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The Dynamics and Characteristics of Water and Groundwater in Basrah Governorate and its Health Effects

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Abstract: ***The study examined the properties of well water and drinking water And domestic use in the Basrah governorate , and The studytargeted to identify the chemical, physical and biological properties of water in Basra Governorate,As well as an assessment of the procedures involved in the transfer of diverted water used for drinking, also identifiedOn the means of storing household drinking water in the governorate. The study was based on laboratory tests at the University of Basrah and reports from the Health General Laboratory in the Ministry of Health, and the Directorate of Water Basrah in the analysis. and study of the characteristics of some water Wells in the western Basrah governorate, which amounted to 4 wells working. In addition, 100 samples of household drinking water were collected in Basra governorate .In the study area, the sample was divided by the number of dwellings in that area. 100 questionnaires were distributed to the sample. The study found that the quality of groundwater is generally good in Basrah governorate in terms of concentration of some elements (total hardness TH, Magnesium Mg, Calcium Ca, Potassium K) where it was found to be within the standard specificationsWhich were authorized by the WHO and the Iraqi Ministry of Health, and that the values of another elements like Electrical conductivity E.C, solid TDS, NO3, Cl, Na do not matchWith WHO standards and Iraqi standards for water quality. The study showed that the Ca element of drinking water was dose does not conform to the WHO criteria and Iraqi water quality standards, followed by the K element(18%) and nitrate (15%). These elements have been removed from diverted drinking water are important elements of the human health, due to the high efficiency of desalination plants, as well as chemical analysis elements (C.E, TDS, Cl, TH, Na, Mg) Are within the international standard WHO and the Iraqi standard . The study recommended not buying water from horse-drawn vehicles, and taking care to periodically clean tanks And regular, And the need to change the internal caliber of the household filter, and for microbiological contamination (Organic) In domestic drinking water: Municipality, purchase, home filter, special purchase , The study indicated a high percentage of microbiological contamination with total coliform bacteria(TC)Coliform and hyperthyroidism (FC)Which exceeded WHO standards. The study showed a relationship between water pollution and total coliform bacteria and the feaced bacteria and the water, storage tool, and the cleaning period of the tank.***

Keywords: Pollution, water well , buying water, Municipality, purchase, home filter, special purchase, total coliform bacteria , feaced bacteria

1. Introduction

Water is the most abundant on Earth, accounting for 72% of Earth's surface. Water is present in nature in all three cases. It is seen in snow and ice in the polar regions and cold areas throughout the year. It is also found in the sea, ocean and river waters. It is also found in the form of gas (water vapor) stuck in the air in the form of moisture or In the form of clouds, but the most water situations present in nature is the liquid state. Water has a range of characteristics that distinguish it from other compounds or liquid elements

Water Characteristics The characteristics of water are divided into[1-7]:

a) Natural properties
b) Chemical properties
c) Biological characteristics

a) Natural Characteristics

1) Temperature

Temperature affects water treatment processes. It helps to quickly melt the added chemicals and the rapid deposition of particulate matter.

2) Turbidity

Organic substances such as algae and inorganic materials such as silt and sand may be. The turbidity in the surface water is more than in the groundwater because the latter are filtered as they pass through different soil layers.

3) Color

Water coloration occurs in the surface resource due to the degradation of organic matter or the presence of inorganic materials such as iron and manganese. Water coloration is one of the most significant indications of its non-applicability to human consumption and most industrial uses.

4) Taste

Water may sometimes be unpalatable, due to the presence of algae and rotting organic matter, or as a result of mixing it with waste water or industrial waste before treatment.

5) Odor

The presence of taste is unpalatable in the water with a bad smell at the same time, as the smell is caused in most cases by the causes of bad taste.

b) Chemical characteristics

1) Ph or Acidity:
Water is acidic if the pH is less than 7. One of the causes of the water tank is the presence of dissolved carbon dioxide or some organic acids resulting from the decomposition of plant residues. The disposal of industrial waste containing acids in water bodies increases the pH of the water. In addition to the corrosion and corrosion of iron pipes, acid water dissolves some harmful substances such as copper, lead and zinc. The preferred water to drink is pH (6.5 - 8.5).

2) Hardness
It is the presence of significant amounts of minerals that do not dissolve in water such as calcium and magnesium. Their presence in the water increases the pH of the water. And hardness causes crusts inside pipes, counters and water heaters. It also earns water that is unpalatable and makes it difficult to use soap.

3) Dissolved oxygen
Oxygen is present in fresh water as a result of natural ventilation, and the proportion of dissolved oxygen in cold water than in hot water, and the presence of algae in the water to produce oxygen during the day increases the level of oxygen dissolved in water and at night, Oxygen reduces the dissolved oxygen level in the water, and increasing the proportion of dissolved oxygen in the water causes corrosion in the metal surfaces contact with them such as valves, counters and pumps.

4) Alkalinity
Water alkalinity is due to the presence of hydroxides - carbonate - bicarbonate .. Some elements of active metals (Alkala) such as sodium, calcium, magnesium and potassium. Rising alkalinity of water leads to increased biological reproduction. There is no damage from water containing alkaline to 400 mg / l.

5) Dissolved Materials
When surface or ground water passes through soil or rock, it melts some of these solids and mixes with water. There is a maximum allowable solubility in water so as not to cause consumers health problems or gain water with unacceptable odor and odor. Some soluble substances are harmful to human health, so care should be taken to dispose of them during treatment .

6) Organic substances
There are many new types of organic substances whose effect on drinking water is not known in the long term. However, some of these substances cause cancer and others change the basis of cell formation.

The problem of the study[8-14]:
The world is witnessing remarkable urban and economic development, as well as a significant increase in population And increased prosperity and prosperity at the global, regional and local levels, which in turn has led to an increase Population consumption of water resources, which is the end source in Basrah governorate .A large water column is the first pillar of life and for all human activitiesAt the local level, Basra is facing a major water crisis ,Where underground stocks have deteriorated due to groundwater contamination, resulting in a clear deterioration in water characteristics. Negatively affected the health of the population, hence the problem of the study through: Assessment of the validity of water, whether groundwater or water for domestic use in the province of Basrah, and through the study we analysis of water samples used by the population to drink with different type, Domestic or municipal water or waters well, in addition to the study and analysis of samples

The water of the irrigation wells used in the west of the area of Basrah and then comparing the results of the analyzes.

Importance of the study[15-20]:
Growing population growth in the governorate of Basra has increased demand for water, with sources of remaining .This has led to the deterioration of water quality in Basrah Governorate as well as salinity
Water caused by excessive pumping resulting in the closure of many of the old wells from here come of importance this study.

Study the characteristics of drinking water in the governorate.

a) Evaluation of samples of drinking water sweetened by studying the characteristics of water before and after the desalination process.
b) Know the causes of deterioration in the quality of river water, well water and domestic drinking water in the governorate.
c) Provide recommendations to stakeholders and decision-makers on the causes of changing water characteristics Drinking in the governorate.
d) The study is based on the hypothesis that the city of Basrah suffers from high concentrations of mineral elements. In the water of rivers and groundwater as well as water is liquefied according to natural and human factors which directly affect the Public health of the resident of Basrah

Objectives of the study:
The objectives of the study are as follows:

a) Identification of the chemical, physical and biological characteristics of domestic drinking water in theBasrah governorate and compared with the international standard specifications and Iraqi allowed.
b) Identification of chemical and physical properties of drinking water in Basrah Governorate.
c) And compare them with the international standards (WHO) and Iraqi permitted.
d) Identify the causes that lead to changing the characteristics of drinking water in the Basrah governorate.
e) Evaluate procedures for the transfer of desalinated water used for drinking.
f) Identify the means of storage of drinking water in the governorate.

Study hypotheses:

a) Basrah suffers from changing drinking water characteristics.

b) Desalination owners follow wrong methods in transporting drinking water.
c) People follow wrong methods in transporting and storing drinking water.
d) Poor storage and storage of domestic drinking water (sweetened) is the real cause of changing characteristics microbiological drinking water.
e) There are differences in the characteristics of drinking water between the neighborhoods of Basrah governorate.

The importance of the study

The importance of the study is that the river flowing through the city of Basrah is exposed to manyUrban, industrial and agricultural contaminants as well as the high content of silt and plankton

And the seeds of plants and mammals that enter the river in its upper stage in addition to the influence of the city itself on quality ,Water of the rivers, which causes high concentration of mineral elements. In turn, they reflect the quality of the water, Affecting the health of the population living around the riverbed. Therefore, this study was conducted to identify the possibility Detection of the levels of the elements spatially and temporally, especially those that exist at a concentration exceeding the permissible limit with it . The current study attempts to reveal this and using the scientific method and through the following objectives

1) Conducting physical and chemical tests for the quality of water in Basrah city and evaluating its variation in place and Time.
2) Assessment of the quality of water in terms of the extent to which drinking water compared to global health determinants.
3) Evaluation of health effects on the population of the city of Basrah.

2. Methods of Sampling

Municipality water take directly from river water, the samples were collected by clean plastic and glass bottles and a capacity of 5.0 liters , Wash well with acetone and then from the same water of the river, with fixed numbers for each sample to avoid later abstraction. The water samples were drawn at a depth of 35 cm. To avoid floating impurities. Near the river bank, for being are more affected by the city's pollutants that are always on its banks. A great effort has been made to collect samples in the same to assess the concentration of pollutants more closely to reality.

As for the water samples of the lake, they were pulled from the faucet of each house, avoiding water reservoirs, For the purpose of verifying the actual quality of the water flowing to each neighborhood through its dwellings. Water bottles were also sterilized and add sodium thiosulfate to reduce with the deadly action of chlorine. After the completion of the sampling process, Depending on the seasons, they are transported as soon as possible to the laboratories after being placed in refrigerated cases.

