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Microbial contamination of drinking water supplies in Basrah province

Kassim Fawzi Abdul-kareem and Hussein K . Abdul-Sada
Department of Pharmacology and Clinical laboratory Sciences
College of pharmacy/ University of Basrah

Abstract:-

Microbial contamination of water persists to be a major problem; the usual source is human and animal fecal matters that have entered the water systems.The presence of bacteria and pathogenic organisms is of great concern when considering the safety of drinking water, as pathogenic organisms can cause intestinal infections, dysentery, hepatitis, cholera and other serious illnesses. Water samples for laboratory examination were collected from 14 areas all over the Basra governorate , three samples were taken from each area .The total number examined was 84 samples, which were classified as : 42 samples from Reverse Osmosis (RO) Drinking water ,and 42 samples from Tap water. Each sample was submitted for direct microscopic examination, then cultivation was done using appropriate media for the identification of microbial contaminants (bacterial and fungal).Tap water samples were found to be highly contaminated with many types of pathogenic bacteria such as Coliform ,*Salmonella,Shigella,Pseudomonas* . and *Candida* and fungi were detected in all samples examined , whereas R.O. water samples also were found contaminated with *Candida* and fungi in all samples , other pathogens such as Coliform in almost all of the tanks from which the samples were collected . In conclusion the main results were that drinking water in Basrah is not safe from the microbiological point of view.

The aim: This microbiological study takes a glance at the current situation regarding how healthy drinking water supplies are in Basrah.

Introduction:

Water is the most important substance on earth .It makes about 80% of our body weights, comprises about 92% of the blood and nearly 98% of gastrointestinal secretions. Water holds all nutrient factors in solution and acts as a transportation medium for these substances. One of the most important functions of water is to flush toxins from the body. (1)

Contamination of water poses a serious problem .These contaminants can be divided into two broad categories: substances that affect water taste or appearance and considered harmless, and substances that represent health hazards; these include pathogenic micro-organisms, inorganic and organic chemicals and radionuclides. (2)

The presence of bacteria and other pathogenic (disease-causing) organisms in water can cause intestinal infections, dysentery, hepatitis, typhoid fever, cholera, and other illnesses .

Key words: Drinking water, microbial contamination.

Bacterial contamination can result from a number of sources , Human and animal wastes are primary sources of bacteria in water. These sources of bacterial contamination include runoff from feedlots, pastures, dog runs, and other land areas where animal wastes are deposited (3,14).

Additional sources include seepage or discharge from septic tanks and sewage treatment facilities. Bacteria from these sources can enter wells that are either open at the land surface, or do not have water-tight casings or caps (4,8).

Another way bacteria can enter a water supply is through inundation or infiltration by flood waters or by surface runoff. Flood waters commonly contain high levels of bacteria. Small depressions filled with flood water provide an excellent breeding ground for bacteria. (4)

During the last five to ten years, well and water distribution system construction has improved to the point where bacterial contamination is rare in newer wells (5).

Materials and Methods:

This study was performed in Basrah province during October to December 2006 .Water samples for laboratory examinations were collected from 14 areas all over the governorate. Three samples were taken from each area and mixed with each .The total number examined was 84 samples, which were classified as seen in Table (1). The samples tested in microbiological laboratories of Pharmacy college , Basrah university .

1-Collection of samples:

One liter of water samples were collected in sterile bottles used for collection of water samples by the health authorities and the laboratory analysis was performed afterward .

2- Sample preparation:

Each sample was first prepared by centrifugation of the whole container and10 ml from the residual of solution were collected to direct examination then the whole containers water were filtered three time with sterile syringe single use filter unit 0.45 μm from (Difco) to cultivation on three types of media (2) .

3- Direct microscopic examination using the direct slide method was done in order to decide the presence or absence of micro-organisms.

