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Assessment of Household Drinking Water Quality in Zabied City, Yemen

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Abstract: Thirty samples were collected from different four residential communities of Zabied City in Yemen to evaluate household water for drinking use. TDS and EC content ranged from (355 to 375) mg/L and (883 to 933) µScm^{-1} respectively. Na^+ is the most dominant cation in household drinking water and represents 56.24% of total cations, whereas HCO_{3-} is the most dominant anion and represents 58.80 % of the anions in the samples. The order of abundance Ions were: $Na^+ > Ca^{+2}$, Mg^{+2} and $K^+ > Cl^- > NO_3^-$ and $HCO_3^- > SO_4^{-2} > Cl^- > NO_3^-$. The total hardness (TH) as ($CaCO_3^-$) in this study ranged from 220 to 270 (mg/l). All of the studied samples belong to the very hard water type. The Household Drinking Water Quality Index (WQI) of Zabied City in four areas indicates to good water quality index in four areas which ranged from 56.85 to 58.29. The contents of heavy metals in all samples fall within the World Health Organization (WHO) guideline limits and Yemeni standards with a range of (0.001-0.005) for Cu, (0.001-0.006) for Zn, (0.001-0.005) for Cd, (0.001-0.003) for Cr, (0.004-0.009) for Fe, (0.001- 0.006) for Mn, (0.001-0.005) for Co, (0.001-0.005) for Ni, (0.001-0.005) for Al. The first component (PC1) accounts for 4.87 and is controlled by HCO-3, TDS, and Na. PC2 accounts account for 2.82 and is controlled by Ni, Fe, and F, in addition to PC3 which accounts for 2.569 and is controlled by TH and Mg.

Keywords: • Household • Water Quality • Zabied City Yemen

INTRODUCTION

All countries around the world are striving to provide safe, cheap, and healthy drinking water in a sustainable manner for the Public. Yemen is a developing country that lies in arid and semiarid areas. Yemen suffers from water scarcity in quantity and deterioration of quality. Groundwater is the main source of water supply for domestic needs [1]. Safe drinking water is a basic need for development, health, and human well-being.

The reach to a sufficient quantity of household water uses poses a great problem in Yemen in

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general and in rural areas especially. Unsafe sources of drinking water are widespread amongst communities in rural areas in Yemen such as Zabied District.

There are 17.8 million people who lack access to safe water and adequate sanitation services in Yemen [2]. The current water network reaches less than 30% of the Yemeni population.

Thus, millions of Yemenis, including women and children need to walk for miles to fetch water in the countryside of al Hudaydah governorate.

This situation exposes society, especially children to the risk of infection of waterborne diseases. There remain gaps regarding the quality of household drinking water from unsafe sources and the methods used to treat household water.

Yemen suffers from contamination of drinking water with biological contaminants such as total coliform and Fecal coliform, in addition to chemical pollutants [1, 3]. To control household drinking water, national agencies set standards and guidelines to humans from toxic chemicals and pathogens.

This contamination comes from the sources of household drinking water such as wells, tankers of transportation of water, and domestic drinking water tanks.

The safe storage of household drinking water and purification is important to improve the quality of drinking water and reduce diarrheal disease, particularly among those who rely on water from unsafe sources.

This study aims to assess the quality of household drinking water and to know its constituents, in addition to identifying the household drinking water quality index (DWQI) in Zabied City in Yemen and to compare it with the Yemeni guidelines and the standards of WHO.

RESEARCH DESIGN AND METHODOLOGY

The Study Area and Sampling: Zabied City is located in the south of Al Hudaydah Governorate in Yemen in the southern part of the Tehama coastal plain (Figure.1). Thirty samples of household drinking water (HDWS) were collected in 500 mL of clean polyethylene bottles sterile polyethylene bottles from house tanks at the month of December 2021. The samples were taken from four residential zones representing the city of Zabid (Aleali, Aljamie, Almujanbidh, and Aljuz).

Samples were saved after collection and transported to the laboratory in a cooler box. metals levels. HDWS were collected in a clean polyethylene bottle sterile. After being washed using dilute hydrochloric acid and distilled water in the laboratory, and then it was washed several times with the same water sample that was collected, numbered, and saved.

Before sampling, the tap was turned on for at least five min to eliminate the impact of water retention in the pipelines and the faucet. All samples were tested for physicochemical parameters and concentrations.

Physicochemical Analysis.

Field Measurements: The temperature (T °C), pH, Electrical conductivity (EC), and TDS were measured immediately on the same site using a multimeter (model HI “HANNA” instruments) according to the standard methods for the examination of water and wastewater [4]. The instrument was washed with de-ionized water and calibrated and the value of each sample was taken after submerging the probe in the water and held for a couple of minutes to achieve a trusted reading.

Laboratory Analysis: The Household drinking water samples were measured at the Laboratory of Hydrochemistry in the Department of Applied Geology and Environment at the Faculty of Sciences at the University of Jordan. Water samples were analyzed for chemical constituents major anions and major cations, heavy metals, F and B listed in Table (1).

