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Evaluation of Ground Water Quality and Suitability for Irrigation Purposes Using Chemical Indices: A case Study for the Ground Water in the Western Part of Jifarah Plain Area, Libya.

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ABSTRACT: *The current study aims at evaluating the ground water in Jifarah plain area, Northwest Libya, for irrigation application. Thirty samples were collected from the ground water wells at different depths. The samples were analyzed for Calcium (Ca 2+) Potassium (K+), Magnesium (Mg 2+), Sodium (Na+), Chloride (Cl -), Bicarbonate (HCO3-), Sulfate (SO42-), and Electrical conductivity (EC). For classification purposes, some chemical indices like Electrical conductivity (EC), Sodium percentage (SP), Sodium absorption ratio (SAR), residual sodium carbonate (RSC), Residual sodium bicarbonate (RBSC), Permeability index (PI), Magnesium ratio (MR), Potential salinity (PS), and Kelly`s ratio (KR), were calculated. This study revealed that around 93.33 % of the samples PI fall in class III and unsuitable category, 96.67 % of the samples PS > 10, and unsuitable for the irrigation purposes. It`s also revealed that 26.67 % and 20 % of the samples EC level under doubtful and unsuitable class. This in turn implies to the importance of carrying out a pre – treatment and monitoring of the studied wells if they were to be utilized in the irrigation. Regarding the remaining indices, the results showed that 100 % of the samples were found to be within the safe limits and likely suitable for the agricultural irrigation purposes*

KEYWORDS: *Irrigation, indices, Jifarah plain, ground water, Libya.*

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I. INTRODUCTION

Water is a valuable natural resource and vital element for sustainability. Groundwater resource is one key factor that play important role in sustaining the socio-economic standards in any society. It supports various phases of development, including agriculture and industry. In arid and semi-arid regions, groundwater quality is considered a critical issue that is emphasized strongly in the governments' agendas. The shortage of precipitation, unsustainable human activities and environmental pollution, are few examples of the challenges faced in this region of the world. The groundwater of the northwestern part of Libya is the major water supply for all daily applications. Specifically, the groundwater in the Jiffarah Plain Basin in this part of the Libyan geography, has been under heavily use over decades by the rapidly expanding development. This development has affected adversely the quality of the groundwater, in terms of chemical, physical and biological aspects.

Characterizing the properties of groundwater for specific application by its industrial or human consumption is considered vital for deciding the feasibility of the resource and its safeness for the public health and the environment. For agricultural application, the chemical parameters of ground water should comply with the irrigation requirements. If these parameters exceeded the recommended values, the resource is considered unsafe. In many countries, different studies related to the ground water quality relied on using different indices for judging `how safe is safe`. For example, [1, 2, 3, 4] employed the indices like electrical conductivity (EC), Sodium absorption ratio (SAR), Residual sodium carbonate (RSC), Magnesium ratio (MAR), Kelly`s ratio(KR), potential salinity(PS), and Permeability index (PI) for deciding the feasibility of the ground water in the agricultural irrigation. [5] Assessed the ground water quality for the agricultural purposes in the Gushegu Municipality and some parts of east Mamprusi district, Ghana. They reported that the ground water is unsuitable for irrigation purposes due to high sodium percentage, magnesium ratio, and sodium absorption ratio.