Laboratory examination: The mineral elements were examined laboratoryly through the filter paper and as follows:

1) Calcium: Its ions were estimated to be corrected by the addition of the Fresnite solution [(5.59N) Na2-EDTA]Using the Murxide Directory.
2) Magnesium: Its ions are estimated in a computational manner. After estimating both calcium and magnesium ions togetherCorrected by adding the Fresnite solution and using the Erichrome Black guide and putting the concentration of ions Calcium.
3) Sodium and Potassium: Their ions were measured using a Flame Photometer . Jenway PFP7 type.
4) Chlorides: Their ions were corrected with silver nitrate [AgNO3], using a dicromate guide Potassium [K2Cr2O7].
5) Bicarbonate: Determined in a pH-Alkalinity method.
6) Sulfates: Turbid metric is estimated by using a spectrum instrument The Spectrophotometer is a U-9055 HITACHI, with wavelength 425 nm

3. Study Area

Basrah has an Iraqi city located in southern Iraq near the confluence of the Tigris and Euphrates Rivers 130 km from the Arabian Gulf. Thus they are located in the northern hemisphere, in the warm temperate zone. Basrah has a rainfall of not more than 100 mm per year.

Basrah is about 8 feet above sea level (2.4 meters). It is characterized by its important geographical location, which is the main gate of Iraq from the south with the different countries of the world. The location of Basrah is the meeting point of the Shatt al-Arab at the head of the Arabian Gulf, where the roads are clustered in southern Iraq.

Basrah is the second largest city in Iraq after Baghdad, and the main port of the state. Basrah is considered the economic capital of Iraq. The city reached the rank of million cities during the eighth decade of the twentieth century AD, where the population was 1,540,000 people in the census in 1977, and during the Gulf War in 1991 was exposed .The population of Basrah is currently more than one tenth of the total population of Iraq at present (10.91%). Population growth Basrah is one of the fastest growing cities in the world. Its population has doubled 81 times since the beginning of the 20the century. Basrah city of heavy shelling, causing the departure of many of its civilians and their residence in other parts of Iraq. And then increased to about two million in 1993. Since the beginning of the second half of the 20th century, the city has grown by 52% per year, doubling its population every two years Figure 1.

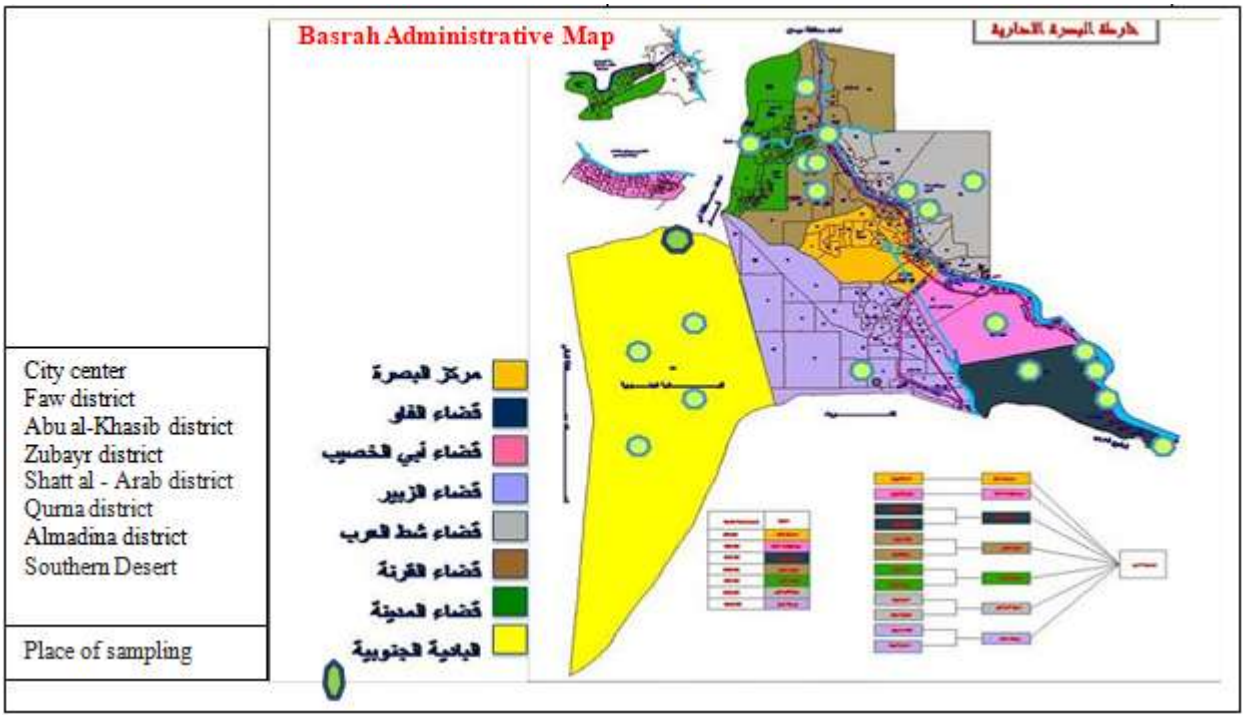

Figure 1: Basrah Administrative Map

Period of Study

The period of study was based on fieldwork and collection of water samples from citizens' homes. Basrah Governorate from 2016 to 2017 and analyzed by the laboratories of the University of Basra and the public health laboratory of the Iraqi Ministry of Health in the vicinity of Basrah, as well as the use of data available to the Directorate of Municipalities and Municipalities of Basrah and the Iraqi Ministry of Health and this period was set in 2016-2017.

Water Pollution Sections:

Contaminated water contains substances that are foreign to its natural component, which may be solid soluble or stuck,or dissolved organic or inorganic substances, or fine materials such as bacteria, algae or parasites,Thereby altering its natural, chemical or biological properties, making water unsuitable

For drinking or domestic consumption, nor is it suitable for use in agriculture or industry.

Water pollution is divided into several types:

1) Natural pollution: pollution that changes the properties of natural water and makes it unpalatable for human use to change its color and taste and acquire bad smell.
2) Chemical pollution: a pollution in which water becomes poisonous, due to the existence of hazardous chemicals Such as lead compounds, mercury, arsenic and pesticides.
3) Biological pollution: the presence of microbes or parasites in the water or the presence of plant life. Such as algae in large quantities that cause the change in nature and quality of water.

Accordingly, microbiological, physical and chemical analyzes can be conducted to determine the effect of contamination, Water with coliform bacteria, and the rise of some physical and chemical elements in the water and their effect on the human health.

Types of laboratory analysis:

Laboratory analysis of drinking water contamination is divided into three types:

1) Microbiological Analysis:

It is a laboratory analysis to determine the extent of water contamination with total coliform bacteria (C.T) and coliform bacteria (F.C) faeces (table 1). Water Pollution Microbiology:

Water pollution is a microorganism that sometimes causes illness to the population or may be non-pathogenic due to its normal presence in the human intestine such as bacteriae-coli, but its presence in drinking water refers to water pollution with wastes of human origin.

The World Health Organization and the Iraqi Ministry of Health have developed standards and specifications Standard for drinking water to ensure its safety or pollution.

The World Health Organization (WHO) has identified the percentage of pollution allowed in polluted water samples(5) e-coli bacterial colonies in the sample. For Fichus coliform bacteria, the World Health Organization (WHO) did not permit the existence of any bacterial colony and the sample of water is contaminated if any bacterial colony is found. The following table illustrates the microbiological characteristics of drinking water according to Iraqi health standards.

Table 1: Microbiological characteristics of drinking water according to the standards of the Iraqi Ministry of Health

Property	Unit of Measure	Maximum	Effect Quality	Notes
Total number of bacteria	Ml at the temperature ^{o}C (31-22)	On average Natural	Healthy	when necessary Way of Filtration
Total colon bacteria	100 ml / L	0.0	Healthy	95% of samples. It must be Clean
Colon bacteria Feces	100 ml / L	0.0	Healthy	-
Streptococcus bacteria Feces	100 ml / L	0.0	Healthy	-

Microbiological pollution treatment:
The safety of potable water, cooking and washing must be maintained during the process of pumping and storage until it reaches the population. Therefore, the source of pollution must be removed or alleviated, as well as the treatment of pollution. Water must be sterilized so that bacteria and microscopic microorganisms can be killed to maintain human health. Free chlorine can be added to the water to sterilize it (chlorination).

2) Physical Analysis

a) (PH)
Is a measure of the concentration of the hydrogen ion in the solution, to indicate whether the solution. Acidic or alkaline, ranging between (0-14), where the number (7) represents the degree of equivalence, so what Is less than (7) is acid, but more than (7) is alkaline Decreased and called (acidic): Lack of pH in drinking water leads to tooth erosion, acidity of the stomach, and contributes to the occurrence of duodenal ulcer.