4- Cultivation for micro-organisms: Filter papers of syringe unite were cultured for bacteria using Petri dishes containing nutrient agar and kept for 36 hrs. at 37Cº to isolate bacterial contaminants . Other selective media Salmonella-Shigella agar were used at same condition to identify *Salmonella* and *Shigella* . While Sabaurod-Dextrose agar media were used to cultivate the same samples for 7 days at 32Cº for the detection of fungal contaminants (6).

5- Microbial examination and diagnosis was performed after the isolation of pure colonies and the following tests were done in order to identify the type of bacteria and other micro-organisms in water samples :

-Gram stain (for bacterial colonies)
-INVIC test (for identification of Coliform bacteria)
-Carbohydrates fermentation test. (for differentiation between *Salmonella* and *Shigella* and for identification of *Candida*).
-Colonies and slide features (for diagnostic fungi) (6,12)

6-Statistical analysis :

The study was qualitative test however the statistical analysis was done to confirm the percentage of occurrence of microbial types in area of study according to formula in below(8) :

$$O\% = \frac{r}{N} \times 100$$

O% = Percentage of Occurrence
r = times of isolate appearance
N= No. of samples

Results and Discussion:

In the present study the direct primary examination of water samples revealed the presence of high numbers of micro-organisms which is an indication of microbial contamination.

Table (1) shows the results of cultures of tap water samples according to the area from which it was collected. *Candida* and different types of fungi were present in all samples of tap water, *Aspergillus* and *Fusarium* were present in almost areas , that means the water contaminated with soil and air source(7).Coliform bacteria is present in almost all areas examined, the presence of coliforms usually means that the water may be contaminated by sewage effluent(9). *E. coli* is regarded as the most dangerous polluter of coliforms and is used as a standard for the detection of water cleanliness for human use(10,11). It is well known that tap water must be clear, clean and drinkable and the presence of *E coli* in any reserve of water denies its use for human supplies.

The detection of *Salmonella* and *Shigella* in three areas is catastrophic due to the ominous outcomes of epidemics that may be caused by these organisms as these are the most dangerous types of bacteria to contaminate food or water supplies (13) . A single cell of *Salmonella* that may be detected in a water reserve of a whole city renders that reserve unhealthy and refused altogether (14) .

Bacillus species were found also in many areas. This soil borne contamination may be attributed to water contact with soil from the broken, old, punctured and badly maintained water pipes(6).

Candida species was detected in all tap water samples examined .It has a minor morbidity on adults, however it is highly symptomatic in children and causes severe gastroenteritis (7,12) .

The greenish color of tap water commonly encountered may be attributed to the presence of many fungi in that water (8).

It is worth noticing that no significant difference was found among the different areas examined for tap water contamination regarding the cultural and economic status of that area .It is concluded that the source of contamination is the same one, i.e. the main resource of the city, or may be due to the passage underground of water pipes side by side with sewage pipes (6).Therefore it is recommended that all community public water systems must submit samples for coliform bacteria testing on a regular monthly basis.

The second part of the study was performed on the drinking water prepared by reverse osmosis method (called R.O. water).This water is prepared by ultra filtration using the reverse osmosis systems present in certain industrial plants(petrochemical plant in southern Basrah) which is then

transported and distributed in the city by large tankers . Water of these tankers is pour through other containers in each community .

Table (2) shows the results of examination of R.O. water collected from 14 areas. Petrochemicals Plant was free from all types of micro-organisms and only three areas (Alkhalig, Jubaila and Hakimia) were free of coliform bacteria in the R.O water. The results of cultured water samples consistently indicate the contamination of tanks from which water is pour and/or that people who pour water are ill themselves, since the samples which were taken from the source (i.e. petrochemical plant) were sterile .

In Hartha (a rural area) a serious contamination with *salmonella* was detected, which may explain high occurrence of typhoid in this area (13). *Candida* was found in seven out of 14 tanks . This yeast gives a sticky and mucous material on the walls of these water containers, which was clear during the study.