The suitability of the ground water quality for irrigation in various Mandalas of Nellore district in Andhra Pradesh was evaluated and the analysis of the chemical parameters indicated that the studied wells showed different degrees of suitability [6]. Likewise, [7] assessed the subsurface water and its suitability for irrigation purposes in Pakistan and found that based on SAR, Na % and MH the samples were unsafe for crops irrigation, whereas, around 86.96 % for RSC and 69.57 % for PI the sample locations of the study area were fit for the agricultural purposes. Based on the chemical indices that carried out by [8], about 85 % of the water wells are suitable for agricultural irrigation, with exception of some ground water wells, which have high salinity hazards. Similarly, [9] found that the ground water in Nanton, district, Ghana was suitable for irrigation purposes, except for few samples. The chemical indices such as, Na %, SAR, RSC, PI, MR , and KR indicated that the ground water in Attur Taluk, Salem, Tamilandu, India are suitable for irrigation [10]. Correspondingly, [11] based on the chemical indices the ground water quality of the Marathon basin, NE Attica, Greece was found suitable and meet the requirements of the agricultural irrigation purposes. Whereas, [12] reported that the ground water wells in the region of Laayoune – Pakhla, Morocco, were fit for the irrigation purposes with high electrical conductivity. On the other hand, the ground water samples in Al – Mouqdadiya district, Diyala, Iraq, was found unsuitable for irrigation purposes [13].

While, [14] assessed the ground water wells in Essaouira basin, Morocco and reported that it is suitable for crops irrigation. Similarly, [15] reported that around 90% of the sampling sites in central of Telangana are well suitable for crop irrigation. [16] Stated that the results highlighted that the ground water wells are unsafe for crop irrigation. Likewise, [17] found that the subsurface water in Esssaouira region, Morocco, is poor and unsuitable for the agricultural purposes. They researchers also stated that one option is to grow salt tolerant crops to overcome this problem. Correspondingly, [18] reported that most of the ground water wells in El – mania, Egypt are suitable for the irrigation. While, [19] assessed the shallow ground water wells in Chott Djerid, South – Western Tunisia and found that the studied water could be used for the irrigation of date palm. The suitability of ground water for crop irrigation, was assessed based on some chemical indices, and was found that most of wells were suitable for the irrigation purposes [20]. Likewise, [21] reported that the high percentage of the studied wells are suitable for the irrigation uses. While [22] assessed the suitability of the ground water wells for the irrigation, and found that most of the sampling sites are inappropriate for the agricultural irrigation. More than 95% of the ground water wells in the area of Alagilat, Libya are suitable for the agricultural irrigation with exception of some wells that had very high concentrations of salts [23]. However, in Libya, including the Northwestern area, the data similar to such studies are not made on a major scale in the country. Therefore, the current study aims to evaluate the ground water quality for agricultural purposes at Jifarah plain area as a representative region to be a base line for subsequent studies.

II. METHOGOLOGY

Jifarah plain area located between latitude 32° 30` and longitude 12° 30`, Northwest of Libya. It covers an area of 20000km2 and heavily populated along the coast. The area bounded on the north by the Mediterranean Sea; on the south by Nafusa, mountain .It also shares an international boundary with Tunisia to the west Fig 1. The area topographically is a low lying; its topography rises slowly from the sea level along the coast to 200 m at the foot of the escarpment of Nefusa Mountain. The maximum temperature is about 45°C and minimum of 20°C with an average annual rainfall varies between 100 and 300 mm. It has a dry climate with hot summer and cold winter. The Jifarah plain can be divided into geological formations, which comprised of rocks rich in minerals that may influence the chemistry of the ground water wells in the study area [24, 25]. The main aquifers, which play a major role in the ground water flow in the Jifarah plain are the Upper Miocene, Pliocene and Quaternary, the Middle and lower Miocene, and Triassic formation [26]. Groundwater considered the main source of water supply in the area. The dominant soils are sandy, clay and salty soils. Economically, Jifarah plain is considered one of the most important plains in Libya.

