Typological Bacteriological Quality of the Gharb Water Table-Morocco

N. Ait Said, S.Sadek, k. EL Bouqdaoui, A.Tajjiou, Abd. Hamdan, Abd. Elmniai

Abstract: ***Waterborne diseases are generally caused by enteric pathogens belonging to the group of organisms that are mainly transmitted by the fecal-oral route. In other words, they are mainly excreted in feces by infected individuals and ingested by others in the form of water or faecally contaminated food. Some pathogens may be of animal origin. Water can also play a role in the transmission of pathogens that are not excreted by feces.This study was carried out on 60 wells in the Gharb region in order to know the quality of the water table; samples were collected in three cities: Sidi Kacem, Macheraa Belksiri and Sidi Alal Tazi were analyzed for pollution indicator organisms (faecal coliforms and faecal streptococci, as well as anaerobic spores-sulphite-reducing agents. enumeration of the bacteria was done by the filtration technique and by incorporation in supercooled solid medium.The results showed that well water was substandard because of the presence of faecal coliform pollution indicators, faecal streptococci. In contrast, pathogenic germs, however, the concentrations of microbial indicators monitored differ according to the location of wells compared to different sources of contamination.Pollution of these wells has generally been linked to non-compliance with hygienic drawdown conditions. The bacteriological quality of the waters of these wells can be improved by adequate protection.***

Keywords: Bacteriological quality, well water, food industry, gharb slick.

I. INTRODUCTION

The presence of bacteria in groundwater has been demonstrated by the enumeration of cultured bacteria. Bacteria are adapted to the adverse conditions of the underground environment, particularly low nutrient and oxygen levels [1,2].

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The origin of bacteria in various types of groundwater is still under discussion [3,4], most of the groundwater bacteria come from the surface medium by transport during the infiltration of surface water into groundwater [1]. According to Van Elsas and Heijnen [5], optimal survival conditions are essential for the introduction of bacterial microorganisms into the soil, and their transfer to the water table. For Fenchel [6], the ancestors of native bacteria in the aquatic ecosystems underground would come from anoxigenic microorganisms that have evolved. Various observations suggest that they are active in situ and can play an important geochemical role in the environment and more specifically in the contaminated aquifer [7]. In this chapter we aim at microbiological parameters, which can be appreciated by ; the micro-organs revivable, total coliforms, fecal contamination indicators (faecal coliforms, faecal streptococci and anaerobic sulphite the gear boxes).

I. Material and Methods

I.1. Study site

The plain of Gharb or Basin-pouring Sebou- is a region located in the North West of Morocco, characterized by a very important agricultural and industrial potential. It is crossed by Sebou.

I.2. Study Method

The data presented in this study come from 12 months of water withdrawal from all 60 stations (wells); Samples are taken according to Moroccan standards under the references: NM.ISO 19458; 2009. Once the sample has been taken, the vials are kept in a cooler at 4 °C. This is transported to the laboratory for bacteriological analysis within 8 hours. The geographical coordinates of the wells were obtained using a GPS. The analyzes of the samples of well water are carried out at the level of National Institute Hygiene RABAT « Department of Microbiology and Food Hygiene by the analytical methods of reference. Bacteriological parameters sought as well as the references of the methods used are summarized in the following **table 1**.

Table 1: Desired germs and methods of analysis used

Faecal streptococci	ISO 7899-2
Coliforms	ISO 9308-1
anaerobic sulfite the gear boxes (ASR)	ISO 6461-2 (1993)
Micro-organisms revivable at 22 ° C and 37 ° C	ISO 6222 (1999)

Bacteria are the most diverse living organisms on our

planet. They are ubiquitous and abundant, they play a role in the process of the circulation of energy and light in ecosystems. Their distribution on land is limited by only a few factors, namely temperature, pH, and water availability [8].
The five main groups of water indicator organisms were searched for and counted in the water of the wells and sources surveyed. However, the results of our studies will be presented in the form of curves, representing a temporal variation in the rate of germs research, as well as annual means and standard deviations of microbiological parameters during the study period (February 2016 to January 2017).