Quality Control and Quality Assurances (QC/QA) were applied in all procedures. Physical parameters including pH, EC, and total dissolved solids (TDS) are measured directly in the field.

The analyses of Major cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}) and Major Anions (HCO_3^- Cl^-, NO_3^-, SO_4^{-2},) were carried out based on standard methods of the American Public Health Association (APHA).

The analyses of Cd, Ni, Cr, Mn, Fe, Zn, Cu, Al, Ba, F, and B, were carried out in the laboratory of Water Chemistry in the Department of Applied Geology and Environment at the Faculty of Sciences at the University of Jordan. Table (1) shows the physiochemical parameters for the sampling zones in Zabied City.

The accuracy of the results of water samples analyses were verified by calculating ionic balance error which is about 5% in general. Quality Assurance and Quality Control (QA/QC) were used to evaluate potential contamination problems and included replicate, field blank, and Laboratory blank samples. This study used standard methods and standard procedures by Flame Atomic Absorption Spectrophotometer (FAAS) to analysis heavy metals.

Data Processing and Statistical Analysis: The results of the physiochemical analyses were subjected to descriptive statistics to compute the range, minimum, maximum, standard deviation, and mean values were calculated for all parameters.

The Drinking Water Quality Index (DWQI) was determined according to [5] and the cation and anion Index (CAI) was computed according to [6] as the following equation: $CAI = (Cl - (Na+K))/Cl$; where concentration is in meq/l. Cluster Analysis (CA), correlation matrix, and Principal Component Analysis (PCA) were used by creating groupings of similar water quality characteristics that have the same concentration patterns. Microsoft software packages and the Statistical Package for the Social (SPSS) were used to analyze and interpreted the data of the study samples. All concentration of parameters was compared with the lower limits and upper acceptable values set by WHO and Yemeni's drinking water standards (Table. 1).

All values of pH were under the guidelines of [7] and Yemen standards of drinking waters [8]. A pH value of drinking water above 8.5 indicates that a high level of alkalinity minerals is found, and a pH value greater than 7 indicates that water is probably hard and contains calcium and magnesium. The pH values ranged from 6.80 to 8.16 and they are within permissible limits. The Water's temperature plays a vital role in the physicochemical and biological behavior of aquatic systems [9]**.** The water temperature in this study varied from 28.70 to

31.10 °C. The highest temperature was recorded in the Aleali area and the lowest was recorded in the Aljaz area. The values of Electrical conductivity (EC) ranged from 883 to 933 µS/cm with a mean value was 910.6 µS/cm (Table1).

The variation in samples content is related to many different sources that support houses in Zabied City by water such as groundwater wells, dug wells, and Tankers of water

RESULTS AND DISCUSSION

Field Measurements: The results of the field test and lab measurements were presented in Table 1 and Figure 2. pH values ranged from 7.70 to 8.22 with a mean value is 7.69. Samples 5 and 12 recorded the lowest and highest values (7.12 and 8.22). The waters that come from ground wells and shallow well have a high content of EC, whereas the water that is subject to treatment and filtration has a low value of EC. All samples of this study were characterized by low enrichment of salts (EC < 1,500 µS/cm. The quality of drinking water in the present study was classified as fresh in all samples. TDS consists mainly of Na, $HCO\text{-}_3$, $SO\text{-}_4$, Cl^-, Ca, Mg, and nitrates. A high TDS value indicates that water is highly mineralized.

The water which is containing salts (TDS 1500 mg/L) can cause kidney stones. So, the TDS value is < 600 mg/L according to [7]. TDS values in this study ranged from 355 mg/L to 375 mg/L with a mean value is 365.93. TDS values in all studied samples were below the limits of, making the water suitable for drinking and various domestic activities. The results of TDS for all samples agree with many previous studies [10,11]. Generally, the total TDS residue after evaporation is the sum of both dissolved and suspended material in water. The TDS residue content was found to be in the range of 420.66, 480.42 mg/L within the permissible limits of the Yemeni standard for drinking water (YSDW) and WHO.

Cations and Anions: The concentrations of major cations (Na, K, Ca, and Mg) were ranged (mg/L) from 91.83 to 125.85 with a mean (107.95). Figure.3 shows that Na is a dominant cation and represents 56.24% of total cations. The order of abundance is Na (91.837-125.850) > Ca (28.056-52.104) >Mg (28.20192-46.19280) > K (.304-.506).

Most water supplies contain less than 20 mg of sodium per litter, but in some countries, levels can exceed 250 mg/L. Saline intrusion, mineral deposits, seawater spray, sewage effluents, and fertilizers can all contribute significant quantities of sodium to the water. In addition, water-treatment chemicals, such as sodium fluoride, sodium bicarbonate, and sodium hypochlorite, can together result in sodium levels as high as 30 mg/L [12].