The described area is known as an urban and rural area that the society mostly depends on its land resource for the human consumption. A round 60% of the irrigated areas situated in this region. The agriculture considered one of the most important activities in the area where barley, wheat, peanuts, vegetables and fodder crops are grown. No comprehensive studies have been done to assess the ground water quality for the agricultural irrigation purposes in the Jifarah plain area. The current study aims to evaluate the ground water quality for irrigation purposes at Jifarah plain area as a representative region to be a base line for subsequent studies. The sites of the samples collection equally distributed between three locations of Jifarah plain area namely, in the Mountain of Nafusa, at the foot of Nafusa Mountain, and the Coastal plain area. The Global-positioning system (Garmin`s GPS map 76CSx) was used to locate the ground water wells. Thirty-Groundwater samples were collected in January 2023 from the Cities and the Towns those

located on those sites. The samples collected from public wells, private wells, water sources in the health centers, and schools. First, the water left to run for few minutes from the wells to pump out the standing water before taking the final samples. The samples were collected in pre cleaned sterilized polyethylene plastic bottles of 1L capacity then were placed in clean containers and immediately put in ice boxes. The boxes were transported to the national oil corporation, Libya, where the analyses were carried out in the laboratories of specific training center for oil industries, Alzawia. The samples were analyzed for some hydro- chemical parameters such as Calcium (Ca), Magnesium (Mg), Potassium (K), Sulfate (SO_4), Chloride (Cl), Sodium (Na^+), and Bicarbonate (HCO_3) using standard techniques, whereas the other parameters like pH and Electrical conductivity (EC) were measured in situ using field kits. All chemical parameters were expressed in mg /l except pH and EC (µs /cm).

In order to achieve the aim of this research work several chemical indices for irrigation uses such as Sodium absorption ratio (SAR), Permeability index (PI), Sodium percentage (SP), Magnesium ratio (MAR), Residual sodium carbonate (RSC), Kelly`s ratio (KR), Residual sodium bicarbonate (RBSC), Potential salinity (PS) , and Electrical conductivity (EC) were applied. The parameters converted from mg/l to meq/l, and the chemical indices calculated from the standard equations Table 1 and used in the assessment of the ground water suitability for crop irrigation.

III. RESULTS AND DISCUSSION

The results of the chemical elements in the ground water of the study area are presented in Table 2. As can be seen from the results that around 90% 0f Ca levels in the ground water wells and Mg concentrations in 96.67 % of them are very high. The results also showed that Cl levels in more than 60 %, K concentrations in 66.67 %, and SO4 concentrations in more than 53.33 % of the studied wells were relatively high. The high values of the chemical characteristics are probably due to the seawater intrusion, chemical fertilizers application, or due to the geological formations that comprised of rocks rich in the chemical elements [24, 25].

Regarding, the suitability of the ground water wells for the agricultural irrigation. The concentrations of the parameters were converted to meq/l; thin the chemical indices such as, KR, SAR, and Na %, PI, MAR, RSC, RBSC, and PS were calculated using the equations displayed in Table 1. The calculated indices that used to evaluate the ground water for irrigation purposes are presented in Tables 3 and 4.The following projections can be made based on the results.

**Kelly`s ratio:** Based on [27], Categorization scheme, KR > 1 is considered unsuitable for irrigation purposes; whereas, sample of ratio < 1 are considered suitable for irrigation. In the present study, the range of Kelly`s ratio was between 0.00 and 0.12 % , with an average of 0.05 %.The lowest value was seen in the samples that collected from sites of Surman and Wazzin; while the highest one was observed in Alqwasim area. All collected samples fall within the permissible limit of < 1 and, thus are considered suitable for the agricultural irrigation purposes Table 5 A.

Sodium Absorption Ratio (SAR): this tool is very important parameter to determine the suitability of the ground water for irrigation because it gives a clear idea about the soil alkalinity. In this study, the SAR ranged between 0.03 and 1.08 with an average of 0.55, the lowest and the highest values were noticed in the sites of Surman and Alqwasim respectively. As can be seen from Table 5 B, all ground water samples (100 %) were < 10, fall within the excellent class and suitable for irrigation uses.

Sodium Percentage (SP or Na %): Na is one of the major elements that used to assess the suitability of ground water for the crops irrigation. High soluble Sodium percentage in the ground water can stunt the plant growth and decrease the soil permeability [35]. In the current study, the soluble Sodium Percentage varied from 0.33 to 12 % with a mean level of 5.09 %. The highest value was calculated in the area of Alqwasim and the lowest value was in Wazzin area. According to the classification proposed by [29], Table 1, all sampling sites in the study area were < 20 %, and fall within excellent class Table 5 C, indicating that all wells are suitable for irrigation.

