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Detection of Microbial Contamination in Drinking Water from Dammad City, Jazan, Saudi Arabia

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Recently, the problems of water contaminated with sewage are increased severely in many countries which use the groundwater for drinking. Prior to sampling, water was allowed to run for several minutes. Water samples were collected from four locations (north, south, east, and west) of the Dammad city under a sterile. The water samples were collected in 500 ml sterile glass bottles. They were kept in ice pocket and then shipped to the laboratory and analysis was carried out immediately. Dilution series of water samples were made in autoclaved distilled water, samples (0.1ml) from each dilution were transferred into each of three plates of Nutrient Agar media for bacteria and CzapekDox media for fungi, then the plates were inoculated with swabs, incubated at 36 - 37°C for 24-72 hr for bacteria and at 25-27 °C for 7-14 days for fungi. After the incubation period, plates were examined for the growth of microorganisms. Some species of bacteria were observed such as *E.coli, Enterobacters* and some species of fungi, such as *Aspergillusflavus* and *Aspergillusniger*. Due to the emergence of odors from water system and the observed growth of bacteria and fungi, we suspect that the sewerage system of Dammad city may be the source of contamination of the drinking water system including the groundwater and the water tanks.

Key words: Microbial Contamination, Groundwater, Water System, Dammad City, Jazan Region, Saudi Arabia.

This is the first study of its kind reporting the microbial contamination of the water system of the Dammad province, Jazan region, south west of Saudi Arabia, having an estimated age of more than 30 years.Recently, the problems of water contaminated with sewage are increasing especially in many countries which use the groundwater for drinking [1], as noted the spread of many diseases, which is closely linked to the contamination of water used for drinking, particularly in some countries that depend on the groundwater systems which do not use a network of desalinated water (such as some networks, desalination of sea water), and the reason may be due to after those bodies of water such as sea or the lack of tributaries of water such as rivers or lakes, which allow total appropriation for the old networks as sources of drinking water for the emergence of many problems of pollution in the drinking water and these problems have caused great concern for planners and decision makers [2]. The problems of polluted water became a threat for human health with the increasing pollution of water resources, either directly or indirectly. Kingdom of Saudi Arabia is not in isolation from

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the rest of the world and worry about the large spread of those contaminants to sidestep the normal level of the content of the microbial to reach dangerous level. Safe and good quality drinking water is essential for human health. However, when contaminated, it may become a source of undesirable substances dangerous to human health [3]. The main source of drinking water in Saudi Arabia is groundwater, although most regions in Saudi Arabia do not face serious problems regarding drinking water as other parts of world, there are still water quality problems. Some studies have shown *E.coli* as well as *Salmonella* sp. From 18 groundwater well samples inSabha City, Libya [4]. Given the importance of groundwater pollution, which is one of the tributaries of the basic drinking water systems in the world. There, are several potential sources that may cause chemical and microbial contamination in groundwater. These include intensive application of organic and inorganic fertilizers, pesticides, and animal waste. Seepage from septic tanks and wastewater discharged to soil might also in some locations contribute to the deterioration of both chemical and microbial quality of groundwater [5]. In Saudi Arabia, the quality of drinking water is currently receiving some attention from environmentalist and water scientists; the quality of 40 wells water in selected villages in Hael Region, North Central of Saudi Arabia used mainly for drinking was examined with respect to total dissolved salts (TDS), pH, total hardness, concentrations of calcium, magnesium, potassium, sodium, chloride, fluoride, nitrate, and bicarbonate, beside coliform bacteria as an indicator of bacterial contamination [6]. Floating biofilms developed at the water–air interface which harbor numerous microorganisms, some of which are human pathogens like *Legionella pneumophila* were also reported by [7]. In some studies of drinking water of many countries reported contaminates are not only microorganism but also mineral such as arsenics [8]. The high prevalence of elevated levels of arsenic in drinking-water in many countries has necessitated the development of reliable and rapid methods for the determination of a wide range of arsenic concentrations in water. The present study was conducted during 2011 to evaluate the quality of water system in Dammad city, Jazan Region, south west Saudi Arabia. It situated on the banks of the Valley of Dammad, which is the most famous valleys south west Saudi Arabia and characterized by frequent rain water and this gives a clear perception of the high level of groundwater and surface water. Limited studies of the contaminants of drinking water and groundwater in the Jazan region has been made. There is also a lack of new sewer system of domestic sewage disposal in Dammad city and the old one is non-functional and the only active system which consists of septic tanks and cesspits constructed directly over the fractured-granite and alluvial layers. This may be the main reason of migration of different contaminants in such strata. Houses without filtering or sterilization(bymotors pull water) so, are access to drinking water from the main water system which lacks the means of safety and security standards to obtain a source of drinking water free from contaminants.

