

Physico-chemical quality of drinking water in the south of Algeria (Case of El-Oued region) study of excess minerals

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ABSTRACT

The aim of this study was to determine the physicochemical composition of water intended for human consumption in several regions of El-Oued - Algeria. Excess minerals in drinking water, including magnesium, calcium, sulfates, chloride and fluorides play a fundamental role in the prevention of urinary calculi, which are formed mainly from calcium oxalate. The results revealed that wholes water samples are analyzed magnesium ($[Mg^{2+}] > 50 \text{ mg / L}$). The rate of sulfate ions average 638 mg / l , exceeding the maximum allowable concentration (MAC) recommended by WHO ($[SO_4^{2-}] > 250 \text{ mg / L}$). In addition, 85 % had excess fluoride $[F^-] > 0.85 \text{ mg / L}$, and 100 % are calcium, the rate of Ca^{2+} is greater than 150 mg / L .

Keywords: mineral salts; drinking water; El-Oued; urinary calculi

1. INTRODUCTION

At the international level, the demand for drinking water of good quality is becoming stronger. Indeed, the population increases and the water needs of industry and agriculture are increasingly high. To meet this demand, we must use the waters under various origins: surface and groundwater. In addition, the chemical water quality is directly related to the geological and physico-chemical characteristics of the soil with which they are in contact. Many minerals are essential to the body: Ca^{2+} , Mg^{2+} , SO_4^{2-} , Cl^- , F^- . On the other hand, excessive intake of these substances can cause adverse health effects. A urinary calculi is a common disorder that affects 4-18 % of the population according to studies and countries. It is little studied in Algeria [1,2].

The number of renal failure progresses in a sensible way in Algeria and the management of these patients is very poor in hem dialysis centers [3], thus constituting a serious public health. Water plays an essential role in the prevention of kidney stones. With adequate fluid intake, urine is diluted, which reduces the concentration of lithogenic salts as calcium oxalate and uric acid are present and which are at the origin of the formation of urinary calculi [4]. In their work, HM Djellouli et al [5], and Arnaud Hartemann [6] that there is an inverse correlation between kidney stones and concentration of calcium, magnesium and Sulfate of drinking water [7].

2. EXPERIMENTAL

2. 1. Description of experiment

In the province of El-Oued, potable water is provided exclusively by groundwater from aquifers Complex Terminal (CT) and the Continental Intercalary (CI). The chemical quality of the water is sulfate-chloride-type and highly mineralized [5]. Samples were collected from wells of different layers used. Figure 1 show the location of El-Oued wilaya where water samples were collected.