Permeability index (PI): this index can be influenced by the long-term use of the irrigation water when it contains high amounts of salts. The values of the permeability index obtained in the current study are presented in Table 3 and 4, the values were between 0 .35 and 4.99 with an average of 3.52. The results showed that the highest value of PI was seen in Alqawalish area, whereas, the lowest one was calculated in the area of Surman. Around 28 samples (93.33%) fall in class III, while, 2 samples (6.67%) in the class numbered II, Table 5 D. The high values of PI indicates that the agricultural soil can be influenced by the irrigation water rich in salts

Magnesium ratio (MAR) : Magnesium ration play an important role in the evaluation of the ground water for the agricultural uses, Usually, calcium and magnesium sustain the equilibrium in most water types. When water Mg increases, the soil salinity increases; therefore, the crop yield is reduced. Based on to the classification proposed by [31], Table 1, a round 76.67 % were greater than 50 % , thus were suitable for the agricultural irrigation, whereas, the remains of the sampling sites, 3 samples (23.33 %) were fall in unsuitable class, Table 5 E.

Residual Sodium Carb0nate (RSC): the ground water for irrigation purposes can be, influenced by the high levels of carbonate and bicarbonate. [32] Gave the classification for residual sodium carbonate. In the present study, all RSC values fall within the safe class Table 5 F, suggesting that all water samples are considered safe for the agricultural irrigation purposes.

Residual Sodium Bicarbonate (RBSC): [33] classified the ground water for irrigation purposes based on RSBC. In the current study, the RSBC of the sampling sites ranged from -88.16 to -7.44 meq/l with an average value of -38.12 meq/l. The lowest and the highest values of the RSBC were observed in the sites of Abukammash and Arrayainah respectively Table 5 G. Based on this classification all wells are safe for the agricultural irrigation.

The electrical conductivity (EC): is a powerful criterion to measure the salinity hazard to the crops. It conveys information about the soluble salts in the water samples and potential risk to the productivity of the crops.

The higher values of the electrical conductivity the less amount of water that is available to the crops. For the EC in this study, Table5H demonstrates that 8 samples (26.67%) fall within Doubtful category, 6 samples (20%) was in unsuitable category ; while, 14 samples (46.67%) and 2 samples (6.67%) fall within the permissible and good categories respectively.

Potential salinity (PS): the suitability of water for irrigation is not dependent of the soluble salts. Because, the low solubility salts precipitate and accumulate in the soil profile with continuous irrigation, the high solubility of the salts increases the soil salinity. In the current study, the potential salinity was in the range between 8.79 and 136.90 meq/l with an average of 35.06 meq/l. The highest value was calculated in Algmail area, whereas, the lowest one was in the area of Jado area. According to [30], Around 29 samples (96.67%) are >10, thus, making the ground water unsuitable for irrigation purposes Table 5 I.

