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Drinking water quality at the urban and rural area in Makkah 2018.

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Abstract. Water is the most important substance in our daily life. Without it, life would not have been possible. Drinking water from different water resources such as wells and tankers should be free from contamination with waterborne pathogens including bacteria, fungi, viruses and parasites. Potable water is essential to humans and other life forms, as water is important to the mechanics of biological metabolisms in the body. Water is unsafe for human consumption when it contains pathogenic or disease-causing microorganisms. In addition, water transferring techniques may contaminate the drinking water. **Aim of the study:** To assess Drinking water quality at the urban and rural area during 2018 in Makkah and understanding the differences between these areas in water quality to improve the situation. **Method**: Cross-sectional design was adopted in the present study. Environmental Health Administration - Makkah Health Affairs. Self-administered Secondary data collection from Environmental Health Administration Files. All water samples results (319) in EHD during 2018 will be taken. **Results:** In our study, showed that the majority of TDS test the reference result is (1000) were Mean ± SD was 194.48±507.62 and Range (2-7890) put the PH test the references result is (6.5-8.5) were Mean ± SD was 7.11±0.40 and Range (5.40-8.55). And the Turbidity test the references is (5) were Mean ± SD was 0.59±0.93 and Range (0.11-14.30). Also showed that there is a significant relation between place and final results p-value <0.001. the majority test place from Urban used potable water (75.6%) while not potable is 38.6% on the other hand in Rural the potable water (24.4%) while not potable is (61.4%) were the Chi-square (22.724). **Conclusion:** The best way to make sure drinking water supplies are kept clean, safe and reliable is to take a preventive risk management approach. This means understanding each water supply from its beginning in nature to where it reaches you, the consumer. This understanding--about the water's characteristics, the ways it could become contaminated, and the type of treatment it needs--comes from collecting and studying data. **Recommendations:** ensuring the safety of a drinking-water supply. The use of a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from catchment to consumer. In these Guidelines, such approaches are termed water safety applied to drinking-water and to ensure the applicability of these practices to the management of drinking-water quality assessments that include and encompass the whole of the water supply system and its operation.

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1. Introduction:

Water safety and quality are fundamental to human development and wellbeing. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty. The best way to make sure drinking water supplies are kept clean, safe and reliable is to take a preventive risk management approach. (Ramakrishnaiah et al 2009). Another way that drinking water can become contaminated is through the products and materials with which it comes into contact. Water is a solvent and can leach metals and other chemicals from pipes, fittings, fixtures, and other products. (Smith et al 2008).

The national and international works standards-setting organizations to develop health- based performance standards for these products and materials to make sure they are not contributing harmful contaminants to your drinking water. (DeZuane1997). Understanding the differences between rural and urban areas in water quality can help public health departments to identify, monitor, and prioritize potential environmental public health concerns and opportunities for action. These findings suggest a continued need to develop more geographically targeted, evidence-based interventions to prevent morbidity and mortality associated with poor water quality. (Strosnider et at 2015).

Literature Review

Safe drinking water is everybody's business. Managing drinking water supplies properly, from the source water to the consumer's tap, takes a great deal of knowledge and coordination among multiple stakeholders--from governments and businesses, to individuals like you and me. (World Health Organization. 2004).

Quality The target for water quality should be compliance with national standards, which should in turn be based on the health criteria given in Water quality is assessed by means of sanitary inspections and appropriate analytical measurements. Saudi Arabia is one of the driest regions in the world, with no perennial rivers. Water is obtained from four distinct sources:

1. Non-renewable groundwater from the deep fossil aquifers
2. desalinated water
3. Surface water
4. renewable groundwater from shallow sediment aquifers

Only the last 2 sources are renewable. Desalination plants provide about half the country's drinking water. Desalination plants provide about half the country's drinking water. About 40% comes from. The rest comes from surface water (about 10%). Desalinated water is current on the coasts, surface water within the southwest region and groundwater elsewhere. The capital Riyadh, however, is equipped to a good extent with desalinated water tense from the gulf over 467 km to the city located in the heart of the country. (Starr et al.1991).