Results of % occurrence :

Table(3) shows that all samples of tap water (100%) were contaminated with *Candida* and 64.2% with *E. coli* which reflects this ecological problem . Whereas drinking water samples showed a high occurrence of the same contaminants (57% for *Candida* and 35.7% for *E. coli*). However it should be remembered that drinking water should be colorless odorless and free of any micro-organisms (7).

In conclusion , the study found a constant and serious contamination threat to community health through the presence of contamination of both tap water and drinking water. This necessitates urgent and comprehensive measures to overcome this serious problem on health of our growing society.The use of chlorine and fluorine for water sterilization is mandatory, assuming that the water pipes are intact before reaching the consumers.

Table (1) : Isolates of Tap water samples according to area

Area Examined	*Tap Water*
Petrochemicals Plant	*Bacillus spp. E.coli, Actinomycetes,Candida , Fusarium ,Aspergillus*
Junaina	*Bacillus spp., Klebsiella , E.coli Actinomycetes, Candida, Fusarium*
Jubaila	*Bacillus spp., Klebsiella , E.coli Actinomycetes, Candida, Fusarium*
Ashar	*Bacillus spp., Klebsiella , Aspergillus, Candida, Fusarium*
Jamhooria	*Bacillus spp., Shigella,Pseudomonas , E.coli, Candida, Alternaria ,Aspergillus*
Five miles	*Alternaria,Aspergillus Klebsiella , Candida, Fusarium*
Al-khaleej	*Bacillus spp., Shigella,Pseudomonas, E.coli, Candida ,Alternaria,Aspergillus Actinomycetes, Fusarium*
Hakeemia	*Bacillus spp., Shigella,Pseudomonas , E.coli, Candida, Alternaria ,Aspergillus*
Al-Jazaer	*Bacillus spp., Shigella,Pseudomonas , E.coli, Candida, Alternaria ,Aspergillus*
Buradhea	*Bacillus spp. E.coli, Actinomycetes,Candida , Fusarium ,Aspergillus*
Abu-Alkhasseb	*Bacillus spp., Klebsiella , Salmonella, Candida,*
Al-Hartha	*Alternaria,Aspergillus Klebsiella , Candida, Fusarium*
Al-Garma	*Bacillus E coli ,Aspergillus Candida, Fusarium*
Al-Hadi	*Alternaria,Aspergillus Klebsiella , Candida, Fusarium*

Table (2): Isolates of (R.O.) water samples according to area.

Area Examined	*R.O. Water*
Petrochemicals Plant	None
Junaina	*Klebsiella,E.coli ,Candida,*
Jubaila	*Candida*
Ashar	*Cladisporium*
Jamhooria	*E.coli, Cladosporium*
Five miles	*Cladosporium, Candida,*
Al-khaleej	*None*
Hakeemia	*Candida, Cladosporium*
Al-Jazaer	*Klebsiella*
Buradhea	*Klebsiella, Aspergillus,*
Abu-Alkhasseb	*E.coli Klebsiella, Candida.*
Al-Hartha	*E.coli, Klebsiella, Salmonella Candida, Penicilliun, Cladosporium*
Al-Garma	*E. coli, Penicillium, Cladosporium,*
Al-Hadi	*Klebsiella, Candida,*

Table (3): The percantage occurrence of isolates in tap and drinking water

Area Examined	*% Occurrence in Tap water*	*% Occurrence in Drinking water*
Bacillus	*78.57*	0.0
E.coli	64.28	35.71
Candida	100	57.14
Klebsiella	50	42.85
Shigella	21.42	0.0
*Pseudom*onas	28.57	0.0
Fusarium	71.42	0.0
Aspergillus	78.54	7.1
*Alterna*ria	50	0.0
*Actinomy*cetes	35.71	0.0
Penicillium	0.0	14.28
Cladisporium	7.1	14.28
Salmonella	7.1	7.1

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