IV. FIGURES AND TABLES

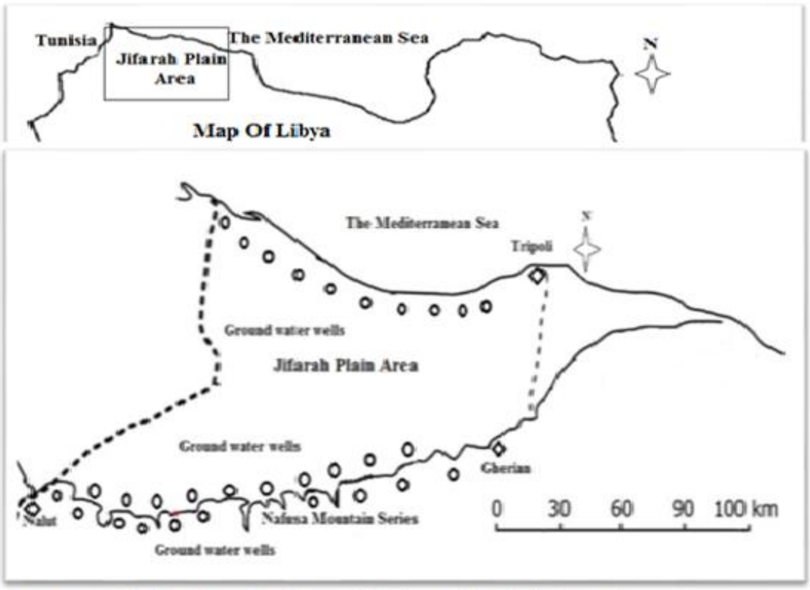

Fig 1. Map of Libya showing the sampling sites (Jifarah Plain area)

Table 1. The equations used to calculate the chemical indices

Index	Equation	Reference
Kelly`s ratio	$KR = \frac{Na^+}{(Ca^{2+} + Mg^{2+})}$	(27)
Sodium absorption ratio	$SAR = \frac{Na^+}{\sqrt{Ca^{2+} + Mg^{2+}/2}}$	(28)
Sodium percentage	$Na\ \% = \frac{(Na^+ + K^+)}{(Ca^{2+} + Mg^{2+} + Na^+ + K^+)} \times 100$	(29)
Permeability index	$PI = \frac{\sqrt{HCO3 -} + Na^+}{\sqrt{(Na^+ + Ca^{2+} + Mg^{2+})}} \times 100$	(28 & 30)
Magnesium ratio	$Mg\ ratio = \frac{Mg^{2+}}{(Ca^{2+} + Mg^{2+})} \times 100$	(31)
Residual sodium carbonate	$RSC = [\ (CO_3^{2-} + HCO_3^-) - (Ca^{2+} + Mg^{2+})]$	(32)
Residual sodium bicarbonate	$RBSC = HCO_3^{\ -} - Ca^{\ 2+}$	(33)
Potential salinity	$PS = Cl^- + ½ \times SO_4^{\ 2-}$	(30)
Electrical conductivity (EC)	--	(34)

Table 2. Concentrations of the chemical elements in the ground water of the study area

City/Town	Ca	K	Na	Mg	Cl	SO_4	HCO_3	EC
Abukammash	1800	10.90	92.90	1400	631.00	253.34	112.29	2760
Zilten	1360	3.90	97.10	2240	3839.90	1462.89	138.72	13830
Rigdaleen	1180	23.30	51.90	2320	1620.41	1349.11	140.52	7080
Algmail	1500	4.10	50.90	2200	3989.40	2356.44	156.13	14630
Attawelah	1700	10.20	42.30	1200	1930.37	1783.23	164.85	8000
Alagilat	980	15.20	93.00	820	762.47	1165.12	175.06	4400
Surman	840	14.70	4.10	660	474.64	785.67	167.64	4090
Sabratah	260	18.40	75.50	1140	684.98	859.45	109.68	4070
Alzawia	260	28.30	50.50	300	332.11	129.11	90.68	516
Bir bemshaab	220	18.70	88.60	320	392.99	139.32	164.26	582
Qasr alhaj	930	10.20	109.00	270	1105.60	987.03	148.32	5330
Shakshuk	740	2.60	110.00	860	1112.50	691.03	132.69	4280
Tigi	1720	9.60	23.20	680	1830.70	1451.13	151.69	7290
Alhawamid	700	6.30	59.00	800	1262.00	843.23	157.32	4640
Wazzin	560	9.70	46.00	8040	686.30	324.21	135.66	2760
Badr	200	14.70	103.00	700	791.50	329.10	124.07	3160
Alagazayah	400	10.20	99.50	340	769.38	319.78	106.30	1104
Aljawsh	920	13.30	94.40	620	878.71	873.43	183.17	1854
Wadi alhii	1320	14.70	90.80	280	734.79	1217.07	111.88	1641
Arrabtah	1700	15.30	99.90	620	1216.35	1100.04	124.31	2250
Alzintan	220	21.90	105.00	400	420.66	97.78	103.26	1670
Arrayainah	180	16.50	97.20	360	359.80	83.03	94.89	1430
Omaljersan	680	20.20	88.30	20	321.04	95.44	99.09	1250
Kiklah	620	15.50	107.00	380	431.74	242.07	108.47	1700
Alqawalish	660	19.90	111.00	280	509.21	409.12	102.67	1590
Alasabaa	280	17.90	107.00	660	348.71	86.99	95.31	1420
Alqwasim	280	19.70	109.00	300	453.88	73.45	135.12	1790
Jado	180	15.00	37.20	260	287.83	65.89	76.87	1084
Kabaow	860	22.10	19.90	330	968.69	911.08	82.29	1416
Nalut	860	31.40	59.80	1240	503.69	315.67	84.68	760