The drinking water that's equipped to our homes comes from either surface water or ground water. Surface water collects in streams, rivers, lakes, and reservoirs. Ground water is water settled below the bottom wherever it collects in pores and areas among rocks and in underground aquifers. We have a tendency to acquire ground water by drilling wells and pumping it to the surface. Public water systems offer water from surface and ground water for public use. Water treatment systems are either government or privately-held facilities. Surface water systems withdraw water from the supply, treat it, and deliver it to our homes. Groundwater systems additionally withdraw and deliver water, however they are doing not continuously treat it. (DeNicola et al.2015).

Since 2000, the govt. has progressively relied on the personal sector to control water and sanitation infrastructure, starting with chemical process and waste product treatment plants. Since the creation of the National waterworks (NWC) in 2008, the operation of urban water distribution systems within the four largest cities has bit by bit been delegated to personal firms further. (Abdurrahman et al. 2000).

The health problems will be associated with water quality the presence of sure contaminants in our water can lead to health issues, including gastrointestinal illness, reproductive problems, and neurological disorders. Infants, young children, pregnant women, the aged, and immune compromised persons could also be particularly in danger for turning into unwell when drinking contaminated water. as an example, elevated levels of lead will cause serious health issues, particularly for pregnant girls and young youngsters. Federal law needs that systems cut back sure contaminants to line levels, so as to safeguard human health. (*Ann C & Grandjean 2004).*

One of the Millennium Development Goals (MDGs) set by the UN includes environmental property. In 2004, only 42% of people in rural areas had access to clean water worldwide Water 21, Magazine of the International Water Association, (April 2008) comes like group action of Water and Sanitation Governance by suggests that of Socio-Technical Innovations work to develop new accessible water treatment systems for poor rural areas, reducing the price of drinking water. Jump up to: *"Saudi fires starting gun for SWCC privatisation". (June 2016*)

The World Health Organization/UNICEF Joint Monitoring Program (JMP) for water and Sanitation (Ageel & Amin, M. A. 1997).

is that the official world organisation mechanism tasked with watching progress towards the Millennium Development Goal (MDG) with reference to drinking-water and sanitation (MDG seven, Target 7c), that is to: "Halve, by 2015, the proportion of individuals without sustainable access to safe drinking-water and basic sanitation". (Alkolibi et al 2002).

Contaminants (germs and chemicals) get into beverage there will be several sources of contamination of our water systems. Here may be a list of the foremost common sources of contaminants: present chemicals and minerals (for example, arsenic, radon, uranium.

• Local land use practices (fertilizers, pesticides, livestock, targeted animal feeding operations)

• Manufacturing processes

•Sewer overflows

•Malfunctioning effluent treatment systems (for example, close septic systems)

Many contaminants that create acknowledged human health risks are regulated by the use Environmental Protection Agency (EPA). Environmental Protection Agency makes certain that water meets sure standards, therefore you'll take care that prime levels of contaminants aren't in your water. (Sale et al2008). According to this indicator on improved water sources, the MDG was met in 2010, 5 years earlier than schedule. Over two billion additional individuals used improved potable sources in 2010 than did in 1990. However, the task is way from finished. 780 million individuals are still while not improved sources of potable, and lots of additional individuals still lack safe potable. Estimates suggest that at least 25% of improved. sources contain fecal contamination (Ferrier & C 2001).

And an estimated 1.8 billion people globally use a source of drinking water which suffers from fecal contamination. (Parsons et al 2010). The standard of those sources varies over time and infrequently gets worse throughout the wet season. (Osborn et al 2011).

Continuing efforts are required to cut back urban-rural disparities and inequities related to poverty; to dramatically increase safe potable coverage in countries in sub-Saharan Africa and Oceania; to push world observation of drinking water quality; and to seem on the far side the MDG target towards universal coverage (Gordalla & Frimmel 2013).

Rationale:

The researchers are working in the environmental health department (EHD) in public health that dealing with the results of water investigation from different sites. They noticed a big difference between these result were not potable for drinking. Also, there is no similar pervious study in Saudi Arabia.

Aim of the study:

To assess Drinking water quality at the urban and rural area during 2018 in Makkah and understanding the differences between these areas in water quality to improve the situation.

Research objectives:

1. Assess Drinking water quality at the urban and rural area during 2018 in Makkah.
2. Compare the water quality of the urban and rural areas.

