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Water Analysis Of Physiological And Chemical Properties Of River, Well And Tap Water From Different Regions Along Tigris River

By

Mazin Raad Mahmood ALSalman
Public Health Department/ College of Veterinary Medicine/ University of Baghdad/Iraq

Tamara Natik Dawood
Public Health Department/ College of Veterinary Medicine/ University of Baghdad/Iraq

Abstract

This study was conducted to find out the concentration of some properties (pH , TDS, EC & Turbidity) in well water, river water, and tap water along the Tigris River (Mosul, Salah al-Din, Baghdad, Wasit, and Maysan).

The results showed that the differences between water types were significant ($P < 0.05$) for all groups. And the differences between the governorates, that there is a significant increase in the pH of tap water ($P < 0.05$) in Wasit Governorate (7.64). While the highest rate of acidity was recorded in the river water in Missan and Wasit. While well water was significantly higher ($P < 0.05$) in Baghdad governorate. The results of total dissolved solids for drinking water were significantly higher ($P < 0.05$) in Missan and Mosul governorates. While the highest concentration was recorded in the river water of Baghdad and Mosul governorates. Well water recorded the highest concentration in Missan Governorate compared to its concentration in other governorates, in addition to that the electrical conductivity was significantly higher ($P < 0.05$) in well water compared to other types of water in different governorates. Turbidity levels were significantly higher ($P < 0.05$) in the water of Mosul wells compared to other water sources in all different governorates.

Keywords: Water analysis; tap water; Tigris River

Introduction

The study of water pollution is one of the important studies in the world that deals with the life of the living organism, especially the water used for drinking or irrigation, and there are many studies of different water sources such as lakes, rivers and rain, as well as groundwater and the extent to which it is affected by pollutants whose concentrations have increased recently as a result of population growth and the growth of industrial activities and the increasing use of chemicals such as pesticides and compounds used in various industries as well as means of transportation, which has a great impact on water quality, so it was necessary to work on it and prevent its pollution in order to preserve human health and the public life cycle **(Afifi & Fathi Abdel Aziz,2000).** Human activities like industrial production, mining, agriculture, and transportation emit large amounts of heavy metals into surface and ground water, soils, and the biosphere **(Nasir et al., 2015).** Also the quality of water effect of each mineral and its role in public health, and to set the upper permissible

limits in the use of water, according to the standard specifications and the system for the maintenance of water from pollution **(Hadad., 1977).**

This study aims to know the concentrations of some properties in river water, well water and tap water through chemical and physical analysis of the water and its impact on human and animal health.

Material And Method

This experiment was about collecting samples of river, well and tap water from different areas along the Tigris River in Iraq (Mosul, Salahuddin, Baghdad, Wasit, Maysan), and measuring the concentrations of some elements, pH, dissolved solids, electrical conductivity and turbidity of the water. This study lasted (3 months) February, March and April 2022. The samples were kept in the refrigerator at 4 degrees Celsius before analysis, after which they are sent to the laboratories of the Iraqi Ministry of Science and Technology to measure the concentration of these elements.

pH measurement

The procedure to estimating of pH examination was by pH meter/ SD300Ph/Lovi/Germany .

TDS measurement

Total dissolved solids (TDS) is measured as a volume of water with the unit milligrams per liter (mg/L) by TDS meter/ 0-9990 PPM / USA.

EC measurement

Electrical conductivity estimation were done by using electrical conductivity the unit microSiemens per linear centimeter (mS/cm) meter/cond7110/WTW/Germany.

Turbidity measurement

Turbidity estimation were done by using Turbid meter / Nephelometric Turbidity Units (NTU) 2020wi/Lamotte/USA.

References for water

Standard Methods for the Examination of Wastewater.American Public Health Association. American Water Works Association, Water Enviroment Federation.2017.

Statistical analysis

The program was used to detect the effect of difference locations in study parameters. Least significant difference -LSD test (Analysis of Variation - ANOVA) was used to significant comparison between Estimate of correlation coefficient between variables in this study means (SAS, 2012).

Results And Discussion

Table (1) results revealed that the differences among type of water are significant ($P< 0.05$) for all groups except Maysan and Wasit. The differences among governorates showed that there were significant increase in Tap water pH ($P<0.05$) of Wasit governorate (7.64). While the highest mean of pH in River water was detected in Maysan and Wasit. Whereas, well water were significantly higher ($P< 0.05$) in Baghdad governorate.

Table (1): *pH value of the River, Well & Tap from Different Regions along Tigris River*

pH	Tap	River	Well
Baghdad	B7.14±0.08c	B6.96±0.09b	A8.06±0.12a
Mosul	B7.16±0.12bc	B7.20±0.05ab	A7.86±0.03ab
Salah Al-Din	B7.13±0.08c	B7.00±0.05b	A7.60±0.20b
Maysan	A7.56±0.14ab	A7.53±0.20a	A7.70±0.30ab
Wasit	A7.64±0.05a	A7.50±0.17a	A7.73±0.04ab
LSD	0.40		

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (2) showed Total dissolved solids results of tab water from different governorates revealed that TDS were higher significantly (P<0.05) in Maysan and Mosul governorates compared with its concentration in other governorates. While TDS recorded the significant (P<0.05) highest concentration in the river water of Baghdad and Mosul governorates compared with its concentration in other governorates. TDS in the well water recorded it highest significant concentration (P<0.05) in Maysan governorates compared with it concentration in other governorates. In addition, well water recorded significant highest (P<0.05) TDS compared with other water type and in the different governorates.