Increases the pH of drinking water to indigestion. It is equivalent to acidity in the stomach and this leads to colic, and if stool is analyzed the stool will appear undigested.

b) Turbidity
The turbidity is shown in the water due to its particulate matter, such as clay, colloidal matter, and some microorganisms. Water turbidity is measured by its ability to diffuse or absorb light

c) Color
Absolute water has no color but color in natural water is produced by several large organic molecules.

d) Odor
The odor emanating from water may have been due to the breakdown of nitrogen, phosphorus and sulfur compounds ,Organic and inorganic or the death of algae and microorganisms and their disintegration or the production of some gases or substances such as ammonia, chlorine and sulfate, and the most important risks of persistent unpleasant odors, psychological frustration, psychological stress, headache, fainting, exhaustion, insomnia, difficulty breathing.

e) Taste
The taste of drinking water affects the palatability and acceptance of the consumer public, and the taste is produced due to the presence of organic or inorganic substances in the water. The characteristics of fresh water lack color, smell and taste

f) Electrical conductivity (C.E)
Is the water solution to carry an electric current, And all water has electrical conductivity, and the degree of electrical conductivity in the assessment of the degree of total salinity in water, as saline water conductive good electricity, while the water pure is chemically has a weak electrical connection is considered a good insulation, and the electrical conductivity is evidence of the existence of salts dissolved in water, there is a relationship between Electrical conductivity, drinking water salinity, and electrical conductivity measurement in the unit Cm / Mho Water can be divided according to its specifications listed in table (2).

Table 2: Classification of water according to the value of electrical conductivity

Classification ohm/cm	the description
Less than 250	Very good
250-750	Good
750-2000	Water can be used
2000-3000	Suspicious water
More than 3000	Can not used

It is estimated in water in the way of electrodes, This method depends on water temperature, and the concentration of salts in water by Conductivity meter device.

g) Total dissolved solids (TDS):
The soluble solids (TDS) consist primarily of inorganic salts such as calcium-Magnesium, potassium, sodium, bicarbonate, chlorides, sulphates and small quantities Of dissolved organic matter in water, and its measure of water salinity. Concentrations of (TDS) in water vary greatly in different geological areas due toDifferences in melting grades of metals. TDS is used as a measure or indicatorFor water salinity, the measurement is done by the same device used in estimating of the electrical conductivity, and finally,the measurement of dissolved total salts Water can be classified into six types as in Table 3

Table 3: Types of water according to their content of dissolved salts

Types of water	Percentage of dissolved salts per mg / l
Distilled water	1-2
fresh water	50-1500
Low salinity water	1500-10000
Medium saline water	10000-25000
Saline Water	25000- 50000
Seawater water	More than 50000

3) Analysis of chemical elements

a) Total hardness (T.H):
Calcium salts, magnesium, and sometimes iron, tin and aluminum salts. These salts are deposits with soap. These sediments prevent the foam from being used for cleaning, leading to the consumption of a large amount of soap.As the inability of the water to form a foam of soap ,Where the salts of calcium and magnesium ,These are the most important sources of natural water hardening, and they are of particular importance to the human body because they are the main

components of cells, bones and teeth. Increased overall difficulty in drinking water leads to increased cardiovascular disease and hypertension blood pressure. They pose a serious risk to human health and to fatal diseases such as high blood pressure, heart attacks, deposition of salts in the body and atherosclerosis.

Table 4: Classification of water hardness according to its value

Water Hardness(mg/l)	Degree of hardness
0-70	Water is drinkable (mild)
71-150	Moderate mild
151-175	Moderate hard
176-300	Hard
More than 300	Very hard

b) Chloride (Cl):
Chloride is one of the most common elements in nature, and the negative ionic fraction of sodium chloride (Nacl), which spreads almost in all the crustal rocks. Sea and ocean waters are an enormous reservoir of Most chloride, these compounds have a high solubility in water, That's due to the widespread spread in all types of surface and groundwater.

The creep of saline water on surface and underground water, especially in coastal areas, is one of the main sources of chlorine, And the farther away from the shore or downstream, the chloride in groundwater is decreasing. The presence of chloride in drinking water is saline because it is primarily associated with sodium (Na) and potassium (K). In addition, increasing chloride in the water gives an unpleasant taste, affects the metal tubes and leads to high blood pressure . It also affects renal function, leading to renal failure.

c) Nitrate (NO3):
Nitrates are natural images of nitrogen compounds in nature, and nitrates are not like other mineral salts in groundwater that originate from the rocks forming the groundwater tank.

Nitrates, however, enter water through the compost and wastewater, and the presence of water. In residential and agricultural areas, which in turn has increased nitrates and has risks to human health Exceeded the limit (more than 12 ppm) in drinking water.

Excess: lead to methyhemoglobiniaIn infants less than 6 months ,Brain dysfunction in severe cases. The danger of nitrates lies in the human body as it turnsTo the nitrogenous compounds are very harmful lead to disruption of kidney function.As well as increased nitrates in Water causes anemia in children.

d) Calcium (Ca):
Calcium is one of the most important positive core ions (cations) found in surface and groundwater.

1) Shortage: Lack of calcium in drinking water leads to osteoporosis in children, and osteoporosisIn older people, and tooth decay in general.
2) Increase: Increased calcium in drinking water leads to calcareous deposits around the joints, helps to form gravel and leads to problems in the urinary system. Calcium ion is of great importance in water due to the dependence of hardness and water quality on its concentration And is an important element of the body is necessary for the stages of embryonic development and pregnancy and lactation as well as its importance in the formation of bone and teeth, blood clotting and the work of the nervous system.

e) Magnesium (Mg):
Magnesium comes after calcium as one of the most important positive core ions found in surface and groundwater. The solubility of calcareous rocks is the primary source of water in water, a necessary component of plant growth and plays an important role in enzymatic interactions and protein and nucleic acids production. Muscular nervousness and muscle contraction.If the limit is increased (12 ppm) it is considered an increase . Magnesium concentration in drinking water is harmful to humans.

f) Sodium (Na):
Sodium is the sixth highest mineral grade for its presence. It is present in most natural waters and is present in high concentration in saline water and hard water treated with sodium chloride solution, and sea water is considered the most water containing sodium. Increase in sodium in drinking water more than (ppm222) leads to high blood pressure and heart disorders.

g) Potassium (K):
Potassium occupies the seventh rank among minerals for its presence, so the concentration of potassium in water is less than the concentration of sodium. Because it is very low in water, and is found in the igneous rocks and sediment. Potassium has an important role in endocrine work, and Fibrinogen is responsible for the coagulation of blood.Increase in potassium increases blood flow.

Evaluation of waters wells in Basrah governorate
The analysis of the samples (electrical conductivity, Total hardness, nitrate, chloride, hardness, calcium, magnesium, potassium, sodium) where was the expense of the Mediterranean arithmetic for each elements in these study through the years 2016-2017. And compare its specifications and the standard of iraqi and global (WHO) for water quality and validity for use the human and watering plants.

Groundwater: Water is filtered through the soil to the groundwater reservoir, and groundwater is shown On the surface of the earth either in the form of springs, or by drilling wells, and it is observed that groundwater Less prone to contamination from surface water due to the natural filtration properties of soil.

The World Health Organization (WHO) has developed standards for drinking water in general and has been developed, So, the Iraqi Ministry of Health has special standards for drinking water, some of which differ from the WHO Global shows in Table 5.

Table 5: Standard Specification for Drinking Water by WHO and Iraqi Ministry of Health

Element	The Iraqi Ministry of Health (PPM)	The World Health Organization (PPM)
Hydrogen Number (pH)	6.5-9.5	6.5-8.5
Electrical conductance E.C.	1500	1000
Total Dissolve Hardness TDS	1500	100-1000
Chloride Cl	600	250
Nitrate NO_3	70	50
Sodium Na	200	200
Calcium Ca	100-200	30-200
Magnesium Mg	150	10-50
Potassium K	12	12

In order to determine the validity of drinking water in Basrah governorate for drinking, watering or human use ,The results of the analyzes are consistent with the Iraqi and international standards as follows:

Table 6: The arithmetic mean of the values of elements in well water

Element	Well 1		Well 2		Well 3		Well 4	
	2016	2017	2016	2017	2016	2017	2016	2017
E.C.	2959.65	2948.25	2970.15	2970.00	3049.18	3030.11	3160.05	3007.28
TDS.	1950.12	1895.55	1895.77	1895.45	1900.05	1895.65	1918.99	1870.07
NO_3	182.12	180.00	183.25	182.12	185.05	180.47	190.15	189.55
Cl	630.00	625.65	635.20	633.76	627.57	626.24	638.00	635.08
T.H.	541.15	540.11	539.25	538.77	539.25	538.77	544.25	542.15
Ca	98.35	95.25	123.45	120.55	186.95	190.25	207.35	205.15
Mg	70.35	65.55	89.85	88.05	69.18	66.55	90.87	90.11
K	4.55	4.35	4.98	4.68	5.16	5.00	6.57	6.57
Na	375.05	370.04	356.12	356.05	319.17	319.00	460.09	440.14

4. Discussion of Results

The results of the analysis of the physical (and chemical) water quality of the wells in Basrah Governorate obtained from the water of four wells located in the western part of the governorate, as shown in Figure 1, and shown in Table 6 and Table 7, were as follows:

Table 7: Summary of results of physical and chemical quality analyzesOf the wells in Basrah Governorate based on the average analysis conducted

Test	Results of tests		WHO	Iraqi standard	State 2016	State 2017
	2016	2017				
E.C.	3035.00	2988.91	1000	1500	Non identical	Non identical
TDS.	1916.23	1889.18	1000	1000	Non identical	Non identical
NO_3	185.14	183.04	50	70	Non identical	Non identical
Cl	632.69	630.18	250	600	Non identical	Non identical
T.H.	540.97	539.95	500	600	identical	identical
Ca	154.03	152.80	30-200	100-200	identical	identical
Mg	80.06	77.56	10-50	150	identical	identical
K	5.32	5.15	12	12	identical	identical
Na	377.61	371.31	200	200	Non identical	Non identical

As for the summary of water wells from which water samples were taken, the following is shown.