3. Materials and Methods

Study Design:

Cross-sectional design was Self-administered Secondary data collection from Environmental Health Administration Files. All water samples results (319) in EHD during 2018 will be taken.

Study Setting:

Environmental Health Administration - Makkah Health Affairs

Study Sampling and Data collection method:

Self-administered Secondary data collection from Environmental Health Administration Files. All water samples results **(319)** in EHD during 2018 will be taken.

Statistical analysed:

Data was analyzed using SPSS version 20.

Ethical consideration:

1. Approval by the Research Ethics Committee in Makkah.

2. Written consent will be obtained in the governmental and private facilities which response to drinking water Makkah

3. Data will be treated confidentially and will be used only for the purpose of research.

4. Results

Table (1) The distribution of physical and chemical examination of the water.

	Range Mean±SD	References
Physical examination		
TDS	2-7890 194.48±507.62	1000
PH	5.40-8.55 7.11±0.40	6.5-8.5
Turbidity	0.11-14.30 0.59±0.93	5
Color		
clear	317 (99.4%)	Clear
Not clear	2 (0.6%)	
Sediments		
NIL	315 (98.7%)	NIL
In	4(1.3%)	
Odor		

	319(100%)	Odorless
Conductivity	2-805166.75±190.46	-
Chemical examination		
CL	19-443 (139.31±144.54)	250
T.H	38-54(46.82±4.57)	500
Ca	6-18(13.55±2.88)	200
Mg	2-8 (3.60±1.84)	150
No3	0.45-107 32.65±33.27	50
Fe	0.01-1.16 0.11±0.29	0.3
SO4	0-206 33.50±72.32	250
NO2	0.001-0.01 0.02±0.03	3
CU	0.004-1 0.10±0.15	2
F	0.01-1 0.15±0.14	1.5
Na	7-12 9.90±1.62	200
K	0.20-1 0.41±0.13	20

Physical examination

In our study, showed that the majority of TDS test the reference result is (1000) were Mean ± SD was 194.48±507.62 and Range (2-7890) put the PH test the references result is (6.5-8.5) were Mean ± SD was 7.11±0.40and Range (5.40-8.55) And the Turbidity test the references is (5) were Mean ± SD was 0.59±0.93 and Range (0.11-14.30).

The color

In our study, showed that the majority of test the reference result is clear and range is 317 (99.4%). on the anther hand the not clear the range is 2 (0.6%).

Sediments

In our study, showed that the majority of test the reference result is NIL and range is 315 (98.7%). But in the rang is (1.3%)

Odor

In our study, showed that the majority of test the reference result is odourless

But the conductivity the rang is 2-805 were Mean ± SD was (166.75±190.46)

Chemical examination

CL

In our study, based on the above results of test the CL Range is (19-443) but The Mean±SD (139.31±144.54) while the references is (250).

T.H

In our study, based on the above results of test the T.H Range is (38-54) but The Mean±SD (46.82±4.57) while the references is (500).

Ca

In our study, based on the above results of test the Ca Range is (6-18) but The Mean±SD (13.55±2.88) while the references is (200).

Mg

In our study, based on the above results of test the **Mg** Range is (2-8) but The Mean±SD (3.60±1.84) while the references is (150).

No3

In our study, based on the above results of test the No3 Range is (0.45-107) but The Mean±SD (32.65±33.27) while the references is (50).

Fe

In our study, based on the above results of test the Fe Range is (0.01-1.16) but The Mean±SD (0.11±0.29) while the references is (0.3).

SO4

In our study, based on the above results of test the SO4 Range is (0-206) but The Mean±SD (33.50±72.32) while the references is (250).

NO2

In our study, based on the above results of test the NO2 Range is (0.001-0.01) but The Mean±SD (0.02±0.03) while the references is (3).

CU

In our study, based on the above results of test the **CU** Range is (0.004-1) but The Mean±SD (0.10±0.15) while the references is (2).

F

In our study, based on the above results of test the **F** Range is (0.01-1) but The Mean±SD (0.15±0.14) while the references is (1.5).

Na

In our study, based on the above results of test the **Na** Range is (7-12) but The Mean±SD (9.90±1.62) while the references is (200).