II. RESULTS AND DISCUSSION

II.1. Study of bacteriological contamination

II.1.1.Enumeration of culturable microorganisms (GT at 37 ° C)

Revivifiable microorganisms (GT) are used as an indicator of global pollution. It encompasses the set of microorganisms capable of multiplying in air at average temperatures, especially at an optimum growth temperature of between 25 and 40°C. It is a health indicator that allows evaluating the number of CFU (Colony Forming Unit) present in 1 ml of water. These are indicators that reveal the possible presence of bacteriological contamination.

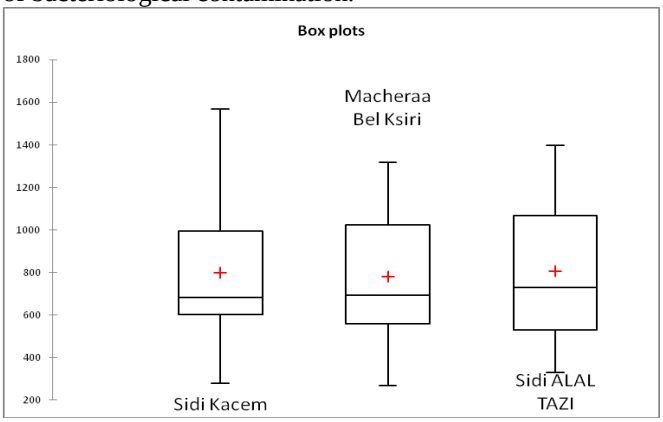

Figure 1: Mean variation revivifiable microorganisms (GT)

The contamination at the level of all the stations follows the same evolution curve. However, the concentration of GT varies between 277 CFU/1mL and 1397 CFU/1mL for well water (**figure 1**).
These differences in total germ concentrations at the different stations studied are explained by the contamination of water by bacteria from several sources of pollution (waste accumulation, lost wells, manure and leachate) and which is at the origin of the construction of favorable environments for bacterial development.
The high total germ values found in the groundwater of the study area are similar to those obtained at the groundwater level of Meknes and El hajeb by Belghiti [9]-[10] and Sadek [11] .

II.1.2.Total coliforms (CT)

Faecal coliforms and streptococci are the most common group of bacteria used for bacteriological examination of water [12].

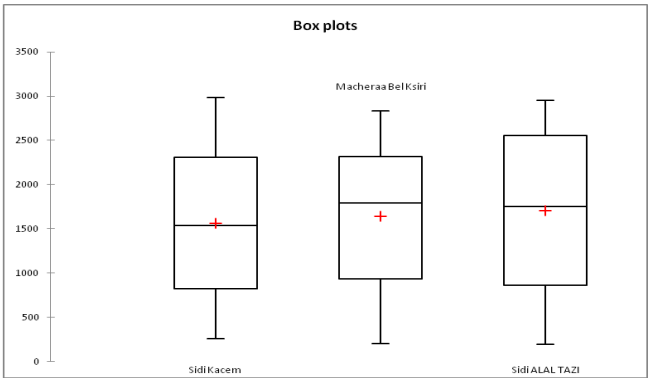

Figure 2: Mean variation total coliforms

Total coliforms (TC) are Gram-negative bacilli; aerobic and anaerobic optional. They are asporulate and do not have oxidase. They are able to ferment lactose with gas, acids and aldehydes at 37 ° C [13]-[14]-[15].The evolution of contamination by total coliforms, has shown that this variation is in saw, and this contamination is important and can reach a maximum of 2981 CFU/100ml (**figure 2**), recorded in the wells of Sidi Kacem. It should be noted that certain increases in bacterial densities must be punctual, depending on the nature of the substances infiltrated to the water table, knowing that these substances can inhibit or activate microbial growth (such as P 5 and P 6 wells). sidi Allal Tazi: located closer to the dump), are all factors related to the variability of the density of bacteria in these wells. The high levels of total coliforms could be explained by the poor protection of these water points, the spreading of manure near the water points and infiltration of surface water. These results corroborate those of Belghiti [9]; Gaujous [16].