The total hardness (T.H.), magnesium (Mg), calcium (Ca), and potassium (K)

The water of the wells was identical to the Iraqi standard and the World Health Organization (WHO)

Prove that the water in the province of Basra in relation to these elements of high quality match

The Iraqi Standards and the World Health Organization (WHO).

While the properties, such as electrical conductivity E.C. , Total solid objects TDS. ,NO3 Nitrate, Cl ions chlorides,And Na sodium ions ,It was not in compliance with Iraqi standards and WHO specifications.

Although these ratios are higher than the allowable rates, they are still used for household and human use, but these are still unsuitable for drinking.

Water wells in general do not conform to Iraqi standards and the World Health Organization (WHO) in all physical and chemical elements, which can be attributed to the use of agricultural fertilizers and chemical pesticides used by farmers in those areas.

It is also noted that the proportion of water specifications in 2016 is worse than the water specifications in 2017 because of the extension of the tongue saline from the Arabian Gulf towards Iraqi territory, which negatively affected "the quality of groundwater.

Water Assessment (Household Drinking) in Governorate Basrah

This part of the research deals with the evaluation of household drinking water, as household drinking water is divided into severalSources (imported water, municipal

water, domestic filter water, desalination plant water), In order to ascertain the extent to which domestic drinking water matches its multiple sources of specifications ,As well as its validity for human use. Therefore, the researcher collected 100 samples of household drinking water, which are divided according to their sources as follows:

1) Drinking Water Purchased: This is the water that is purchased from desalination plants, which amounted to a total ofSamples collected from water purchased (11) samples.
2) Municipal water: The water that is pumped from the wells of the municipalities of Basrah governorate in the seven governorates of the governorate, namely the Almadyna, Qurna, Basrah, Shatt al-Arab, Abu al-Khasib, Faw and al-Zubayr through household networks. The number of samples obtained from water Municipality (73) sample.
3) Domestic Water: This is municipal water that is filtered inside the house by a device
4) The number of samples obtained from the household filter reached 13 samples.as shown in fig. 1.
5) Special canned drinking water: It is the water purchased by some high-income citizens in the province of Basra, where (3) samples were collected.

And then carried out microbiological, chemical and physical tests in the laboratories of the University of Basra and the public health laboratories of the Ministry of Health, and the results were as follows:

Results of Microbiological Quality Analysis of Domestic Drinking Water in Basrah Governorate

Samples of desalinated water (100) samples obtained from (100) houses from Basrah Governorate were taken and microbiological analysis of these samples was conducted at the Public Health Laboratory of the Iraqi Ministry of Health.

1. Contamination of domestic drinking water in Basrah Governorate with total coliform bacteria:
Microbiological analyzes were categorized and the total coliform contamination was classified into five levels. The frequencies and percentages of water samples were calculated in the study area as shown in the following table 8.

Table 8: Percentage of total coliform contamination of domestic drinking water samples in the study area

Degree of contamination of total coliform bacteria C.T / Microbial	Repetition	Percentage %
0	41	41
1-20	21	21
40-21	5	5
60-41	2	2
More than 61	31	31
Total	100	100

Table (8) shows that more than half of the household drinking water samples in the study area are microbiologically contaminated with total coliform bacteria. It is clear that 41% of the water samples in the study area were clean water (not contaminated with this bacteria) Keep the water tank clean constantly, and consume water quickly, And that 59% of the water samples in the study area were drinking water contaminated with these bacteria but in varying degrees, the World Health Organization has identified the percentage of pollution allowed in polluted samplesWith total coliform bacteria (5) bacterial colonies in the sample, The table shows that (21)% of the sample of the study was the degree of contamination of domestic drinking water with C.T less than (20) microbe, and that (5)% of the sample of the study was the degree of contamination of drinking water domestic

The percentage of contamination of domestic drinking water with C.T bacteria ranged from (41-60) microbe, and 31% of the study sample was Domestic drinking water is contaminated with these bacteria with more than (61) CT microbes.

The reason for pollution is the neglect of the population to clean the drinking water tanks and not to clean them periodically and continuously,And not to close the water tanks, which expose them to dust or dust and other pollutants that interact with stagnant water in the tank and with high temperature, which leads to the activation of bacteria in water.

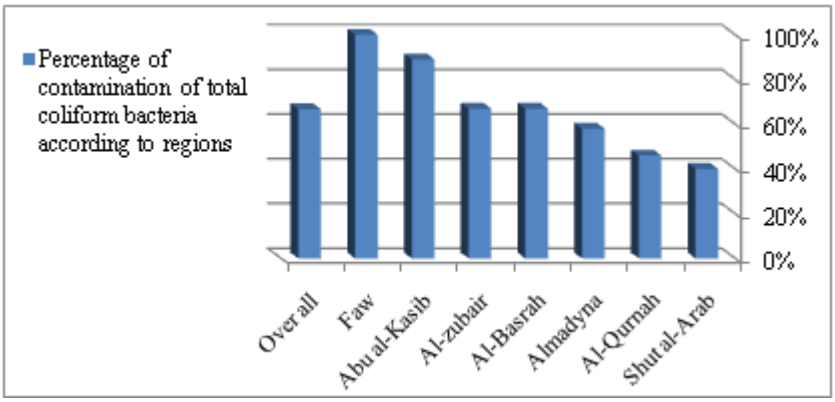

Figure 2: Percentage of contamination of total coliform bacteria according to regions

For water sources:
First: Filtered Water: 69% of the water samples were in the study areaAccess to filtered water was contaminated with total coliform bacteria, due to lengthInternal filter change time for household filter.

Second: Private water: The lowest sample water is contaminated with total coliform bacteria, because it is used directly from water shops and packaged in small gallons for drinking. Where The lowest water in terms of percentage of contamination of total coliform bacteriaWhere the percentage of pollution (33)% of the number of samples obtained.

Third: Municipal Water Pollution rate reached 45% of the total number of samples obtained from municipal water due to the lack of continuous maintenance of water networks, poor sewage networks, the aging of wastewater networks, the lack of cleaning of water tanks,

Fourth: Water Purchased: The percentage of contamination of total coliform bacteria from water samples(60%) were purchased in the study area. Most of these samples were purchased from horse-drawn vehicles. This indicates the seller's lack of interest in water quality and lack of awareness of the importance of water to the health of the population, because it does not clean the water tank on the vehicle Which the horse draws and is sold, leaving this reservoir in place for the horse. filtered water: The most polluted water was contaminated with total coliform bacteria, and the reason for this ,Do not change the internal filter of the household filter or the length of change of the filter does not properly purify the water. Figure 3.

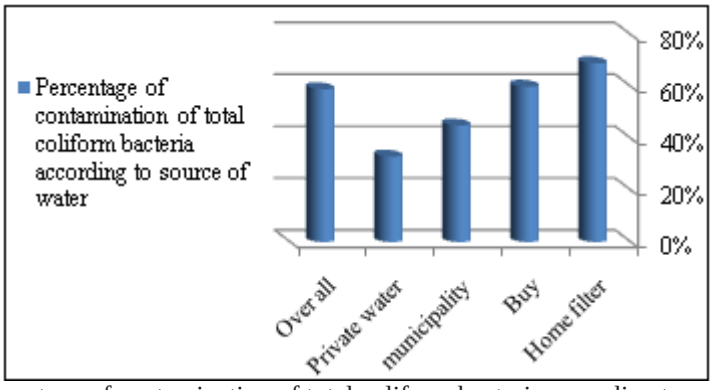

Figure 3: Percentage of contamination of total coliform bacteria according to source of water

Contamination of domestic drinking water in the Governorate of Basrah with coliform bacteria Feces:
Microbiological analyzes were categorized and the degree of contamination of excessive coliform bacteria was classified into five levels. The frequency and percentages of household drinking water samples were calculated in the study area as shown in Table 8 below.

Table 9: Pollution percentage of the faecal coliforms of domestic drinking water samples in the study area

Degree of contamination of feces coliform bacteria F.C / Microbial	Repetition	Percentage %
0	49	49
1-20	19	19
40-21	1	1
60-41	3	3
More than 61	28	28
Total	100	100

Table 9 shows that about half of the water samples in the study area were microbiologically contaminated with streptococcal coliforms. The World Health Organization (WHO) identified the percentage of contamination of faecal coliform bacteria that did not permit any bacterial colony. The sample is contaminated if any bacterial colony is found. Water in the study area was clean water

That is, water that is not contaminated with the bacteria was in the percentage 49% ,This indicates the interest of the majority of the population in the water and storage device, which is a good indicator of the health of the population,In comparison to 51% of the water samples in the study area, domestic drinking water was contaminated with these bacteria but with varying degrees: (19%) of the water samplesIn the study area, the water pollution level was less than (20) CF, and (1)% of the study sample had a water contamination rate of (21-40) CF, compared to 3% The study had a water pollution degree of (41-60) CF, and that (28%) of water samples in the study area were contaminated waterWith more than 60 microbes (C.F), demonstrating the population's lack of awareness of these risks of Bacteria and diseases, and lack of attention to water hygiene or storage.

The percentage of contamination of coliform bacteria among the regions, the largest percentage of contamination of coliform bacteria was in the areas of Qurna and Almadyna by (89)% of the number of samples obtained from them, Followed by the area of the governorate center by pollution(75%) of the total number of samples obtained from domestic drinking water, due to the infrastructure destroyed by successive wars in the region, the absence of regular networks of sewage, or the aging of those networks used and not updated because of the financial crisis experienced by Iraq , That some of the samples obtained had low pollution rates or no pollution rates that could be due to the modernity of the area and the use of sewage networks and follow-up local governments or the governorate of Basrah that continuity of water cleanliness permanently shown in figure 4 .