K

In our study, based on the above results of test the **k** Range is (0.20-1) but The Mean±SD (0.41±0.13) while the references is (20).

Table (2) The Final results distribution of the water.

Final results		
	N	**%**
Potable	275	86.2
Not Potable	44	13.8
Total	319	100.0

In our study, based on the above results the majority of the test is potable the number (275/ 86.2) but the not potable (44/ 13.8)

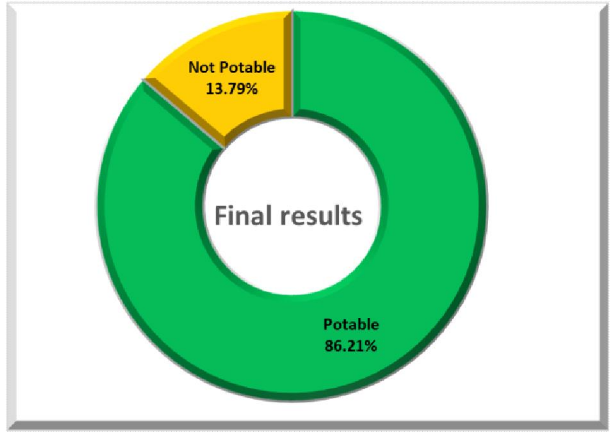


Figure (1) The Final results distribution of the water.

The potable percentage (86.2%) and not potable (13.8)

Odor

In our study, showed that the majority of test negative (100%)

TDS

In our study, showed that the majority of test negative (96.6%) but positive is (3.4%).

Table (3) the distribution of Negative and Positive examination of the water.

	data			
	Negative		**Positive**	
	N	**%**	**N**	**%**
Odor	319	100.0%	0	0.0%
TDS	308	96.6%	11	3.4%
PH	311	97.5%	8	2.5%
Color	318	99.7%	1	0.3%
Sediments	315	98.7%	4	1.3%
Turbidity	318	99.7%	1	0.3%
Conductivity	319	100.0%	0	0.0%
CL	307	96.2%	12	3.8%
T.H	319	100.0%	0	0.0%
Ca	319	100.0%	0	0.0%
Mg	319	100.0%	0	0.0%
No3	307	96.2%	12	3.8%
Fe	316	99.1%	3	0.9%
SO4	319	100.0%	0	0.0%
NO2	319	100.0%	0	0.0%
CU	319	100.0%	0	0.0%
F	319	100.0%	0	0.0%
Na	319	100.0%	0	0.0%
K	319	100.0%	0	0.0%

PH

In our study, showed that the majority of test negative (97.5%) but positive is (2.5%).

Sediments

In our study, showed that the majority of test negative (98.7%) but positive is (1.3%).

Turbidity

In our study, showed that the majority of test negative (99.7%) but positive is (0.3%).

CL

In our study, showed that the majority of test negative (96.2%) but positive is (3.8%)

T.H

In our study, showed that the majority of test negative (100%)

Ca

In our study, showed that the majority of test negative (100%)

Mg

In our study, showed that the majority of test negative (100%)

In our study, showed that the majority of test negative (100%)

F

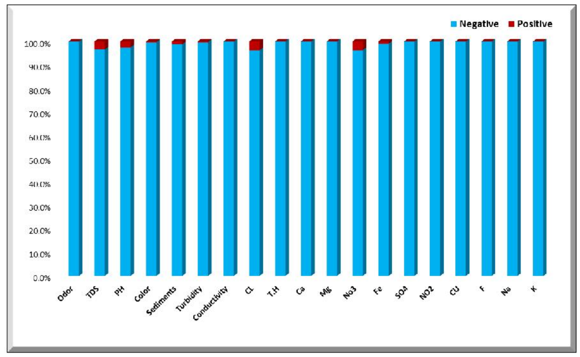
In our study, showed that the majority of test negative (100%)

Na

In our study, showed that the majority of test negative (100%)

K

In our study, showed that the majority of test negative (100%)



