Microbiological Analysis on Tigris River Water in the Selected Sites in Baghdad Province, Iraq

Afrah F. Abd Al-Kareem[1] Kadhum H. Al-Arajy[1] Kifah A. Jassim[2]
1.Department of Biology,College of Science, University of Al-Mustansiriya
2.Central Health Laboratory, Epidemiology Section
Corresponding author's e-mail: starfarah888@yahoo.com

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Abstract
Bacteriological analyses were carried out on Tigris River water while passing through Baghdad City the capital of Iraq. The Tigris River was selected in this study because this river supplies water for many sector of development like agriculture, industry, transportation, aquaculture, public water supply. Microbial pollution indicators such as - total count, total coliforms, fecal coliforms was studied, Samples were collected over a period of twelve months from September 2013 to August 2014. The results showed variation in the number and density of microbial indicators between month and seasons of study sites. A highest number of bacterial pollutants recorded through summer and spring seasons. The total coliform and Faecal coliform counts exceeding acceptable limits are indicative of pollution. to protect human health must reduce the pollution of the river through control the levels of pollutants discharged into Tigris River and reduce dissemination of the coliform and fecal coliform bacteria.
Keywords: Bacterial indicator, Water pollution, Tigris River

1. Introduction

The water of rivers plays an important role in development of the country. (Kumar*,* 2002). River water finds multiple uses in every sector of development like agriculture, industry, transportation, aquaculture, public water supply etc. However, since ancient times, rivers have also been used for cleaning and disposal purposes. Huge loads of waste from industries, domestic sewage and agricultural practices find their way into rivers, resulting in large scale deterioration of the water quality (Ravindra *et al.,* 2003). Urban rivers are more prone to pollution mainly due to their close proximity to many pollution sources like domestic wastewater discharge points, industrial effluent discharge points, and solid-waste disposal sites. Where urban agriculture is practiced, agricultural lands are an additional source of pollution to urban rivers (Mbuligwe and Kaseva, 2005).
Contamination of water has been frequently found associated with transmission of diseases causing bacteria, Vibrio, Salmonella, bacterial and parasitic dysentery, and acute infection diarrhea causing E. coli (Stark *et al.,* 2000).

Water is considered a vehicle for the propagation and dissemination of human associated bacteria (Mulamattathil *et al.,* 2014). Bacteria are ideal sensors for microbial pollution of surface water because of their fast response to environmental changing (Kavka and Poetsch, 2002). There are no unanimous opinions about microbial pollution indicators in aquatic systems, however, coliform group bacteria, especially total coliform bacteria (TCB) and fecal coliform bacteria (FCB), have been selected as water microbial indicators traditionally (APHA, 2005). Coliform group bacteria generally don't cause danger to peoples or animals, but it indicates to presence of other disease causing bacteria in aquatic systems, FCB are a good indicator for human and warm-blood animals wastes tracking in to the aquatic systems (Yehia and Sabae, 2011).

Humans become infected by pathogens through consumption of contaminated foods, such as shellfish from contaminated waters or crops irrigated with wastewater; from drinking contaminated water; and through exposure to contaminated surface waters as may occur during bathing or at recreational sites. Furthermore, those individuals infected by the above processes become sources of infection through their excrement, thereby completing the cycle (Pepper *et al.,* 2006).

Tigris River receives many pollutants when it is passing through Baghdad City, due to many human activities and factories which have been discharged their wastewater into the river without any real treatments. It has been for that reason, Tigris River used as a sink for wastes from agricultural, industry and other human activities due to its flow and ecological nature, Therefore, the aim of this research was to assess the microbiological quality of the Tigris River water in the selected sites within Bagdad City.

2. Materials and Methods

2.1. Study area

Tigris River consider one of the most important twin rivers in Iraq, sharing with Euphrates River as the main sources for man use, especially for drinking water and irrigation since they cross the major cities in the

country(Rabee *et al.,* 2011). Baghdad has an area of 800 km2, and 65% of all the industrial institutions and factories were located in Baghdad. This condition generated ecological problems threatening the ecosystem of Baghdad city, due to the drainage of sewages and byproducts of these institutions and factories directly to the body of Tigris River. (Al-Bayatti *et al.,* 2012)
The study area included three stations on Tigris River Within Baghdad city, the first was located at North of Baghdad in the northern area of Ghera'att City, and the second at middle part in the area Baghdad medical city, whereas the third station located at South part in the area near Al-Jadiriah Bridge (Figure2).