All chemical parameters are expressed in terms of mg/l except of EC (μs/cm).

Table 3. Calculated indices for the parameters in the ground water of the study area

Site	**PS**	**RBSC**	**PI**	**SAR**	**EC**	**RSC**	**MAR**	**Na%**	**KR**
Abukammash	20.41	-88.16	4.13	0.40	2760	-202.91	56.04	2.07	0.02
Zilten	123.40	-65.73	4.32	0.38	13830	-249.33	72.97	1.69	0.02
Rigdaleen	59.70	-56.70	2.35	0.20	7080	-246.86	76.32	1.13	0.01
Algmail	136.90	-72.44	2.31	0.20	14630	-252.77	70.63	0.90	0.01
Attawelah	72.95	-82.30	1.96	0.19	8000	-180.66	53.64	1.13	0.01
Alagilat	33.61	-46.13	4.20	0.53	4400	-113.34	57.84	3.67	0.03
Surman	21.55	-39.25	0.35	0.03	4090	-93.35	56.29	0.57	0.00
Sabratah	28.25	-11.20	3.41	0.45	4070	-104.65	87.79	3.41	0.03
Alzawia	10.70	-11.51	2.39	0.51	516	-36.10	65.42	7.21	0.06
Bir benshaab	12.52	-8.31	4.11	0.89	582	-34.54	70.45	10.4	0.10
Qasr alhaj	41.43	-44.07	4.92	0.81	5330	-66.20	32.25	6.79	0.07
Shakshuk	38.54	-34.82	4.92	0.65	4280	-105.32	65.58	4.32	0.04
Tigi	66.68	-83.51	1.14	0.12	7290	-139.25	39.32	0.88	0.01

Alhawamid	44.33	-32.42	2.72	0.36	4640	-97.99	65.2	2.64	0.03
Wazzin	22.71	-25.78	2.06	0.11	2760	-684.79	95.92	0.33	0.00
Badr	25.72	-7.97	4.65	0.77	3160	-65.34	85.16	6.72	0.07
Alagazayah	25.00	-18.26	4.51	0.88	1104	-46.13	58.22	8.74	0.09
Aljawsh	33.85	-43.00	4.28	0.59	1854	-93.82	52.49	4.39	0.04
Wadi alhii	33.38	-64.17	4.09	0.59	1641	-87.12	25.8	4.64	0.04
Arrabtah	45.72	-82.96	4.46	0.53	2250	-133.78	37.42	3.37	0.03
Alzintan	12.87	-9.31	4.75	0.98	1670	-42.09	74.88	10.50	0.10
Arrayainah	11.00	-7.44	4.42	0.96	1430	-36.95	76.63	10.80	0.11
Omaljersan	10.04	-32.38	4.04	0.91	1250	-34.02	4.60	10.90	0.11
Kiklah	14.68	-29.22	4.82	0.83	1700	-60.37	50.12	7.51	0.07
Alqawalish	18.61	-31.32	4.99	0.91	1590	-54.27	41.02	8.71	0.09
Alasabaa	10.73	-12.44	4.80	0.8	1420	-66.54	79.44	6.98	0.07
Alqwasim	13.55	-11.78	4.97	1.08	1790	-36.38	63.72	12.00	0.12
Jado	8.79	-7.74	1.82	0.42	1084	-29.05	70.31	6.19	0.05
Kabaow	36.78	-41.65	1.00	0.15	1416	-68.70	38.61	2.00	0.01
Nalut	17.48	-41.61	2.70	0.31	760	-143.25	70.27	2.30	0.02