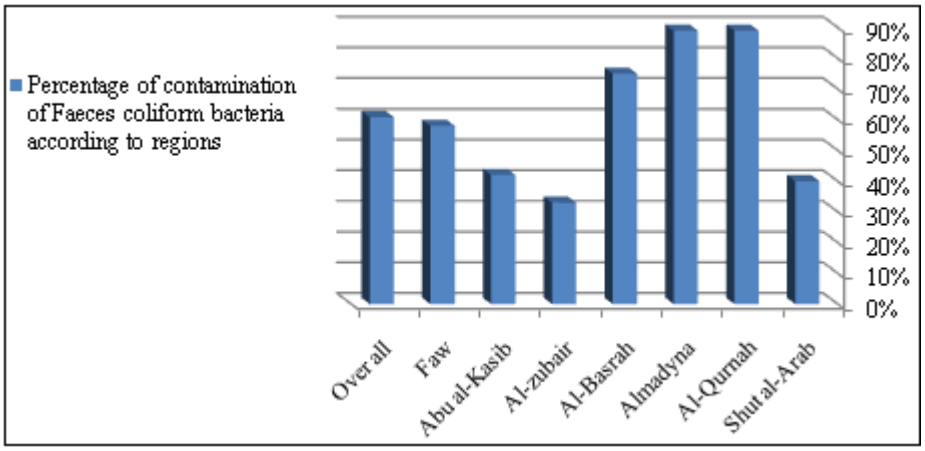

Figure 4: Percentage of contamination of Faeces coliform bacteria according to regions

i.e. In addition to the absence of sewage networks operating regularly and correct, while the percentages were lower in the samples obtained from domestic drinking water any percentage of pollution in the rest of the administrative units in the governorate of Basrah., likely because the reason that these areas are modern construction and the use of sewage networks As well as the continuous maintenance of water tanks permanently, and the high standard of living and education of the population, and because the survival of water in the reservoir is very short, and therefore the province of Basra in general need to seriously follow the sources of water and address the cause of the existence of coliform bacteria faeces and contaminated water Serious bacteria.

We can summaries the results in these points below :

a) The study showed that there is a significant increase in the percentage of microbiological contamination in reservoirs ,Maintaining household drinking water in Basrah Governorate, where the percentage of contamination of coliform bacteriaTotal C.T (67%) and the percentage of C.F infection (59%).
b) Private Wells Water The lowest sample water is contaminated with total coliform bacteria and coliform bacteria Excessive. (Reasons explained earlier),Filtered Water Most of the sample water is contaminated with total coliform bacteria as well as fecal coliform bacteria, For the length of change in the internal calibrator of the household filter, which leads to the failure to purify the water properly.
c) There is a spatial variation between the areas of Basra governorate in terms of the percentage of pollution, where it was found that the highest level of pollution was in the area of Faw, in the percentage of contamination with C.T (100%) And C.F (75%), where it is noted that this is due to the low level of awareness of the importance of cleaning Tanks, leaving it for long periods without cleaning, as well as poor water conservation procedures in this area, Followed by Al Qurna and Almadyna by 89% and 89% respectively.

The results of the physical and chemical quality analysis of drinking water in Basra. In order to achieve the objectives of the study, samples of the transferred water were collected (100) samples Obtained from 100samples by chemical analysis .A house from the homes of the governorate of Basrah, and the physicality of these samples in the public health laboratory of the Iraqi Ministry of Health.

E.C.

The average value of electrical conductivity in household drinking water was calculated according to the results of the chemical analysis carried out in the laboratories of the University of Basrah and the Public Health Laboratory of the Iraqi Ministry of Health for the sample as a whole and for the classification according to the source of access.The water specifications conform to the Iraqi standards and the World Health Organization, and the results are shown in the table10.

Table10: The arithmetic mean of the electrical conductivity value for the sample as a whole and the source of water access (Micro mho / cm)

Source Water	Average E.C	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average	Classification According To the average E.C.
Municipal	2619	11	99	5290	7	non compatible	Suspicious water
Buy	207	73	30	1600	2	Compatible (Suitable)	Very good
Home filter	490	13	53	1390	0	Compatible (Suitable)	Good
Special purchase	840	3	58	2300	1	Compatible (Suitable)	Good
Over all The samples	529	100	30	5290	10	Compatible (Suitable)	Good

The table10 shows the following results:

A- The value of electrical conductivity in the municipal water was between (99-5290) Micro.ohm/ cm

With a mean average of 2619 Micro ohm/ cm, which does not correspond to the Iraqi and global standard of electricity conductivity (E.C). Municipal water is considered to be the worst water sample of the study in terms of electrical conductivity (E.C).

B- The water purchased from the lowest types of water shall be regarded as an electrical connection

Micro (207) with an average micro mho / cm (1600 -30) between the electrode conduction

Ohm/cm. This corresponds to the Iraqi standard and the WHO specifications for electrical conductivity (C.E), while the water purchased was the best water in the study sample in terms of electrical conductivity (C.E).
C) Filtered water is the second lowest type of water with an electrical connection, where the value of the connection Micro ohm / cm (494) with an average micro ohm / cm (1390-53) between the electrode conduction. This is in line with the Iraqi Standard and the WHO Specification for Electrical Conductivity (E.C).
W) Filtered water is the only water that did not exceed the highest value of its samples (13 samples)
Iraqi Standard for Electrical Conductivity (E.C.)
D- The general mean of the electric conductivity of the study samples (529 Micro Ohm/cm) is this is in line with the Iraqi Standard and the World Health Organization (WHO) and that (10) samples were not identical to the Iraqi electrical conductivity standard and WHO
Of the (100) samples, ie (10%) of the number of samples: (7 of them were waterMunicipal, 2 of which are purchased water, and one of the buy water).Figure 5.

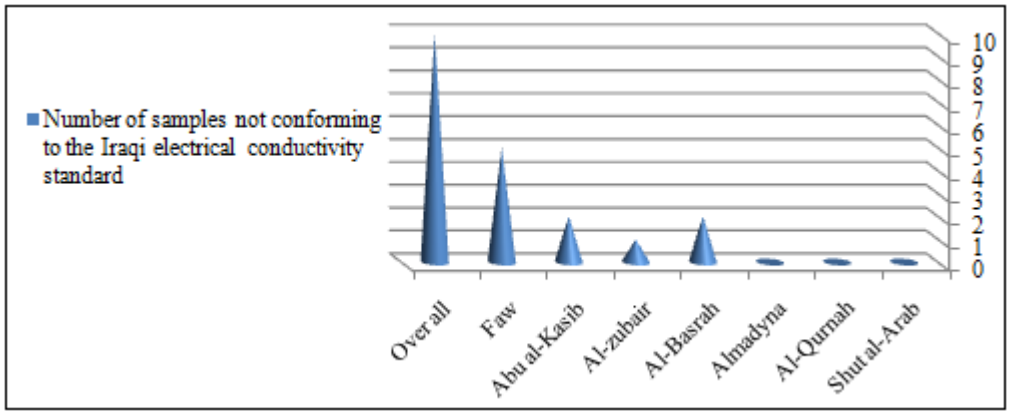

Figure 5: Number of samples not conforming to the Iraqi electrical conductivity standard

TDS
The average solids ratio (TDS) was calculated in household drinking water according to the results of the analysis ,In the laboratories of the University of Basra and the Public Health Laboratory of the Iraqi Ministry of Health for the sample as a whole and for classification according to the source of access, the number of all samples water specifications did not match to the Iraqi standards and the World Health Organization was also determined, and the results are shown in the table11.

Table 11: The arithmetic mean Of the ratio of Solid objects (TDS) For the sample as a whole and for the source of access On water

Source Water	Average TDS.	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average	Classification According to the average TDS
Municipal	1624	11	61	3280	6	non compatible	Low salinity water
Buy	129	73	19	1009	1	Compatible (Suitable)	fresh water
Home filter	306	13	33	862	0	Compatible (Suitable)	fresh water
Special purchase	523	3	36	1426	1	Compatible (Suitable)	fresh water
Over all The samples	328	100	19	3280	8	Compatible (Suitable)	fresh water

Table 11 shows the following results:
A- Municipal water is the most common type of water with a high solids ratio (TDS) with a solid matters ratio between 21 - 3280 mg / L with a mean average of 1624 mg / L, which does not match the Iraqi specifications and WHO for objects (TDS). Municipal water is considered to be the worst water sample of the study in terms of solid objects (TDS).
B- Buys Water is the lowest type of solid-state water (TDS)With a solid matters ratio of 19 to 1009 mg / lWith an average of (129) mg / L, Where the (TDS) here, which is the best sample of the study in terms of solid-matter ratio (TDS).
C- Table (10) shows that filtered water and private purchase water were the proportion of objects (TDS) with less than Iraqi specifications and WHO for solid objects(TDS).So it conforms to the standard and also is considered among the freshwater.
D- The sample water as a whole in Basrah Governorate has a lower proportion of solid bodies (TDS)

Of the Iraqi standard and the WHO for solid objects (TDS) therefore conform to the standardIraqi and WHO, and are also considered freshwater, and that only (8) of the samples were not compatible to (TDS) for the Iraqi standard and WHO out of (722) samples that mean there is (1%) of the total number of samples: 6 of them were municipal water and one was buy water, and one of the private purchase water.

