibiotic-resistant microorganisms, and this is observed in densely populated areas(Dobrowsky et al 2014), as we mentioned above these areas that samples were taken were densely populated, and as we know that the climate of Baghdad / Iraq is suitable for microbial growth, which helps to increase the pollution of the rivers water.In addition to the impact of these pollutants on human health, they also affect the agricultural and industrial sectors, as they lead to agricultural pollution and the proliferation of algae that harm the vital ecosystem (Leong et al 2018). In general, our country faces a shortage of water, as happens in many developing countries, and many regions lack clean, reliable water for human use. Rivers are the main source of fresh water, and these rivers are at risk as a result of being exposed to pollution from human waste, and for this reason there must be Strict laws to conserve water rivers that are important for human living.

Conclusion

The study were revealed the fecal coliform and members of the The Enterobacteriaceae was most prominent bacteria in the studied area and and gram positive bacteria which attributed to the factories and hospitals in the studied area are thrown into the Tigris River .

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