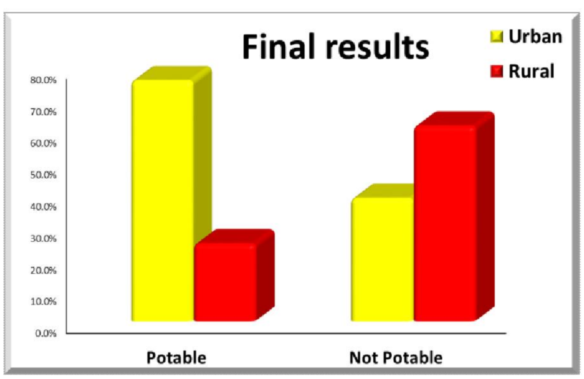


Figure (3) the distribution of the Final results of the water place

facilities in Makkah 2018. In this investigation, the microbiological quality of the drinking water was satisfactory for the chemical indicators of organic contamination in all samples, probably because the values of microbial counts were not high enough to modify them. It should be noted that the same pattern has not been observed for the quantitative and qualitative microbiological parameters. showed that the majority of TDS test the reference result is (1000) were Mean ± SD was 194.48±507.62 and Range (2-7890) put the PH test the references result is (6.5-8.5) were Mean ± SD was 7.11±0.40 and Range (5.40-8.55) And the Turbidity test the references is were Mean ± SD was 0.59±0.93 and Range (0.11-14.30). see Table (1).

In addition, we were interested to determine whether the potable tap water used was responsible for the contamination of the water potable. None of the tap water samples had a bacterial count higher than the water coolers and none of the samples were contaminated with coliforms. Thus, tap water was not directly responsible of water coolers contamination. These findings suggest that the contamination may be caused by the accumulation of small quantity of microorganisms from tap water or from faucet surface which are concentrated at filters. The majority of the test is potable the number (275/ 86.2) but the not potable (44/ 13.8). see Table (2).

It was interesting to find out that the results of the statistical analysis indicated that strongly and highly significant differences in quality and quantity of the microbiological parameters between the water potable samples and the non-potable water samples. See Table (3)

And a significantly higher proportion of relation between place and final results p-value <0.001. the majority test place from Urban used potable water (75.6%) while not potable is 38.6% on the other hand in Rural the potable water (24.4%) while not potable is (61.4%) were the Chi-square (22.724). see Table (4)

Conclusion:

The results emphasize the importance of adopting appropriate routinely monitoring system in order to prevent or to diminish the chances of contamination of this water source. The data presented here raise concern about the microbiological quality of the drinking water plumbed in water coolers and highlights the importance of adopting appropriate monitoring system with changing filters according to their use and the disinfection of the water in order to prevent or to diminish the chances of contamination of this water source." in MDG Target 7c encourages the installation of new improved water sources but does not provide an incentive for maintaining the quality of existing sources. Modifying the target to include both water source quality and the type of source could lead to improvements in existing sources as well as to the installation of new sources. For than reliable water sources water into the home, contamination between the source and the point of use is known to be significant and has led to increasing interest in household water treatment and safe storage.

Recommendations:

Plans dealing with household water should be linked to a hygiene education programmer and advice to households in maintaining water safety. The primary objectives good drinking-water supply practice are the prevention or minimization of contamination of source waters, the reduction or removal of contamination through treatment processes and the prevention of contamination during storage, distribution and handling of drinking-water. These objectives are equally applicable to large piped drinking-water supplies, small community supplies and household systems and are achieved by through:

- Development of an understanding of the specific system and its capability to supply water that meets water quality targets;
- Identification of potential sources of contamination and how they can be controlled;
- Validation of control measures employed to control hazards;
- Implementation of a system for operational monitoring of the control measures within the water system;
- Timely corrective actions to ensure that safe water is consistently supplied.

Three key components, which are guided by health based.

They are:

1) A system assessment to determine whether the drinking-water supply chain (up to the point of consumption) as a whole can deliver water of a quality that meets identified targets. This also Includes the assessment of design criteria of new systems;

2) Identifying control measures in a drinking-water system that will collectively control identified risks and ensure that the health-based targets are met. For each control measure identified, an appropriate means of operational monitoring should be defined that will ensure that any deviation from required performance is rapidly detected in a timely manner;

3) Management and communication plans describing actions to be taken during normal operation or incident conditions and documenting the system assessment, including upgrade and improvement planning, monitoring and communication Plans and supporting programmers.

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