2.2. Sample collection
Sample were collected from three station located on Tigris river, duplicated samples were taken monthly in the morning hours from November 2013 to October 2014, to collection the samples were used sterilized glass bottle of 0.5 L capacity the collected samples were transport to the laboratory by ice box for analysis.

2.3. Microbiological analysis
Samples were analyzed for microbiological properties immediately after collection. Each analysis was carried out in duplicated and then the mean value was taken. Procedures followed for analysis have been in accordance with the Standard methods for examination of water and wastewater (APHA, 2005).
The test are Total Viable Bacterial Counts (TVBCs) were determined by using the spread plate method and incubated at 37˚C for 24hrs. The Total Coliform Bacterial counts (TCBC) were determined by using Most Probable Number (MPN) method. One milliliter from each dilution was added to each of duplicated tubes containing 5ml of luryal trptose bile broth, these tubes had been incubated at 37˚C for 48hrs for Total Coliforms Bacteria and at 44˚C for 24hrs for Fecal Coliforms Bacteria Counts(FCBC), positive result by formation gas that lead to rise derhum tubes and change the color of media from purple to yellow,the results of growth compared according to standard tables (APHA, 2005), these tubes were complete the identification by microscopic examination and biochemical tests

3. Results and Discussion
The distribution and seasonal variation of the Total Bacterial Count in the water of Tigris river are shown in the Table 1 and Figure 1.

The 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. It was normal results to raise the number of bacteria during summer season due to increase in water temperature which leads to increase a microbial activity through its effect on enzymatic activity of these microbes; temperature is widely recognized as an important controlling factor in influencing bacterial growth. (WHO, 2003).

Also raise of TVBC during winter may be due to increase entering bacteria to the water through sewage, drift with soil to water during season of rains and floods as well as the original bacteria in water. the statistical analysis showed that there was a significant differences at p.v≤(0.05) for TVBC among month and season while no any significant differences among station.

TCBC in this study ranged between 10141MPN/100ml at winter season while the highest average value recorded during summer reach to 93500 MPN/100ml The results revealed high level of TCBC at different sites and seasons of current study .The highest number of TCBC was recorded during summer ,which might be the consequence of the high level of suspended solid and nutrients in the drainage water which affected the survival of aquatic microflora, or due to the positive relationship between temperature and bacterial levels suggests that heat induced growth may be a contributing factor to seasonally high bacteria levels, Wastes from agricultural processes, which are usually discharged into surface water have been reported to serious environmental and human health concern (Adams and Kolo, 2006).

Fecal coliforms are the best indicators for the assessment of recent fecal pollution, mainly caused by raw and treated sewage, and diffuse impacts from the farm land and pasture (Kavka and Poetsch, 2002). The results showed the high variability in levels and number of bacterial indicators in month and seasons in Tigris River may be due to the variation of environmental conditions such as turbidity, temperature, salinity, dissolved oxygen and organic matter. Also the highest average value of FCBC in this study were recorded at station2 which conceder discharge point for medical city, Besides that, other sources in urban areas contributed to increase in faecal concentration include domestic animal, also pigeons, geese, and rats. Animal feces accumulate on the ground, and following a storm event are flushed into nearby streams and lakes (Pepper *et al.,* 2006).

In conclusion, the results of this study underline the importance of the surface water and the high concentrations of coliform and fecal coliform bacteria at the three stations in all seasons were more than the international permissible levels recommended by WHO. Therefore, strict measures should be taken in order to control the levels of pollutants discharged into Tigris River and for reduce dissemination of the coliform and fecal coliform bacteria to protect human health.

Table 1: The mean, Standard Deviation, minimum and maximum of bacterial indicator count in water of Tigris River