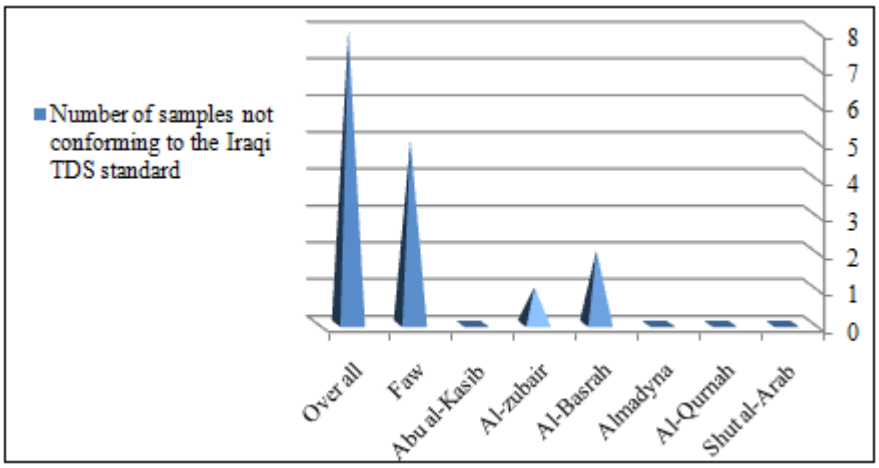

Figure 6: Number of samples not conforming to the Iraqi TDS standard

Figure (6) shows that (5) samples that do not conform to the Iraqi standard and the WHO specifications for solid bodies (TDS), was in the city of Faw and its environs, due to the high water consumption resulting from the increase in the population, and to the salinity of the waters of the port, and (2) in the Basra area, the center of the governorate and (1) in the large Zubair area, the rest of the water was in accordance with the Iraqi standard and the World Health Organization for the proportion ofSolid objects.

NO_3 :

The average nitrate (NO3) was calculated in household drinking water according to the results of the chemical analysis Which were conducted in the laboratories of the University of Basrah and the public health laboratory of the Iraqi Ministry of Health for all the samples and the classification it according to the source of access, and the number of samples that did not match to the specification. Water with the Iraqi Standards and the World Health Organization (WHO), and the results are shown in the table 12.

Table 12: The arithmetic mean Of the ratio of Nitrate (NO_3) For all the samples and the source of access of water

Source Water	Average NO_3	the number	minimum Values	Top Values	Number Samples Non Matching	Case according to the average	Classification according to the average NO_3
Municipal	139	11	12	340	7	non compatible	Low salinity water
Buy	31	3	5	73	1	Compatible (Suitable)	fresh water
Home filter	49	13	1	125	3	Compatible (Suitable)	fresh water
Special purchase	26	73	1	106	4	Compatible (Suitable)	fresh water
Over all The samples	42	100	19	340	15	Compatible (Suitable)	fresh water

The following table 12 shows the following results:

A - The municipal water is considered the most water type with nitrate ratio (NO_3), where nitrate percentage is between (12 - 340 mg / l), with an average of (139) mg / L, which is does not match with the Iraqi and global specifications (WHO) for the standard Iraqi and WHO, ratio for Nitrates, Municipal water is considered to be the worst sample water in terms of nitrate ratio (NO_3). This is due to the oldest of the sewage network in many areas and the frequent use of pesticides and chemicals in others.

B - The water that is purchased the lowest types of water by the proportion of nitrate (NO_3), where the proportion ofNitrates have between (1 - 106) mg / L with an average of (26) mg / L, this corresponds toThe Iraqi standard and the World Health Organization (WHO) for the nitrate ratio. The water purchased from the best sample water is considered in terms of nitrate ratio (NO_3).

Water of the sample of this study as a whole Nitrate percentage was between (340) mg / L to the average of (42) mg / L, which corresponds to the Iraqi standard and the World Health Organization (WHO), And that (15) samples were not identical to the Iraqi standard and the World Health Organization (WHO) for nitrate level (NO_3) from the (722) that mean the percentage equal (71%) from the number of samples: (7) of which were municipal water, (4) purchased water, and (3) filter water and one private buy water.

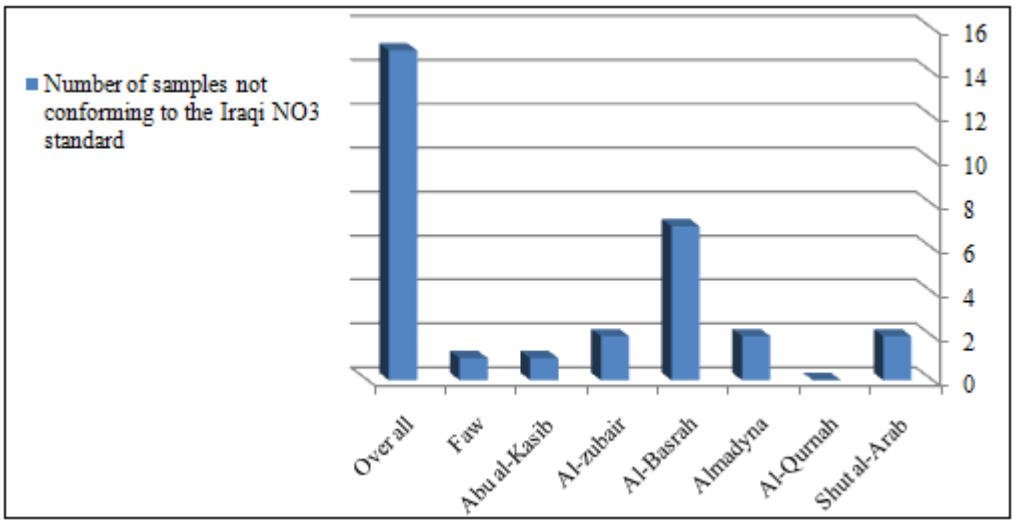

Figure 6: Number of samples not conforming to the Iraqi NO3 standard

Cl

The average chloride (Cl) ratio was calculated in domestic drinking water according to the results of the chemical analysis carried out at the laboratories of the University of Basrah and the Public Health Laboratory of the Iraqi Ministry of Health

For each sample and for the classification they are classified according to the source of the sample, and The number of samples that did not match the specifications was also determined this Water with the Iraqi standard and WHO, and the results are illustrated (Table 13).

Table 13: The arithmetic mean Of the ratio of Chloride (Cl) For all the samples and the source of access of water

Source Water	Average Cl	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average	Classification according to the average Cl
Municipal	586	11	21	1190	6	non compatible	Low salinity water
Buy	39	73	6	323	0	Compatible (Suitable)	fresh water
Home filter	97	13	18	294	0	Compatible (Suitable)	fresh water
Special purchase	167	3	16	452	0	Compatible (Suitable)	fresh water
Over all The samples	111	100	6	1190	6	Compatible (Suitable)	fresh water

Table 13 shows that:

A - The average chloride ratio (Cl) for all water sources and for each sample was identical to the standardIraqi and WHO specifications for chloride ratio.

B - It also turns out that the municipal water was the largest types of water sample of the study in terms of element chloride,

The reason for this is the extension of the saline tongue to the surface water in the Shatt al-Arab and its arrival in the Tigris and Euphrates Rivers. beside the consumption is increasing as the population grows in the governorate. And The water sources remain constant without the desalination plants supplying the citizen with potable water. And lastly Seawater mixed with the underground water.

C - Water purchased is the lowest sample water in terms of chloride, due to the desalination process.

Also (6) only samples were not in accordance with Iraqi specifications and WHO specifications for the ratio of Chloride (Cl) out of (722) samples ie (6%) of the total number of samples were from municipal water. Figure 7 shows the number of samples that do not meet the criteriaIraqi and global chloride distributed by regions

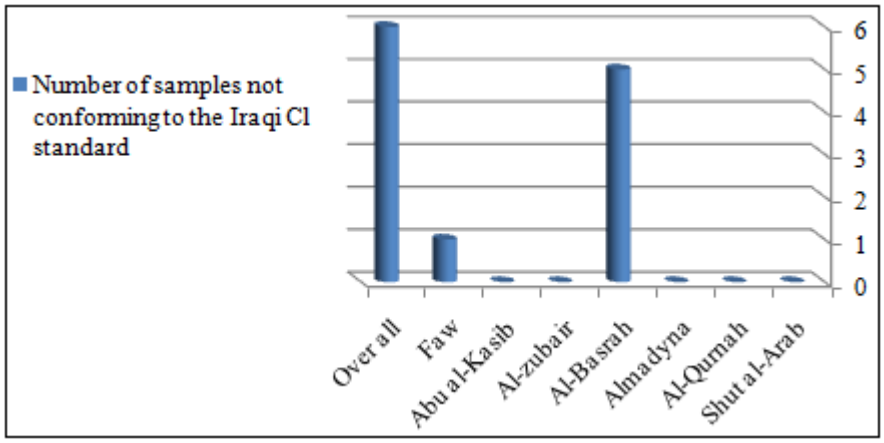

Figure 7: Number of samples not conforming to the Iraqi Cl standard

As shown in Figure 7
That (5) samples are not identical to the criterion of chloride (Cl) Iraqi and global were in the center of the governorate of Basrah and its suburbs, This is because the increases the population, resulting in increased water consumptionWhich extended to the salty age of the waters from the Gulf, And one in the area of Faw, the rest of the water was in accordance with the criterion of chloride (Cl) to the Iraqi WHO standard.

T.H.
The total water hardness (T.H.) was calculated in household drinking water according to the results of the chemical analysisWhich were conducted in the laboratories of the University of Basrah and the laboratory of public health of the Iraqi Ministry of Health for each sample and for the classification according to the source of access, and was identified the number of samples did not match the water specifications with the Iraqi standards and the WHO .The results are explained Table 14.