Table (2): *TDS Concentrations in the River, Well & Tap from Different Regions along Tigris River (µg/l)*

TDS (µg/l)	Tap	River	Well
Baghdad	C579.66±5.78b	B942.26±6.11a	A1961.90±4.80d
Mosul	C720.33±5.48a	B898.66±4.66a	A2312.63±3.73c
Salah Al-Din	B599.66±5.48b	C444.00±6.65c	A1969.30±5.17d
Wasit	B621.50±5.51b	B581.80±6.09b	A21733.33±8.81b
Maysan	B739.03±5.77a	C610.00±5.77b	A27800.00±57.73a
LSD	0.46		

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (3) showed the Electrical conductivity were significantly highest (P<0.05) in well water compared with other water types in the different governorates (table 4). EC in the tap water in the Maysan governorate were higher significantly (P<0.05) compared with Baghdad governorate. While it concentration in Baghdad governorate recorded the highest concentration (P<0.05) compared with other governorates. On the other hand, EC in the well water was (32870.67±5.81) in Maysan governorate which significantly higher compared with other governorates.

Table (3): *Electrical conductivity (EC) in the River, Well & Tap from Different Regions along Tigris River (µs/cm)*

EC µs/cm	Tap	River
Baghdad	C920.33±5.78b	B1298.67±4.66a
Mosul	B1113.00±6.50ab	B1198.33±4.40ab
Salah Al-Din	B983.66±6.33ab	B739.33±5.20c
Maysan	B1200.33±5.78a	B982.66±8.19bc
Wasit	B1042.33±5.48ab	B977.00±5.77bc
LSD	0.0001	0.0001

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

Table (4) showed that turbidity levels were significantly higher (P<0.05) in the well water compared with other water sources in all different governorates. Turbidity levels was significantly higher in well water of Mosul governorates (P<0.05) compared with it level in other governorates. While the results showed non-significant difference in tap and river water between the different governorates.

Table (4): *Turbidity in the River, Well & Tap from Different Regions along Tigris River (NTU)*

Turbidity NTU	Tap	River	Well
Baghdad	B1.70±0.11a	B5.46±0.26a	A220.33±5.78b
Mosul	B2.10±0.05a	B2.70±0.36a	A230.00±5.77a
Salah Al-Din	B2.36±0.23a	B3.56±0.08a	A147.00±4.35e
Wasit	B2.22±0.05a	B4.83±0.05a	A167.66±4.66d
Maysan	B2.30±0.11a	B5.06±0.12a	A208.00±4.61c
LSD	8.47		

Means with a different small letter in the same column are significantly different (P<0.05)
Means with a different capital letter in the same row are significantly different (P<0.05)

The pH within normal range for surface water systems is 6.5 to 8.5 and for groundwater systems 6 to 8.5. PH has an important criterion for assessing the suitability of water for drinking and various uses and the possibility of contamination **(WHO,2011).** The results shown in the table (4-20) indicate that the values ranged (6.96-8.06) and note the fluctuation in the values for all studied sites and sources. The difference did not exceed 1.10 units as noted and this due to high buffering capacity of river water. The presence of HCO3- ions were it not for this capacity, the variations would have been significant and thus affect aquatic life **(Kevat et al., 2016).** As for total dissolved solid values, it is considered one of the most important factors that affect water quality, and the large concentration of total dissolved solid has a harmful effect on aquatic organisms **(Al-Asaaf, 2018).** While in table (2) indicate that the highest TDS concentration in the river water were recorded (942.26±6.11, 898.66±4.66) in Baghdad and Mosul cities respectively, increases and the TDS concentrations in River as a result of high rates of evaporation, Dissolved Solids in natural water are generally consistence from bicarbonate, chloride, calcium, magnesium, sodium and sulfate **(Mossa, 2006).).** However, the sewage waste consisting of many forms of pollution caused by humans, such as non-organic, organic components, radiation, and oil materials as well as biological pollution is thrown directly to the river **(ATSDRA, 2012). Najim and Aziz (2012)** revealed that the free chlorine in drinking water was below the standards set by the World Health Organization (WHO) in the period from July up to the end of August 2007. There are some variables which affect drinking water such as quantity of free chlorine, temperature, pH and oxidation-reduction potential of water on the sanitizing efficiency of the chlorine were studied theses were in the same trend with **Mohammed et al. (2009).**

On the other hand the results are showed in table (4-22) measure electrical conductivity is a water-quality property often measured when water samples are collected for chemical analyses **(McNeal et al., 1970)** measurement of water's ability to conduct electricity, EC is related to water temperature and the total concentration, mobility, valence and relative concentration of ions **(Visconti et al., 2010)**. The results showed that the electrical conductivity in Mousal and Baghdad government are higher than other

governments, most of the geological nature of the Tigris River consists of sedimentary rocks, these sediments are gravel, sand, and mud, It has high electrical conductivity covering large areas in Iraq **(Buday,1980).** The results in table (4) showed that turbidity in well water very higher in Nineveh government compared with it concentration in other governments. Might be due to the high percentage of sulfur in the soil and contribution of agricultural activities from agricultural areas and mixing of wastewater (cracks in pipes sewage networks). Turbidity refers to water clarity. The greater the amount of suspended solids in the water, the murkier it appears, consequently the turbidity values will be higher **(Abbas, 2013).** Moreover, a negative correlation between TDS and the water amount discharge at the river has been found. For example, when river discharge declines, the TDS values increase **(Al-Shawi et al.,2007).** The accumulation of massive amounts of sewage waste from or reduced water flow has been the cause of the seasonal increase in turbidity, which leads to an increase in mineral pollution and threatens agriculture and other human food sources **(Al-Mahdi and Turki 2020).** The TDS level is also affected by tidal movement, and a measurable increase in the TDS concentration has been linked to the ebb tide at the River **(Jawad,1994).**

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