		Station1			Station2			Station3		
		TVBC TCBC TFBC * Season								
Season		TVBC	TCBC	TFBC	TVBC	TCBC	TFBC	TVBC	TCBC	TFBC
Winter	Mean	2825.0000	10141.6667	8333.3333	2593.3333	30416.6667	26433.3333	1704.1667	23066.6667	21766.6667
	Std. Deviation	1248.89952	7408.40176	6985.89054	741.93441	5295.43829	4373.86176	364.83444	16273.49583	16071.92169
	Minimum	1350.00	3600.00	2300.00	2100.00	23000.00	20500.00	1400.00	8400.00	7600.00
	Maximum	4300.00	20000.00	18000.00	3600.00	36000.00	31500.00	2300.00	44000.00	43000.00
	Std. Error of Mean	509.86109	3024.46735	2851.97787	302.89345	2161.85363	1785.62158	148.94304	6643.62685	6561.33455
Spring	Mean	1990.0000	59083.3333	51933.3333	2315.0000	70333.3333	64666.6667	2589.1667	78500.0000	71300.0000
	Std. Deviation	1250.21598	74499.94407	65758.70031	338.43759	34062.68731	32720.79869	431.86128	66929.06693	59319.06945
	Minimum	360.00	4500.00	3600.00	2095.00	23000.00	20000.00	2000.00	11000.00	9600.00
	Maximum	3130.00	160000.00	143000.00	2800.00	95000.00	87600.00	3000.00	160000.00	145000.00
	Std. Error of Mean	510.39854	30414.47481	26845.87699	138.16657	13906.03386	13358.21013	176.30663	27323.67716	24216.90869
Summer	Mean	3806.6667	93500.0000	89333.3333	5253.3333	77333.3333	77750.0000	6933.3333	87666.6667	79550.0000
	Std. Deviation	2955.22362	3781.53408	4512.94435	2747.55649	8524.47457	7954.55844	1430.61758	25711.21675	20490.55880
	Minimum	160.00	90000.00	85000.00	1800.00	65000.00	62500.00	5100.00	54000.00	53500.00
	Maximum	6750.00	100000.00	95500.00	8020.00	89000.00	84500.00	8400.00	116000.00	100000.00
	Std. Error of Mean	1206.46499	1543.80482	1842.40181	1121.68524	3480.10217	3247.43489	584.04718	10496.56028	8365.23560
Autumn	Mean	1886.6667	31350.0000	29083.3333	3160.8333	36583.3333	31316.6667	1775.0000	23433.3333	17800.0000
	Std. Deviation	2088.17305	18296.96696	17359.19545	3331.81395	23821.03412	18446.39983	946.44070	8621.29147	7366.68175
	Minimum	360.00	11300.00	9500.00	755.00	8500.00	7500.00	600.00	15000.00	10200.00
	Maximum	4600.00	55000.00	50000.00	7600.00	65000.00	53500.00	2800.00	35000.00	28500.00
	Std. Error of Mean	852.49308	7469.70548	7086.86187	1360.20735	9724.89646	7530.71120	386.38280	3519.62751	3007.43523
Total	Mean	2627.0833	48518.7500	44670.8333	3330.6250	53666.6667	50041.6667	3250.4167	53166.6667	47604.1667
	Std. Deviation	2036.52620	48087.76580	44300.74569	2362.56737	28865.37969	28593.36981	2356.52052	46218.41029	41746.28834
	Minimum	160.00	3600.00	2300.00	755.00	8500.00	7500.00	600.00	8400.00	7600.00
	Maximum	6750.00	160000.00	143000.00	8020.00	95000.00	87600.00	8400.00	160000.00	145000.00
	Std. Error of Mean	415.70417	9815.87409	9042.85185	482.25705	5892.12096	5836.59717	481.02274	9434.29349	8521.42543