The results in this study reflect the second type of ion exchange process (CAI= negative value) is known as the base ion exchange process, where Ca and Mg are sequestered onto the aquifer material and Na and K are released into the water. The CAI values, in this case, are negative, and there is softening of water [13]. Among the results of anions, the concentrations of HCO_3^-, $SO_{4\text{-}}^{2}$, Cl, and NO_3^- ions ranged from 274.59 to 317.30 with a mean of 299.00. HCO_3^- is the most abundant anion species generally and constitutes about 58.80 % of the equivalent of the anions in the samples. The order of abundance (mg/L) is HCO_3^- (274.59-317.30)> $SO_{4\text{-}}^{2}$ (85.536-112.848) > Cl- (82.474-94.971)> NO_3^- (15.14-32.53. The drinking water that supports Zabied City comes mainly from groundwater aquifers without any purification. Generally, the dominant water type was Na - Ca - HCO_3^- - SO_4^- and classified as very hard water. According to [14] groundwater with a base-exchange reaction in which alkaline earth has been exchanged for Na ions (HCO_3 >Ca + Mg) may be referred to as a base–exchange cation. The CAI values could be negative or positive depending on whether the exchange of Na and K is from the water with Mg and Ca in rock/soil or vice versa. This study computed the (CAI=(Cl–(Na+K))/Cl) in accordance with reference [15].

Total Hardness: Hard water is containing high amounts of calcium and magnesium, which are naturally found in the Earth's crust. The total hardness (TH) as ($CaCO_3^-$) in this study ranged from 220 to 270 (mg/l). All of the studied samples belong to the very hard water type because TH as ($CaCO_3^-$) >180 ppm is very hard [16]. According to [3], 93% of the groundwater samples in Wadi Zabied have a high content of TH but it is within the maximum permissible level of WHO and Yemen standard for drinking purposes. Generally, Water deterioration and contamination may occur through tankers transporting water to homes; lack of interest in cleaning domestic drinking water tanks: in addition, most of the water tanks in the houses are opened and without covers.

Drinking Water Quality Index: The Drinking Water Quality Index (WQI) was calculated for evaluating the influence of natural and anthropogenic activities based on several key parameters of drinking water chemistry [15]. The results of the WQI assessment of Zabid City are shown in Figure 4. It is found that drinking water in four areas has been in a good category. The DWQI was 57.61 for Almujanbidh, 56.85 for Aleali, 58.08 for Aljuz, and 58.29 for Aljamie.

Heavy Metals: Heavy metals can contaminate household drinking water via nature sources through groundwater movement and surface water seepage and run-off or through anthropogenic sources that come from drinking water transport tanks or bad practices of storage of this water at houses.

The minimum, maximum, and average concentrations of trace metals (Cu, Zn, Cd, Cr, Fe, Mn, Co, Ni, Al, and Ba) present in samples from the household taps of Zabied City are presented in Table 1 and Figure 5.

The average and maximum of all samples fall within the WHO guideline limits. As well as the Yemeni standards with a range (0.001-0.005, Mean: 0.003) for Cu, (0.001-0.006: 0.0031) for Zn, (0.001-0.005: 0.0003) for Cd, (0.001-0.003: 0.0035) for Cr, (0.004-0.009: 0.006) for Fe, (0.001- 0.006: 0.0035) for Mn, (0.001-0.005: 0.0015) for Co, (0.001- 0.005: 0.003) for Ni, (0.001-0;.005: 0.003) for Al, and (0.090-0.328:0.127) for Ba.

The content of heavy metal in the present study differs in a very small range. This variation may be due to the distribution system, pipe age, and tank age, in addition to air particulate that is deposited in opened tanks of houses. These tanks do not clean periodically.

The concentration of all heavy metals in this study is less than concentrations of the same metals in other countries according to the comparison with [17, 18, 19]. Based on the mean content of Cu, Zn, Cd, Cr, Fe, Mn, Co, Ni, Al, and Ba, all metals in this study were below the guidelines of standard limits recommended by the standards of Yemeni and WHO for drinking water.

Furthermore, the concentration of heavy metals in this study was less than in other similar studies [20, 21, 22, 23].

Statistical Analysis: The goals of principal component analysis (PCA) are to extract the most significant information from the raw data, minimize dimensionally the data, and simplify it, thereby reducing information loss, and allowing for analysis of the structure of observations and variables [24].

All parameters of the results in this study were distributed in different PCA factors commonalities after Varimax Rotation. According to the results of the PCA, the original variables could be reduced to three components. Eigenvalues were less than 1, which accounted for 10.27 of the total variances (**Table. 2**). The first component (PC1) accounts for 4.87 of the total variance and represents 44.25 %. The PC1 is controlled by HCO_3^-, TDS, and Na. It is associated with good to poor positive loadings: EC (0.675), TDS (0.675), Na (0.597), HCO_3^- (0.751), and NO-3 (0.594), in addition to good negative loadings for K (-0.756) and intermediate negative loading with Ca (-0.515) and Cr (-0.52122). PC2 accounts account for 2.82 of the total variance and represents 29.19 %. F2 controlled by Ni, Fe, and F shows intermediate positive and negative loading in Ni (0.543), Fe (0.502), F (0.527), pH (-0.600), and Ba (-0.543). PC3 accounts for 2.569 and represents 26.56 % of the total variance. It is controlled by TH and Mg which have good positive loading in (0.721) and (0.721) respectively.