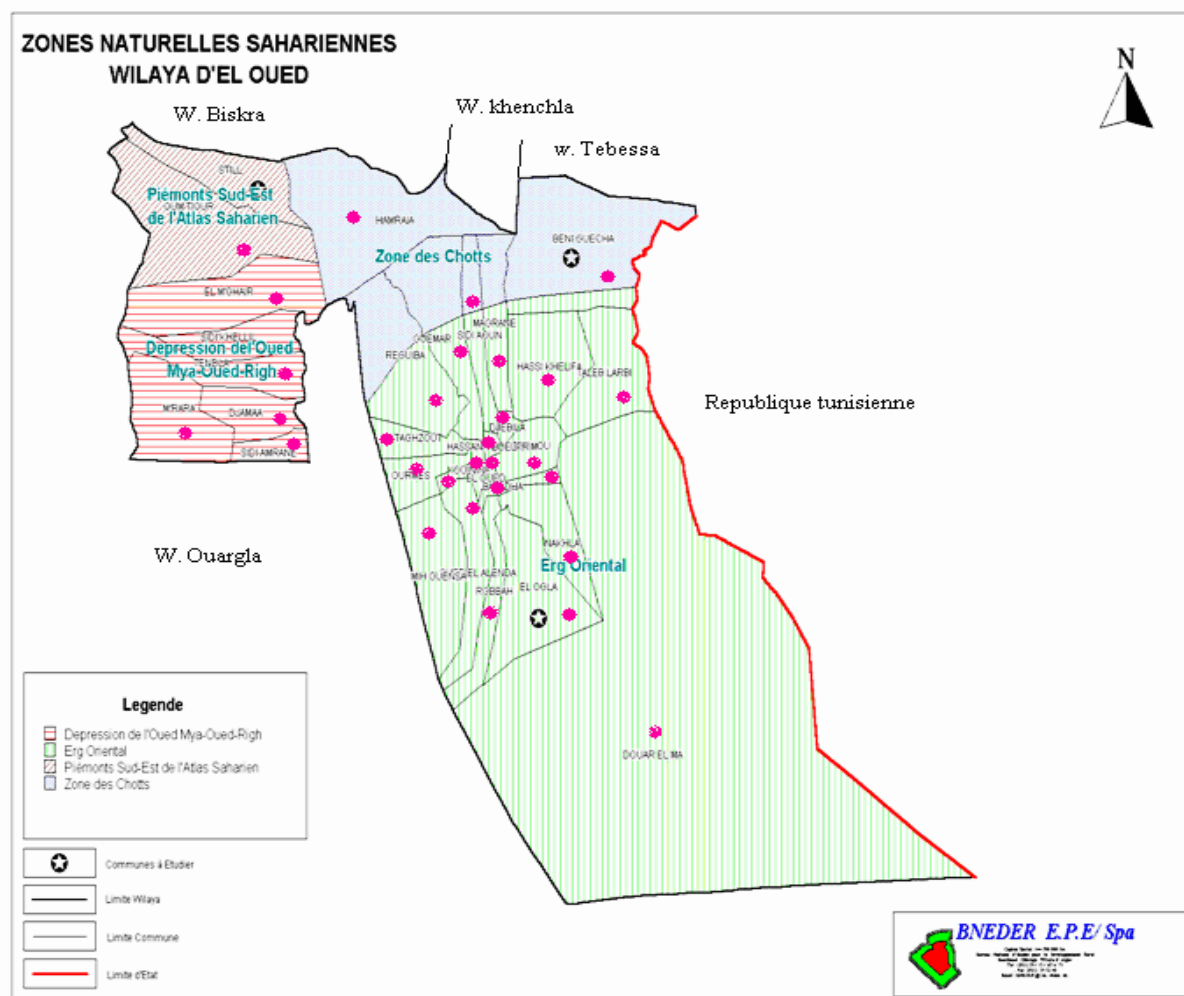


Figure 1. Town of El-Oued with tap water was analyzed.

Great importance and care have been made to the operation and water sampling method. The water samples were collected in plastic bottles of 500 ml, previously rinsed with water drilling chosen. The physico-chemical parameters were measured: pH, conductivity, Ca^{2+} , Mg^{2+} , the SO_4^{2-} , Cl^- , and F^- . Assay methods [8] used are as follows.

The pH and conductivity were measured respectively by a digital pH meter, Type 213Micro-Processor pH / m V/ °C / μS . The calcium and magnesium samples are determined by complex metric by titration with ethylenediaminetetraacetic acid (EDTA) and sodium bicarbonate by volumetric method. Chlorides were assayed according to the method of Mohr.

Gravimetry was used for the determination of Sulfate, it is based on the determination of the weight of the precipitate of the analytic. Fluorine is determined by the spectrophotometer method Type Photo-lab spectral WTW. In general, there are no Algerian drinking water standards for public water supply. For this, we have adopted the values guide published by the World Health Organization (WHO) [9].

3. RESULTS AND DISCUSSION

Samples of groundwater were collected between January and May 2009, on thirty (29) drilling water feeding the wilaya of El Oued in drinking water. The physico-chemical characteristic of the water withdrawn is shown in Table 1. They represent the average of three tests.

Table 1. Physico-chemical characteristics of the groundwater in the region of El Oued.

Location	Drilling	pH	Cond. mS/cm	TH mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	F ⁻ mg/l
Debila	Mio-plio	7,57	3,66	1590	440,88	119,09	801,23	510	2,25
Hassani A/Karim	Mio-plio	7,41	3,50	1190	296,59	109,37	893,16	533	2,07
Oued El Alenda	Mio-plio	7,50	1,75	1390	296,59	157,98	198,08	492	1,89
Sidi kahelli	Mio-Plio	7,20	7,13	2490	545,08	174,64	1264,21	806	2,64
El Robah	Mio-plio	7,61	3,47	1100	264,53	109,37	815,42	468	1,91
El Nakhla	Mio-plio	7,43	3,46	1050	256,51	99,65	801,23	304	1,86
Sidi Aoun	Mio-plio	7,48	3,51	1190	276,55	121,62	815,41	442	2,10
El Oglâ	Mio-plio	7,10	3,51	1090	272,54	99,65	850,85	710	2,03
Hassani A/Karim	Mio-plio	7,42	3,41	1100	272,55	102,08	894,14	710	2,20
Kouininne	Pontien	7,30	4,08	1390	296,59	157,98	953,68	573	2,07
Chouhada 1	Pontien	7,28	4,34	1318	312,62	155,54	829,60	544	2,63
El Hamraïa	Pontien	7,26	3,44	1330	316,63	150,69	836,69	510	1,73
El Meghaier	Pontien	7,84	3,45	1230	392,78	60,76	758,69	694	2,05
Still	Pontien	7,41	4,83	1690	355,70	192,57	935,95	512	2,13
El- oued	Pontien	7,55	4,77	1390	288,58	162,84	829,60	546	2,10
Mouih Ouensa	Pontien	7,23	4,76	1390	296,59	157,98	699,23	400	1,94