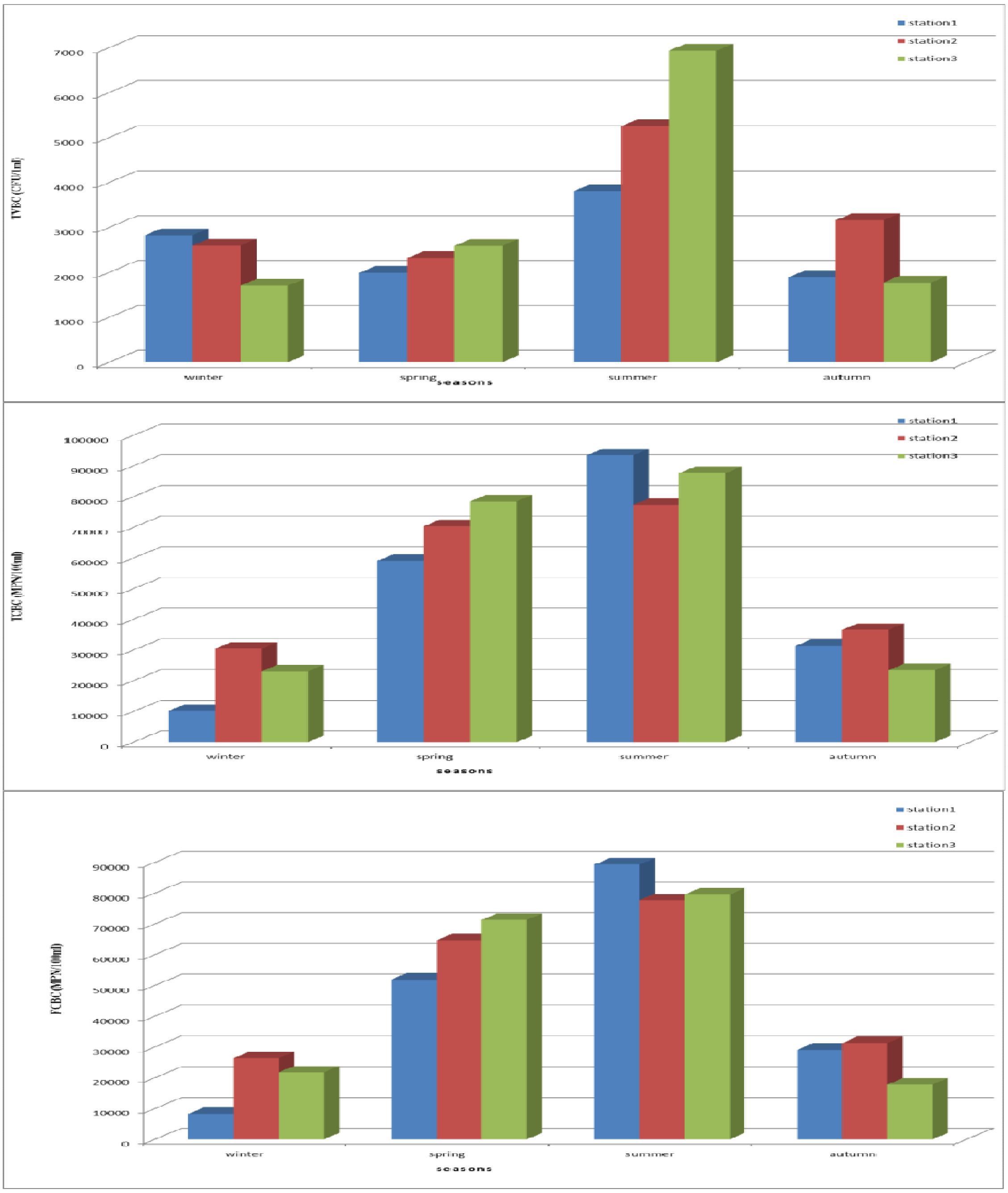

Figure 1. Average of station for four season of bacterial indicator in water of Tigris River

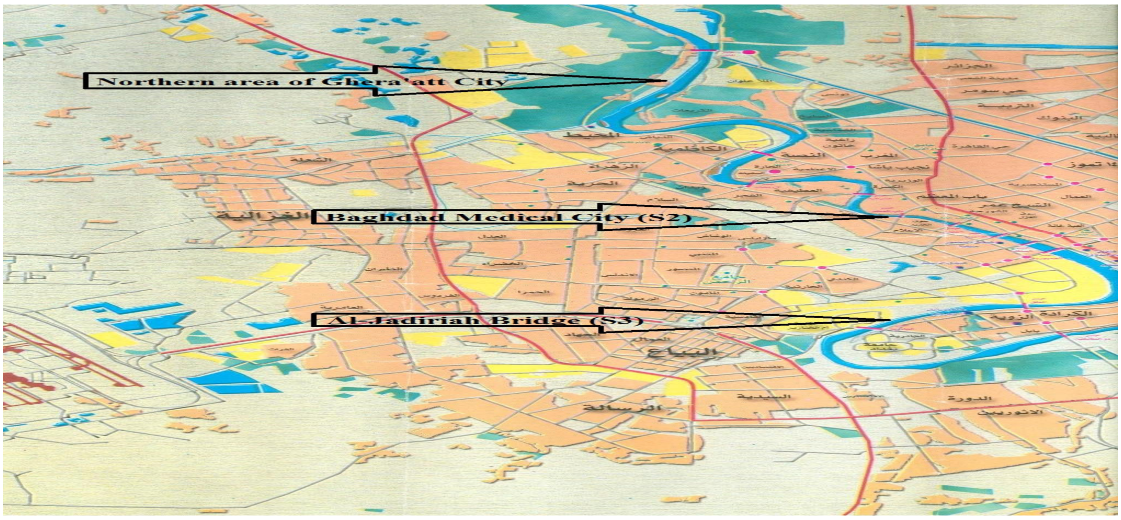

Figure2. Tigris River map and the location of sample station

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