All Indices expressed in terms of meq/l, with exception of EC (μs / cm).

Table 4. Summary statistics of the indices of the ground water samples

Index	Min	Ave	Max	SD
KR	0.00	0.05	0.12	0.04
Na%	0.33	5.09	12.00	3.62
MAR	4.60	59.81	95.92	19.94
RSC	-684.79	-120.20	-29.10	125.84
EC	516	3612.57	14630	3528.20
SAR	0.03	0.55	1.08	0.31
PI	0.35	3.52	4.99	1.38
RBSC	-88.16	-38.12	-7.44	26.04
PS	8.79	35.06	136.90	30.97

V. CONCULSION AND RECOMMENDATIONS

Assessment of ground water quality in Jifarah plain area for agricultural irrigation was carried out using different chemical indices such as, KR, SAR, Na%, PI, MAR, RSC, RBSC, EC, and PS. The results showed that some chemical indices like, KR, SAR, Na %, RSC, and RBSC were complied with the recommended standards, where, 100 % of the studied samples from spatially observed sites were suitable for irrigation purposes. The analysis also showed that around 93.33 % of the samples PI fall in class III and unsuitable category, and 96.67 % of the samples PS > 10. Moreover, about 26.67 % and 20 % of the samples EC level under doubtful and unsuitable class, and unsuitable for crop irrigation. This suggests that such ground water wells require special care and applying an alternative solution to overcome these problems. The author recommend the option of growing salt – tolerant plant species. The author also, recommend that periodical analysis should be carried out to monitor the ground water quality in the study area.

Table 5. Classification of irrigation water based on the chemical indices

KR	Class	No of samples	% of samples	(A)
< 1	Safe	30	100	
> 1	Unsuitable	0	0	

SAR	Class	No of samples	% of samples	(B)
< 10	Excellent	30	100	
10 - 18	Good	0	0	
18 - 26	Fair	0	0	
> 26	Poor	0	0	

Na %	Class	No of samples	% of samples	(C)
< 20	Excellent	30	100	
20 - 40	Good	0	0	
40 - 60	Permissible	0	0	
60 - 80	Doubtful	0	0	
> 80	Unsuitable	0	0	

PI	Class	No of samples	% of samples	(D)
> 75	I	0	0	
25 - 75	II	2	6.67	
< 25	III	28	93.33	

MAR	Class	No of samples	% of samples	(E)
> 50	Suitable	23	76.67	
< 50	Unsuitable	7	23.33	

RSC	Class	No of samples	% of samples	(F)
< 1.25	Safe	30	100	
1.25 - 2.5	marginal	0	0	
> 2.5	Unsuitable	0	0	

RBSC	Class	No of samples	% of samples	(G)
< 5	Satisfactory	30	100	
5 - 10	Marginal	0	0	
> 10	Unsatisfactory	0	0	

EC (Category)	Range	No of samples	% of samples	(H)
Excellent	< 250	0	0	
Good	250 - 750	2	6.67	
Permissible	750 - 2250	14	46.67	
Doubtful	2250 - 5000	8	26.67	
Unsuitable	> 5000	6	20	

PS	Class	No of samples	% of samples	(I)
< 10	Suitable	1	3.33	
>10	Unsuitable	29	96.67	

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