Table 14: The arithmetic mean Of the ratio of Total Hardness (TH) For all the samples and the source of access of water

Source Water	Average TH	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average	Classification According to the average TH
Municipal	394	11	12	751	3	non compatible	Low salinity water
Buy	29	73	6	317	0	Compatible (Suitable)	fresh water
Home filter	69	13	10	258	0	Compatible (Suitable)	fresh water
Special purchase	119	3	6	341	0	Compatible (Suitable)	fresh water
Over all The samples	77	100	6	751	3	Compatible (Suitable)	fresh water

Table 14 shows that:
A - The average total water hardness ratio (TH) for all water sources and for each sample where it was identical withIraqi standard and WHO specifications for total water hardness.
B - Municipal water was also the largest water sample of the study in terms of total water hardness.
Water purchased was The lowest sample water sample in terms of total water hardness.
C-That only 3 samples were not in compliance with the Iraqi total water hardness standard and WHO specifications ,it is founds the (100) samples, or (3)% of the number of samples, all of the municipal water Figure 8.

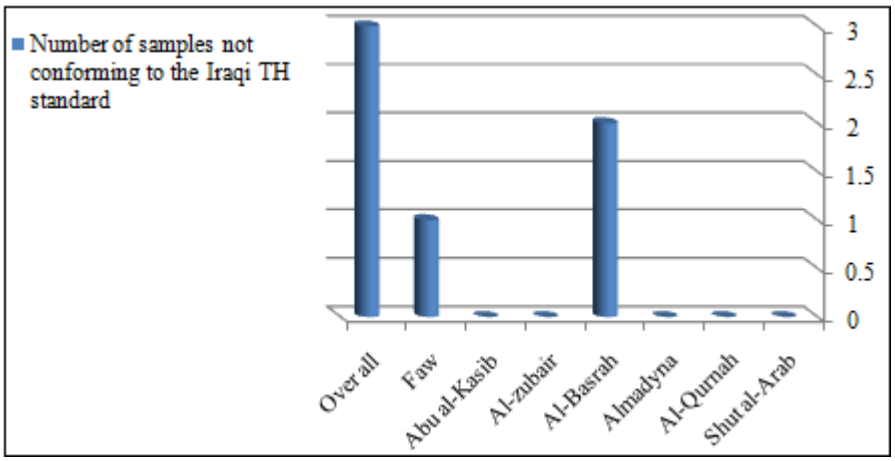

Figure 8: Number of samples not conforming to the Iraqi TH standard

Figure (8) shows that two of the samples do not conform to the total water hardness standard ,And the specifications of (WHO) were in the center of the governorate of Basrah and its suburbs, and one sampleIn the area of Faw, and the rest of the water was in accordance with the criterion of total water hardness.

Ca
Calcium ratio (Ca) was calculated in household drinking water according to the results of chemical analysisWhich were examined in the laboratories of the University of Basra and the public health laboratory of the Iraqi Ministry of Health for the whole samples.And according to their classification according to the source of their acquisition, The number of specimens that did not meet to the recommended water specifications was determined with the Iraqi Standards and the World Health Organization (WHO) .The results are shown in
table no. 15

Table 15: The arithmetic mean of the ratio of Calcium For all the samples and the source of access of water

Source Water	Average Ca	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average
Municipal	65	11	1	129	8	non compatible
Buy	5	73	0	71	73	non compatible
Home filter	12	13	1	52	13	non compatible
Special purchase	18	3	1	51	3	non compatible
Over all The samples	13	100	0	129	97	non compatible

Table 15 shows the following:
A- The average calcium ratio (Ca) for all water sources and for the sample as a whole was not identical with Iraqi standard for calcium (Ca) in desalinated water
B- The results of the study indicate that the concentration of the calcium element is very low, which is purchased and filtered at home. The average calcium of water purchased was (5) mg / L, the household filter (12 mg / L) and the special purchase water (18 mg / L, this indicates the
The calcium component is removed significantly from the water during desalination at the plants.
C- The highest percentage was in municipal water (65) mg / L which is low compared with Iraqi standards, but is in conformity with the specifications of the World Health Organization (WHO).
D- (97) samples From all the sample did not comply with the Iraqi standard and the WHO specifications for the percentage of calcium (97%) of the number of samples:
(8) of which were municipal water, (73) of the water purchased, and (13) of the filter water, and (3) of the private purchase water.Figure 9.

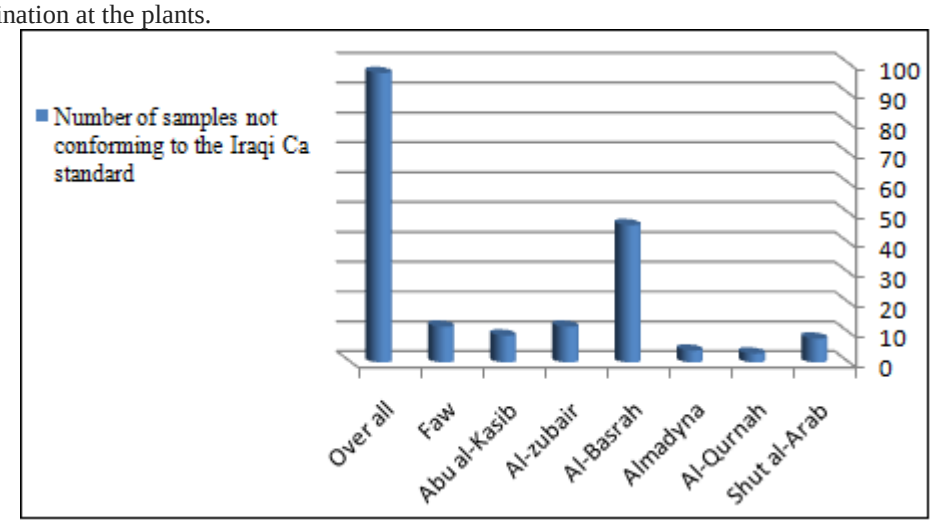

Figure 9: Number of samples not conforming to the Iraqi Ca standard

Figure (9) shows that (46) samples of all samples did not conform to the Iraqi Calcium standard and WHO was in the center of the governorate of Basrah and its environs, 8 samples in the Shatt al-Arab region and 12 samples in the cities of Faw and Zubayr. And (3) samples in the city of Qurnah, (9) samples in the city of Abu al-Khasib and (4) samples were in Almadyna.

Mg

Mean magnesium (Mg) was calculated in domestic drinking water according to the results of the analysis ,In the laboratory of the University of Basrah and the Public Health Laboratory of the Iraqi Ministry of Health for each sample and for the classification of water according to the source of access, and the number of samples that were not conform to the Iraqi Standards and the Public Health Organization (WHO), and the results are shown in the table 16.

Table 16: The arithmetic mean Of the ratio of Magnesium For all the samples and the source of access of water

Source Water	Average Mg	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average
Municipal	56	11	2	109	1	Compatible(Suitable)
Buy	4	73	1	42	0	Compatible (Suitable)
Home filter	9	13	1	31	0	Compatible (Suitable)
Special purchase	18	3	1	52	0	Compatible (Suitable)
Over all The samples	11	100	1	109	1	Compatible (Suitable)

Table 16 shows that:
A- Mean ratio of magnesium (Mg) for all water sources and for each sample where it was identical withIraqi standard of magnesium ratio (Mg).
B - The water purchased was the lowest sample water sample in terms of magnesium, with an average concentration of 4 mg / L and an average household filter of 9 mg / L.
C- The highest value in the samples was (109) mg / L, which is identical to the Iraqi standard but higher than the WHO standard. Therefore, there is no sample that does not comply with the Iraqi and global standard of magnesium ratio.

K

The average potassium content (K) was calculated in domestic drinking water according to the results of the chemical analysis that were examined in the laboratories of the University of Basrah and the laboratory of the Iraqi Ministry of Health relative to the whole sample. and the classification according to the source of access, The number of samples whose water specifications did not match the Iraqi standard was determined and the results are shown in the table 15.

Table 17: The arithmetic mean of the ratio of Magnesium For all the samples and the source of access of water

Source Water	Average K	The number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average
Municipal	4.2	11	0.4	9	9	Compatible (Suitable)
Buy	0.5	73	0.2	3.2	4	Compatible (Suitable)
Home filter	1.1	13	0.2	2.9	4	Compatible (Suitable)
Special purchase	1.1	3	0.2	2.8	1	Compatible (Suitable)
Over all The samples	1.0	100	0.2	9	18	Compatible (Suitable)

As shown in Table (17) :

That the average potassium (K) ratio for all water sources and for each sample was identical to the WHO standard and the Iraqi standard of potassium (K). Where the highest value (9) mg / liter, which is municipal water, Figure 10 shows areas where the potassium ratio was (1) mg / L, The lowest value was from the water purchased, with the average potassium (5.0) mg / L, Followed by private purchase water and household filter, with an average of (1.1) mg / L, This ratio indicates that the potassium component is significantly removed from drinking water in desalination plants.