Figure 6 displays that the first cluster groups represent 86.66 % of the samples while the second groups consist of 10.33 % and the third group that was recording 3.1%. This means almost all the four areas in Zabied City are served by the same sources of groundwater except 14.34 %, which is located on the outskirts of the city of Zabied, which uses the water of agricultural wells or relies on water transported by vehicles to houses. Also, this study conducted a correlation matrix test, the results of the relation degree between two variables. Table (3) displays the relations between all parameters included in this study. It illustrates that high strong positive correlation between TDS and EC (0.994).

TH linked in a good positive correlation with Ca (0.53**) and Mg (0.56**) and a good negative correlation with Na (-0.65**). NO_3- shows a negative correlation with K^+ that indicates no effects of fertilizer application in the groundwater sources which are the main sources of drinking water in the study area. The dataset was subjected also to clustering and multivariate correlation analysis among chemical parameters from 30 houses in the Zabied City of Yemen. Regarding the classification, there are three types of drinking water sources that were classified according to physicochemical parameters.

CONCLUSIONS

Various water quality physicochemical parameters such as pH, EC, TDS, major cations, anions, and heavy metals were assessed for household samples collected from 30 houses in the Zabied City of Yemen. All parameters of all samples were within the permissible limits standards of Yemeni and WHO for drinking water. Na is a dominant cation and represents 56.24% of total cations and HCO_3 is a dominant anion and represents 58.80 % of the equivalent of the anions in the samples. The CAI values, in this case, are negative, and there is softening of water. The DWQI in four areas shows a good category. The first component represents 44.25 % of the total variance and is controlled by HCO_3^-, TDS, EC, and Na. To this end, it is recommended to conduct further investigations into the concentrations of micro-pollutants and biological pollutants to reduce the possibility of health risks.

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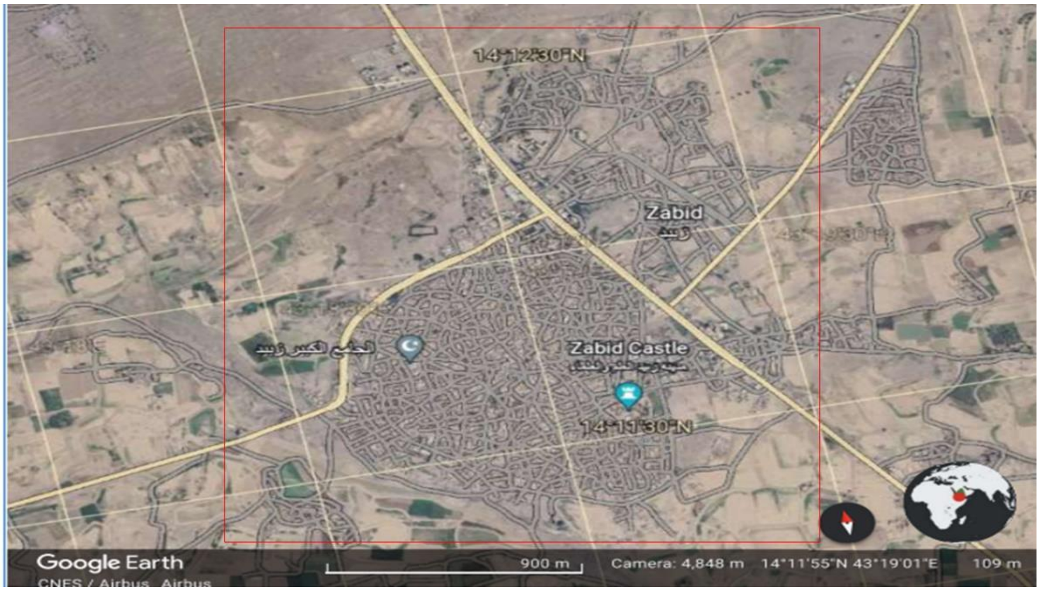