3.1.3.Fecal Coliforms (CF)

The presence of fecal coliforms may be an indication of the presence of entero- pathogenic microorganisms [17]. The detection of faecal coliforms in drinking water must be seriously contaminated by fecal matter.

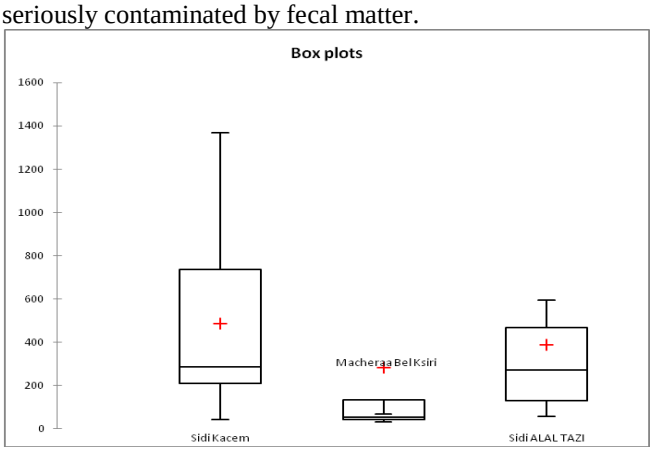

Figure 3: Mean variation fecal coliforms

The rate of contamination is accentuated in the city of Sidi Kacem, with peaks in the wells near Oued R'dam was consistent with the study of Sadek [11], the recorded maximum is 1636 CFU/100ml (**Figure 3**), this well largely open and unprotected. We note low levels of faecal coliforms in the waters of the sampled stations in the town of Macheraa Belksiri.

3.1.4.Streptococci Fecal (SF)

The presence of faecal streptococci usually indicates faecal pollution [18]. Faecal coliforms and streptococci are the most common group of bacteria used for bacteriological examination of water [12]. They are searched for in water as faecal contamination [16]. On the other hand, their survival rate in aquatic ecosystems is sometimes higher than that of faecal coliforms [17].

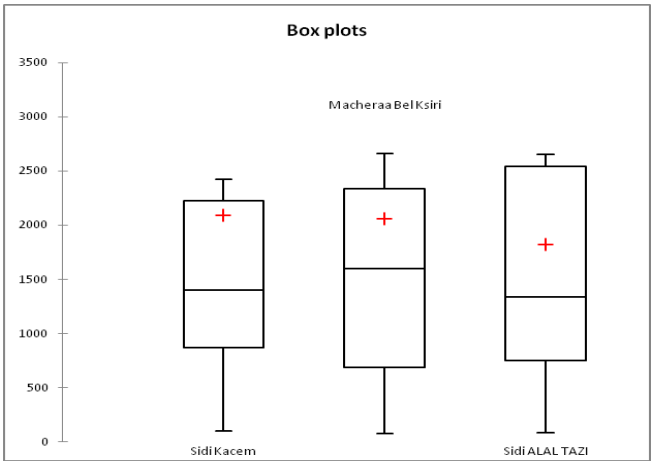

Figure 4: Mean variation faecal streptococci

The mean annual levels of faecal streptococci varied between 73 UFC/100 ml as low average at in Macheraa Station BelKesiri (**figure 4**). These high values of this bacterium have been mentioned in other regions of Morocco, by other authors such as AÏT Boughrous [19] and El Haissoufi [20]

3.1.5.Spores of anaerobic bacteria ASR

Anaerobic Sulphite the gear boxes (ASR) are obligate anaerobes; Gram positive; sporulated and reduce sulphites to hydrogen sulphides. They can survive longer in water than other indicator microorganisms of faecal pollution (coliforms and streptococci) [21]. Because of their high resistance, ASR spores can detect old or intermittent faecal pollution [22].