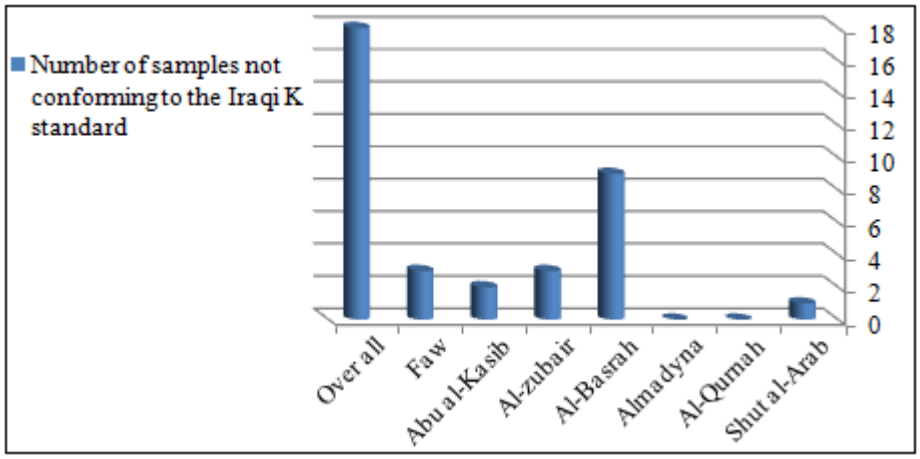

Figure 10: Number of samples not conforming to the Iraqi K standard

Na

The average sodium ratio (Na) was calculated in household drinking water according to the results of the chemical analysisWhich were examined in the laboratories of the University of Basrah and the laboratory of the Iraqi Ministry of Health for each sample, and according to the classification according to the source of access, and was determined the number of samples that did not match the water specificationswith the Iraqi standard and WHO and the results are shown in the table 16.

Table 18: The arithmetic mean of the ratio of Sodium for all the samples and the source of access of water

Source Water	Average Na	the number	minimum Values	Top Values	Number Samples Non Matching	Case According to the average
Municipal	400	11	12	960	6	Non Compatible(not Suitable)
Buy	31	73	3	200	0	Compatible (Suitable)
Home filter	70	13	9	209	1	Compatible (Suitable)
Special purchase	137	3	9	370	1	Compatible (Suitable)
Over all The samples	80	100	3	960	8	Compatible (Suitable)

Table (18) shows that the average concentration of sodium (Na) for all water sources. For each sample, it was identical to the Iraqi standard of sodium ratio, where the average concentration wasSodium (80) mg / L, excluding municipal water, the average sodium ratio is greater than Iraqi standard and WHO, and therefore do not match the Iraqi standard and WHO, and that (8) samples were not identical to the Iraqi sodium standard and WHO out of (100) samples (8%) of sample size:(6) of which were municipal water, and one of the water filter,And one of your private purchase water.

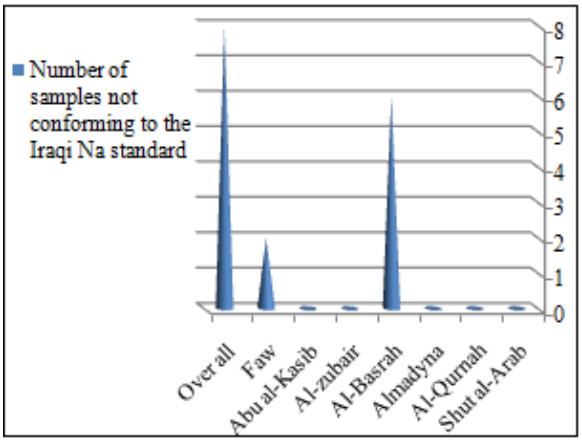

Figure 11: Number of samples not conforming to the Iraqi Na standard

Figure (11) shows that (6) of the samples did not comply with the Iraqi standard and WHO for the ratio of sodium was in the center of the city of Basrah and its suburbs, and (2) of the samples were in Faw area, while samples of the remaining areas were identical to the Iraqi standard. According to the results of the chemical analysis of the study samples it is clear that domestic drinking water is inBasrah governorate suffers from a severe deficiency in the calcium component, where 97% of the samples of the study did not match the Iraqi standard and the WHO for chemical water quality followed by the potassium component of 18% of the samples and the nitrate element by 15% All samples of the study were rich in magnesium and a small fraction (3% - 6%).Respectively is not rich in total hardness element of water and chlorideConform to the Iraqi and global standard of water according to chemical analysis.fig.12 .

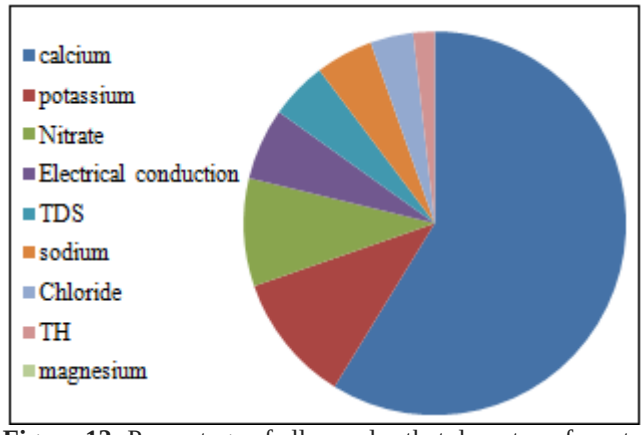

Figure 12: Percentage of all samples that do not conform to Iraqi and international standards

Comparison of concentration of chemical and physical elements in drinking water purchased from desalination plants, with water from wells and compared with Iraqi standard andWorld Health Organization (WHO):

When comparing the chemical and physical elements of domestic drinking water and wells water with the Iraqi standard and the specifications of the World Health Organization, it is clear that:

1 - C.E: The general mean value of electrical conductivity of the study samples in domestic drinking water(529) Micro ohm /cm , which corresponds to the Iraqi and global standard of Electrical Conductance, except for municipal water did not match the international and Iraqi standards, Water wellsWhich is very high, it is not suitable for drinking, the average analysis (2981.76) Micro ohm /cm And do not match the Iraqi and global standard of electrical conductivity. The water of the wells is within the waterWhich is suspect of electric conductivity and this foreshadows a water disaster if the electric conductivity of the wells continues.

2- TDS: The overall average ratio of solid bodies (TDS) in household drinking water was (Referred to) (328) mg / L, which is lower than the Iraqi standard, so it corresponds to the standard Iraqi and international, with the exception of municipal water were not in conformity with international and Iraqi standards, eitherFor well water, the average analysis (1843.81) mg / l, which is high. The reason for their rise in wells is due to soil and rocks that are rich in many species. From salts that melt into groundwater, as well as residues of homes and factories, and agricultural residues from fertilizers and pesticides. Some salts can reach high concentrations as well as to the extension of the saline tongue from the Gulf water to some coastal aquifers, which negatively affects health. Therefore, do not correspond to the global and Iraqi standard for the ratio of solid objects.

3 -NO3: The general average nitrate ratio in domestic drinking water (Referred) (42) mg/l. This is in line with the global and Iraqi standard of Nitrate, while drinking water has reached. The average analysis (186.35) mg / l is double the Iraqi standard twice and half percentageIs very high, and the global standard is three and a half times less, it does not meet the global standard and the Iraqi nitrate ratio.

The increase in nitrates in the wells' water is due to the arrival of surface pollutants from wastewater and agricultural waste to the groundwater reservoir,Water negatively affects human health when it is reduced to NO_2 , Red blood cells that reach the blood give methyglobin, which causes dysfunction in the human body, especially in children and the elderly, and leads to low blood pressure, slow heart movement and poor breathing.

4–Cl: The overall mean chloride ratio in domestic drinking water(Referred) (111) mg / l, which is in line with the global and Iraqi standard of chloride, As for well water, the average analysis for the years 2016 and 2017 was about (628.81) mg / l, which is a high rise slightly above the Iraqi standard of chloride, and the reason for this increasing depletionOf groundwater and the overlap of wastewater with groundwater, they do not match the international standard and the Iraqi.

5 -T.H : The average percentage of total hardness of domestic drinking water (Referred), and the water of the wells was in line with the Iraqi standard for the total hardness ratio, which indicates that the water is of high qualityConform to Iraqi Standards.

6 -Ca: The average calcium ratio for domestic drinking water , Purchase, household filter, drinking water , was (5-12 - 18 mg / L) respectively, and this percentage is not identical withThe global and Iraqi standard of calcium ,This is due to the removal of calcium from drinking water (Purchase), which is purchased from desalination plants and for well water was in compliance with the international and Iraqi standard of calciumWhere the average rate of calcium for the year 2016 and 2017 ,(253 mg / L - 239 mg / L) respectivelyThisindicates that the water is of high quality.

7– Mg: The average percentage of magnesium for domestic drinking water was identical to the WHO standard and the Iraqi standard. The well water was the ratio of magnesium compatible to the Iraqi standard, but was slightly higher than the standard (WHO) where the average ratioOf magnesium was (71.31 - 75.40) mg / L, in 2016 and 2017 respectively in this is the caseIndicates that the water of high quality conform to Iraqi standard specifications.

8 –K: The average ratio of potassium to household drinking water (purchase - household filter – purchase (Refresh) from was (0.5- 1.1 mg / l), which is lower than the standard. The reason for this is to remove the potassium element from the desalinated water ,Purchased from desalination plants and domestic filters, The water of the drinking wells was the proportion of potassium are consistent with the global and Iraqi standard of potassium, where the mean arithmetic value is For the percentage of potassium in the wells water for the years 2016 and 2017 between (4.45 - 4.85 mg / L) respectively. This indicates that the water of high quality conform to the international and Iraqi standard specifications.

9 - Na: The average sodium ratio for domestic drinking water (purchase - household filter - private purchase) the sodium ratio was in accordance with the Iraqi and international standard of sodium ratio. This indicates that the water of high quality conform to Iraqi standard specifications, The average sodium (400 mg / L) , This is a very high percentage ,The international and Iraqi standard, Which is harmful to human health, and the water wells were not are identical to the international standard for sodium, where the average sodium ratio wasIn 2016 and 2017 respectively(390.4 - 407.9) mg / L, due to the rise in the sodium element mud soil and wastewater reaching the groundwater.

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