Figure 1: Satellite image of the study are

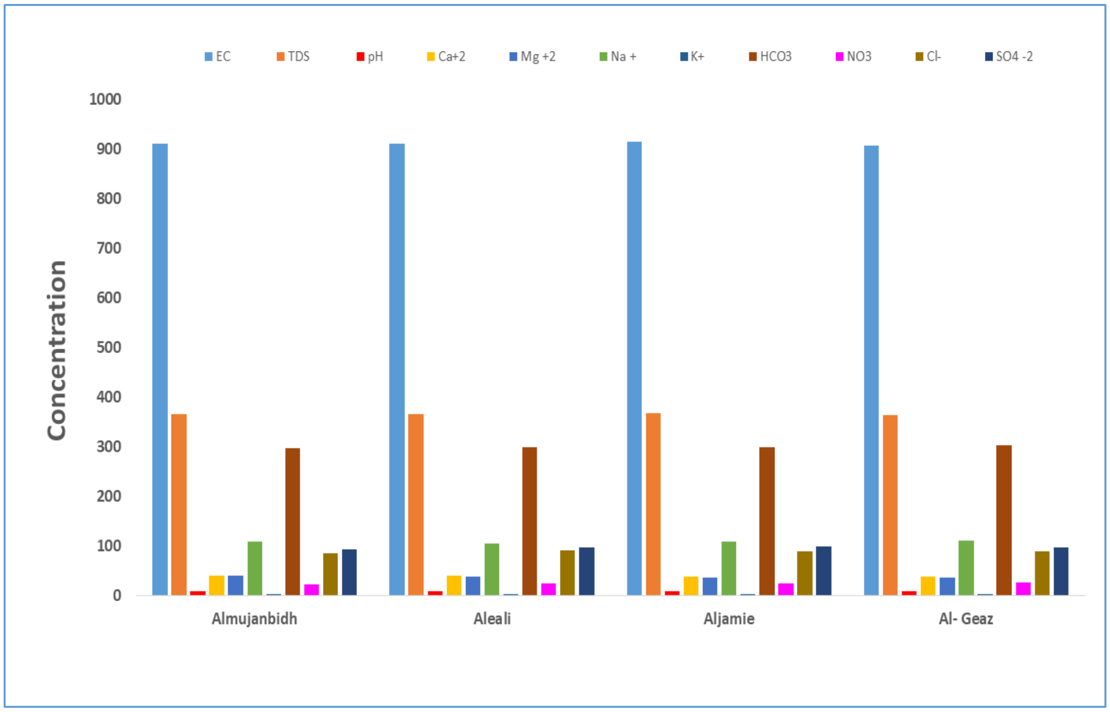

Figure 2: Distribution of Physical and Chemical Parameters in Household in Zabied City