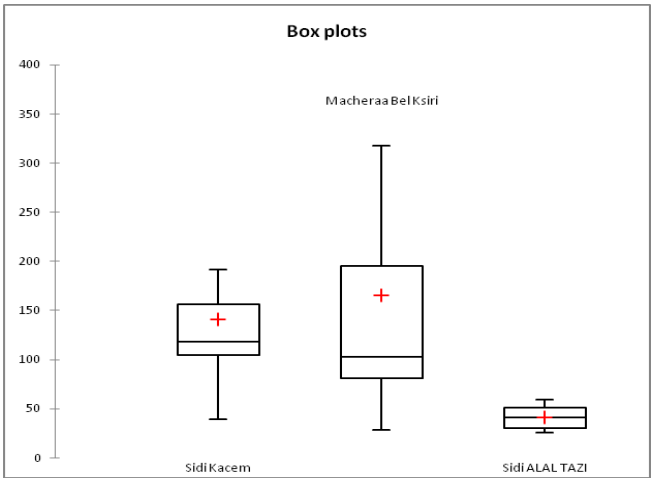

Figure 5: Mean variation Anaerobic sulphite

The contamination rate Anaerobic sulphite the gear boxes is more or less constant throughout the course of the year, with a well pronounced peak with an increase of about 452 CFU/L 20m, counted in the P4 well in the Macheraa station Belksiri (**figure 5**), The values found in most water sources studied exceed the Moroccan drinking water standards (NM 03.7.001. 2006); 0 germ of the gear boxes Anaerobic sulphite in 20 ml sample. These results corroborate those found in other water points studied by El Oualilalami [23] in the region of Fes.

3.2. Typological stations according to bacteriological parameters

Table 2: Presentation of the factors selected according to the kaiser method

component	Own values	Variance (%)	Cumulative variance (%)
F1	4.88	63.04	61.04
F2	2.08	26.09	87.13

Principal Component Analysis performed on a data matrix consisting of 20 rows representing sampled stations and 5 columns representing microbiological parameters showed that total germs at 37 ° C, total coliforms and fecal coliforms contribute negatively to the expression of the F1 axis, which cumulates only 61.04 % of the total variance (table 2).

The variance provided by the first two components F1 and F2 from the PCA of all the variables, is satisfactory. Indeed, they allow us to explain 87.13 % of the total variance.

The projection of the stations (described by bacteriological parameters) in terms of the first two factorial axis of the PCA (**figure 6**) clearly distinguishes four groups of stations:

- Group G1: this group made up of macheraa wells Belksiri which have an average bacteriological water quality, relatively less contaminated with fecal contamination of germs: Total coliforms, fecal coliforms and anaerobic sulphite gear boxes.
- Group G2: this group only has two wells per three wells which is located next to the landfill in the three cities studied , which have very poor bacteriological water quality, relatively more contaminated with fecal contamination germs: GT at 37 ° C , total coliforms and anaerobic sulphite gear boxes.
- Group G3: this group of wells which have water of medium bacteriological quality.

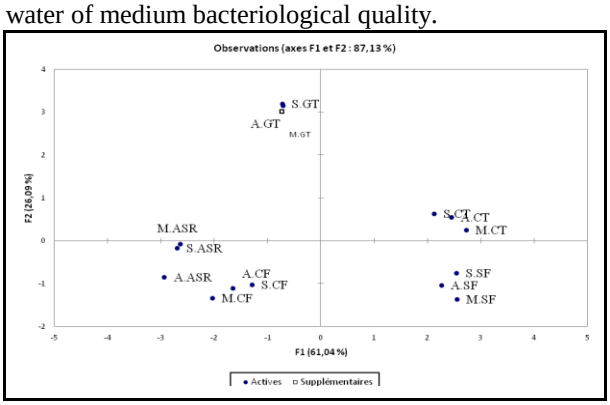

Figure 6: Projection of the physicochemical

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variables on the two axes F1-F2

The results obtained in this study confirm the poor environment of these wells. These results are in agreement with those found by [20]; EL Ouali Lalami [23] for wells and sources prospected in the Fez region, also with those obtained for the Meknes aquifer and those recorded for the surface water table of Marrakech [24].

II. CONCLUSION

The use of well water may nevertheless present tential risks to human health and the environment, although studies in this area are still too rare, particularly in Africa.On the ealth front, the real problems with the use of well water are the lack of appropriate treatment and the informal setting that often accompanies this practice. However, the microbioogical risks are proven, with a transmission of bacterial diseases.

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