Hassi Kahlifa	Pontien	7,83	3,58	1360	384,76	97,22	794,14	712	2,17
Reguiba	Pontien	7,94	4,85	1030	308,10	161,38	815,41	572	2,04
Ourmes	Pontien	7,66	5,14	1590	348,69	174,99	1006,8	533	2,09
Guemmar	Pontien	7,39	4,92	1630	308,61	211,45	872,14	585	2,19
Trifaoui	Pontien	7,72	3,44	1590	384,76	150,69	801,23	698	2,17
El Bayada	Pontien	7,73	3,46	1060	268,54	94,78	815,41	469	2,01
El Magrane	Pontien	7,39	3,45	1230	392,78	60,76	758,69	442	2,02
Guemmar	Pontien	7,47	4,87	1660	352,70	189,57	935,95	507	2,18
Benguecha	Eocène	7,80	5,66	1100	360,72	149,28	893,41	559	2,08
Sidi Amran	Albien	7,51	2,77	1050	252,50	104,51	397,03	570	0,85
Djamaa	Albien	7,24	2,76	1030	204,40	126,38	404,16	620	0,67
Tindla	Albien	7,49	2,74	1180	236,47	143,39	389,98	530	0,62
Chouhada II	Barrémien	7,03	2,17	1100	368,75	97,22	617,99	973	0,63
Hassi Kahlifa	Barrémien	7,01	2,31	810	348,64	191,3	876,3	952	0,67

The water is highly mineralized conductivity ranging from 2.17 to 7.13 mS / cm and a pH between 7.94 and 7, and shows a slight bicarbonate alkalinity. The calcium content, it is concentration varies from one drill to another of 204 to 545 mg / l. is aware that it is recommended that a calcium nephrolithiasis patient to consume water at a rate of calcium does not exceed 150 mg / l in order to have optimal nutritional calcium intake of 900 mg / day [10]. However, recent studies emphasize the beneficial effect of calcium on water preventing the risk of calcium oxalate urinary calculi. There would be an inverse correlation between the amount of calcium intake and the risk of developing gallstones in individuals without a history of nephrolithiasis for high calcium intake (± 1300 mg / day) [11].

Regarding the magnesium varies between 60.76 and 211.45 mg / l, 77 % of the water sampled have a magnesium levels greater than 100 mg / l. It is known in the literature that magnesium is an inhibitor of calcium oxalate. This results in a decrease in urinary super saturation [12,13]. According to the concentrations of calcium and magnesium, have concluded that the total hardness is relatively high.

On the other hand, the waters have high levels of chlorides and sulphates vary respectively between 320-1264 mg / l for chlorides and 304-973 mg / l for Sulfate. The Sulfate ions are described as having a preventive effect against the crystallization of uric acid, chemical constituent involved in the formation of kidney stones [5].

For fluoride ions, shows that 87 % of the water sampled (ie 26 boreholes), have higher levels of fluoride to the WHO standard 0.85 mg / l. Concentrations vary from one region to another, from 0.62 to 2.63 mg / l. This change in concentration of fluoride ion is attributed to the geological aspect of the aquifer. Magmatic rocks, especially, may contain high

concentrations of fluoride. In addition, weather conditions must be taken into consideration, since the dry and arid climate favors the accumulation of salts, including fluoride [14].

The effect of fluoride ingestion of drinking water, in humans, the formation of kidney stones has been no study. However, many epidemiological studies have clearly established that fluoride exert their effects primarily on skeletal tissues (bones and teeth) [9].

4. CONCLUSION

The physico-chemical results of drinking water of the inhabitants of Ouargla region reveal that they are mainly sulfated, magnesia, calcium and fluoride. Perspective, it would be interesting to assess the impact of these waters on the kinetics of the crystallization of calcium oxalate, the main constituent of urinary calculi. Moreover, it would also be interesting to analyze the urinary crystals by microscopy before and after fluid intake, to measure the impact of the increase gallstone risk.

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