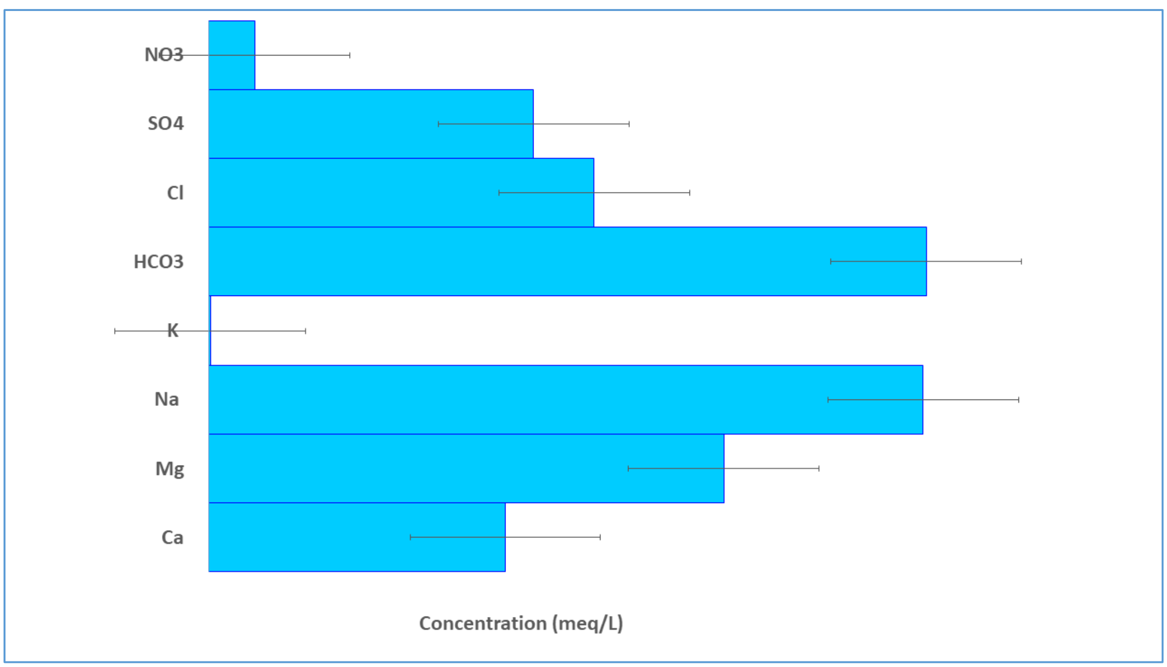

Figure 3: Loading of Cations and Anions

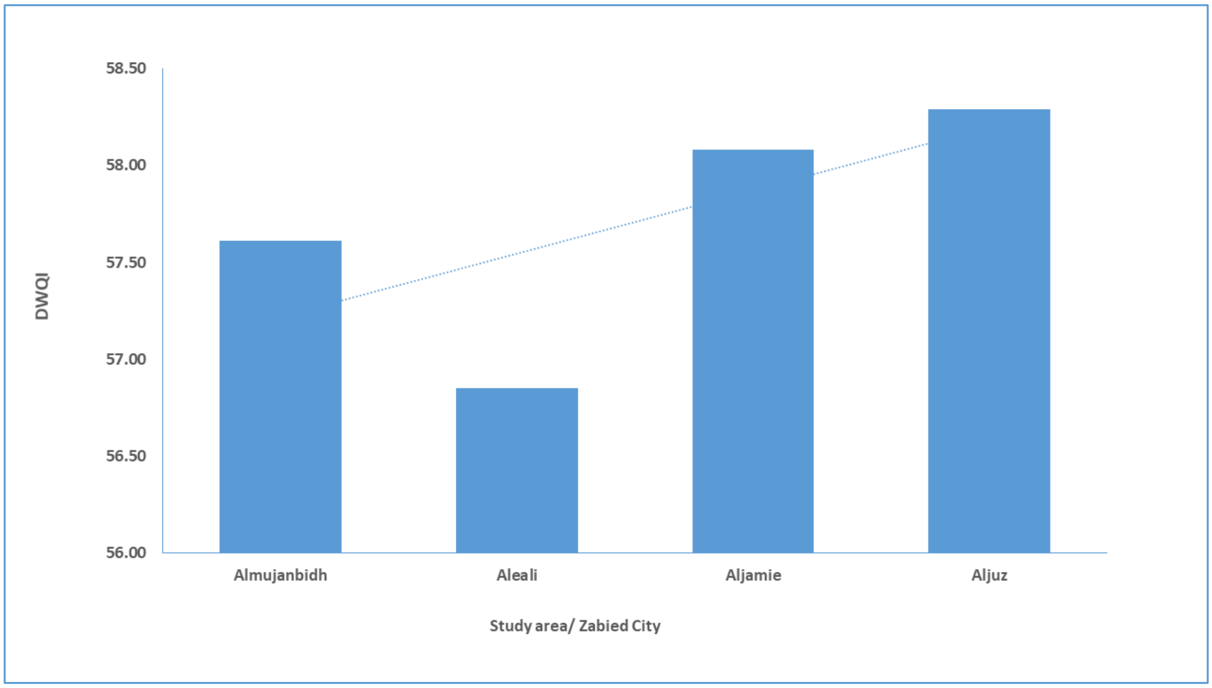

Figure 4: Drinking Water Quality Index (DWQI)

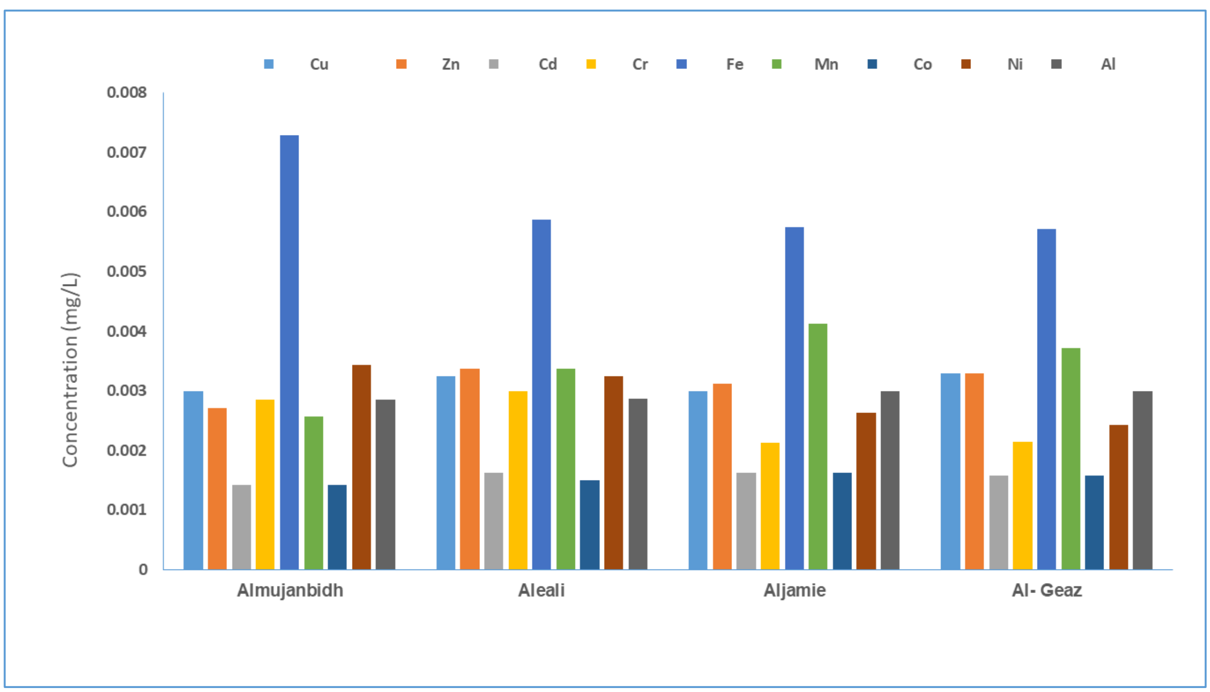

Figure 5: Distribution of Heavy Metals in Household Water

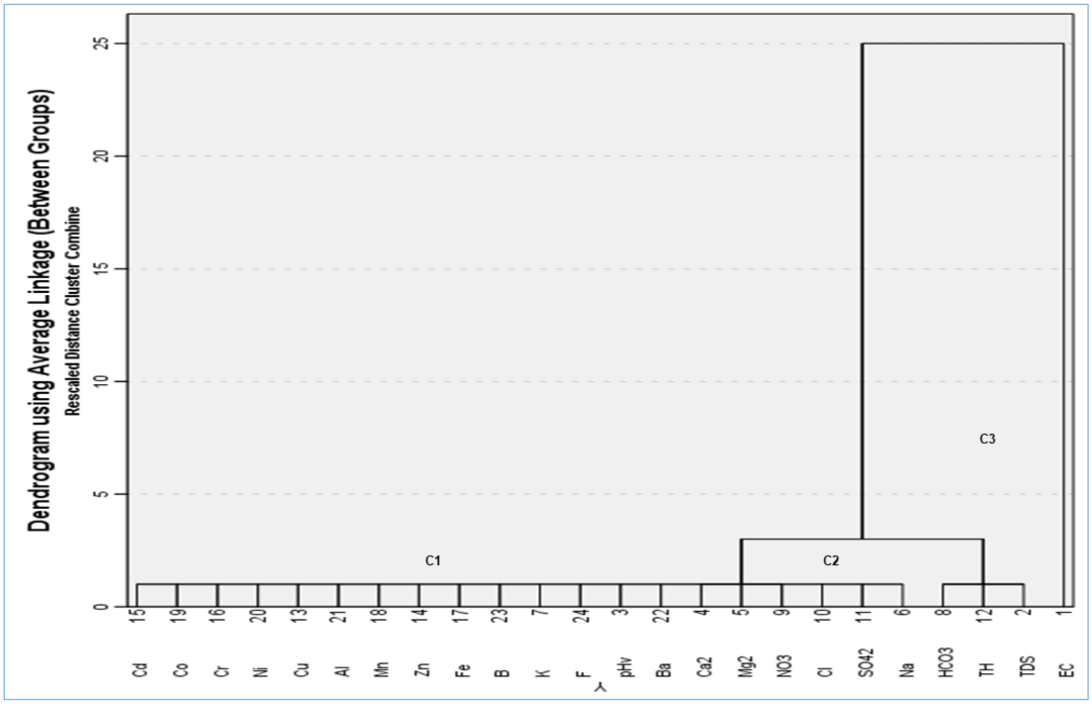

Figure 6. Cluster Analysis

Table 1: Descriptive Data on Household Water in Zabied City

Variable (mg/L)	Minimum	Maximum	Mean	Std. D Division	WHO 2011	YSDW 1999
T °C	28.7	31.1	29.38	.567	------	------
EC µS/ cm	883	933	910.63	13.12	1500	450-1000
TDS	355	375	365.93	5.35	<600	650-1500
pH	7.70	8.22	7.96	0.1	6.5-8.5	6.5-8.5
Ca	28.1	52.14	39.5	5.8	100-300	75-200
Mg	28.2	46.2	37.6	3.6	50	30-150
Na	91.8	125.9	108.0	8.7	200	200-400
K	0.304.0	0.51	0.4	0.1	12	8-12
HCO_3^-	274.6	317.3	299.20	9.8	500	150-500
NO_3^-	15.14	32.5	24.5	5.1	50	10-50
Cl^-	82.5	95.0	88.9	3.0	250	200-600
SO_4^-	85.5	112.9	96.3	6.6	250	200-400
TH	220.0	275.0	253.1	16.1	200	100-500
F	.38	1.07	0.7	0.69	1.50	0.50-1.50
Cu	.001	.005	.00313	.004	2.00	0.5-1
Zn	.001	.006	.00313	.005	3.00	5-15
Cd	0.00	0.00	0.00	0.00	0.003	0.005
Cr	.001	.005	.00253	0.004	0.05	0.05
Fe	.004	.009	.00613	0.005	0.30	0.030-1.00
Mn	.001	.006	.00347	0.005	0.40	0.10-0.20
Co	0.00	0.00	0.00	0.00	0.05	----
Ni	.001	.005	.00293	.004	0.07	0.01-0.02
Al	0.001	.005	.00293	.004	0.40	0.20-0.30
Ba	5.10	11.10	7.6740	6.00	1.30	0.50-1.00
B	0.090	0.32	0.127	0.05	2.40	0.10-0.30

Note:

WHO: World Health Organization. Guidelines for drinking water quality (2011). YSDW: Yemen's Standards for drinking water quality (1999).

Table 2: Principal Component Analysis According to Varimax with Kaiser Normalization.

Variable (mg/L)	**PC-1**	**PC-2**	**PC-3**
EC (µS/cm)	**0.673**	0.107	**0.502**
TDS	**0.675**	0.112	**0.493**
pH	**0.368**	**-0.600**	**0.164**
Ca^{+2}	**-0.515**	-0.172	**0.055**
Mg^{+2}	**0.022**	-0.103	**0.721**
Na^{+}	**0.597**	0.419	**-0.404**
K^{+}	**-0.754**	-0.140	**0.151**
HCO_3^-	**0.752**	0.155	**0.201**
$NO\text{-}_3$	**0.595**	-0.120	-0.117
Cl^-	**0.525**	-0.339	-0.151
SO_4^{-2}	**0.335**	-0.336	-0.296
TH	**-0.449**	-0.253	0.721
Cu	**0.388**	0.420	-0.171
Zn	**-0.359**	-0.271	**-0.307**
Cd	**-0.331**	-0.240	**-0.360**
Cr	**-0.521**	0.194	0.225
Fe	**-0.033**	0.502	0.315
Mn	**0.193**	**-0.435**	-0.124
Co	-0.300	0.075	-0.149
Ni	-0.136	0.543	0.150
Al	0.043	0.203	0.050
Ba	-0.104	-0.543	0.345
B	-0.488	0.414	-0.206
F	-0.269	0.527	0.168
Total	**4.28**	**2.823**	**2.569**
% of Variance	**44.25**	**29.19**	**26.56**

Bold: Influential factors (high correlation with the principal component).

Table 3: Correlation Matrix Between all Parameters (mg/L):

Parameter	EC	T	TDS	pH	Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	HCO_3-	NO_3-	Cl^{-}	SO_4-2	TH	Cu	Zn	Cd	Cr	Fe	Mn	Co	Ni	Al	Ba	B
EC µS/cm	1.0																							
T (°C)	-0.3	1.0																						
TDS	**0.99****	-0.3	1.0																					
pH-value	**.393***	0.0	**.393***	1.0																				
Ca^{+2}	-0.1	0.3	-0.2	0.1	1.0																			
Mg^{+2}	0.2	-0.1	0.2	0.0	**-0.41***	1.0																		
Na^{+}	0.1	-0.2	0.1	-0.1	**-0.46***	-0.3	1.0																	
K^{+}	**-0.44***	0.0	**-.452***	-0.2	**0.40***	0.0	**-0.43***	1.0																
HCO_3-	**0.59****	-0.2	**0.60****	0.2	**-0.41***	0.1	**0.43***	**-0.47****	1.0															
NO_3-	**0.37***	0.2	0.3	0.2	-0.2	-0.1	0.4	-0.3	0.46*	1.0														
Cl^{-}	0.2	-0.1	0.2	0.2	-0.1	-0.1	0.3	-0.2	0.3	**0.41***	1.0													
SO_4^{-2}	0.0	-0.3	0.0	0.2	-0.2	-0.1	0.1	**-.37***	0.0	-0.1	0.3	1.0												
TH	0.0	0.2	0.0	0.1	**0.53****	**0.56****	**-.65****	**0.41***	-0.3	-0.3	-0.3	-0.2	1.0											
Cu	0.3	-0.1	0.3	-0.2	-0.1	-0.2	0.3	**-0.39***	0.2	0.3	0.2	-0.1	-0.2	1.0										
Zn	-0.2	0.2	-0.2	0.1	0.3	-0.3	**-0.39***	0.3	-0.2	0.0	-0.1	0.0	0.0	-0.2	1.0									
Cd	-0.3	0.2	-0.3	0.0	0.2	-0.2	-0.1	0.2	-0.3	0.0	-0.2	-0.3	0.0	0.1	0.2	1.0								
Cr	-0.3	0.1	-0.3	-.41*	-0.1	0.2	-0.3	**0.55****	-0.2	-0.3	-0.2	-.47**	0.1	-0.2	0.1	-0.1	1.0							
Fe	0.1	-0.1	0.1	-0.2	0.3	-0.1	0.2	0.0	0.1	-0.1	-0.2	-0.3	0.2	0.1	-.42*	-0.3	0.0	1.0						
Mn	0.0	0.3	0.0	0.3	0.0	0.0	-0.1	-0.2	0.1	0.3	0.3	-0.1	-0.1	-0.1	0.0	0.2	-0.1	-0.1	1.0					
Co	-0.2	**0.39***	-0.2	-0.2	0.2	-0.2	-0.3	0.1	-0.2	0.0	-0.1	-0.2	0.0	0.0	0.1	0.3	0.1	0.0	0.2	1.0				
Ni	0.2	-0.1	0.2	-0.2	-0.1	-0.1	0.1	0.3	0.0	0.0	-0.1	**-.49****	-0.2	0.1	0.0	-0.1	0.3	0.2	-0.2	0.2	1.0			
Al	-0.1	-0.2	-0.1	-0.3	-0.3	0.3	0.0	0.0	0.0	0.2	-0.2	0.0	0.0	0.3	-0.1	-0.3	0.1	0.0	0.0	0.2	0.1	1.0		
Ba	0.0	0.1	0.0	0.2	0.1	0.2	-0.3	0.3	-0.1	0.2	**0.39***	-0.1	0.3	-0.2	0.0	0.1	0.1	0.0	0.1	-0.1	-0.1	-0.1	1.0	
B	-0.2	0.1	-0.2	-0.2	0.3	-0.3	0.0	0.3	**-0.40***	-0.3	-0.3	-0.2	0.0	0.1	0.3	0.3	0.1	0.2	-0.3	0.0	0.3	-0.3	-0.2	1.0
F	0.0	0.3	0.0	-0.3	0.1	0.1	-0.1	0.0	-0.1	-0.3	-0.3	-0.1	0.2	0.0	0.1	-0.2	0.1	0.3	-0.2	0.2	0.2	0.0	-0.2	**0.48****

Note: **. Correlation is significant at the 0.01 level., ***.** Correlation is significant at the 0.05 le