MATERIALS AND METHODS

This study was conducted in Dammad city during 2011 in the south western region of Saudi Arabia in Jazan Province. Water samples were collected from four Dammad locations (north, south, east, and west) allowing first water to run for several minutes under sterile condition. The water samples were collected in 500 ml sterile glass bottles. They were kept in ice pocket and then shipped to the laboratory and analysis was carried out immediately. Dilution series of water samples were made in autoclaved distilled water, samples (0.1ml) from each dilution were transferred into each of three plates of Nutrient Agar media for bacteria and CzapekDox media for fungi, then the plates were inoculated with swabs, were placed in an incubator for bacteria at 36 - 37°C for 24-72hr; and for fungi at 25-27°C for 7 - 14 days, after the incubation period, plates were examined for growth of microorganisms. Further identified with API Rapid NFT (Analytab Products, Inc., Plain view, N. Y.). MacConkey agar media were used for differentiation of gram negative bacilli into lactose fermenters (pink colonies) and lactose non-fermenters [9]. Aquatic-derived fungi were isolated on Czapek's agar and Taxonomically were identified using morphology characteristics of fungal isolates down to the species level [10-11].

RESULTS

A high density of the microbial content of either bacteria or fungi were isolated from water samples collected from four different locations (north, south, east, west) of groundwater, the main source of water system in Dammad city of Jazan, Saudi Arabia 2011. Microbial contamination was surveyed in this water system in Dammad city. Most species showed wide range in their distribution among all four points and ground water sites. However, three bacteria species were recorded in all sites, *E.coli, Proteus* sp, *Staphylococcus* sp. Five species were found in three sites, *Acinetobacter* sp, *Enterobactersp*, *Pseudomonas sp, Salmonella sp, and Shigella sp*. Two species were found in two sites, *Aerococcus viridian* and *Vibrio* sp. The results also showed that some species were restricted only to a certain site, *Bacillus* sp, *Erwinia* sp, and *Serratia* sp. Table 1. Isolated fungi from drinking Water samples in Dammad City see Table 2. Fungal species were recorded in all sites, *Aspergillus flavus*, *Aspergillus niger* and *A. fumigatus*. Gram – negative Cocci and *Aspergillus flavus* isolated from sample water under light microscopy (100X) (Fig. A and B).

Table 1. Isolated Bacteria from Drinking Water Samples from Dammad City

Isolated Bacteria	Drinking Water samples			
	1	2	3	4
Acinetobacter sp.	+	+	-	+
Aerococcus viridian	-	+	-	+
Bacillus sp.	-	-	+	-
E.coli	+	+	+	+
Entrobacteria sp.	+	-	+	+
Envinia sp.	-	-	-	+
Kelbsiuella pneumonia	-	-	+	-
Proteus sp.	+	+	+	+
Pseudomonas sp.	+	+	-	+
Saimonella sp.	+	+	-	+
Seratla sp.	-	-	-	+
Shigella sp.	+	-	+	+
Staphylococcus sp.	+	+	+	+

West Dammad City: 4 NorthDammad City, 2 : South Dammad City, 3 : East Dammad City1; (+) growth; (-) no growth

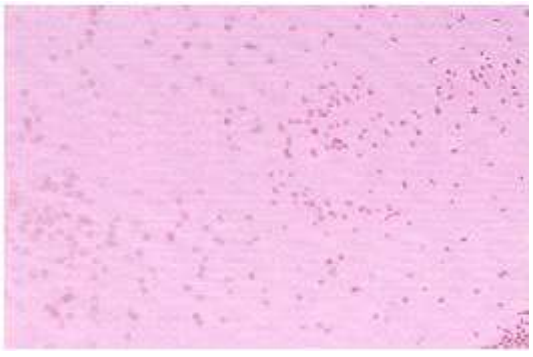

Fig. 1. Gram Stain of *Enterobacter* sp., Gram – negative Cocci (100X)

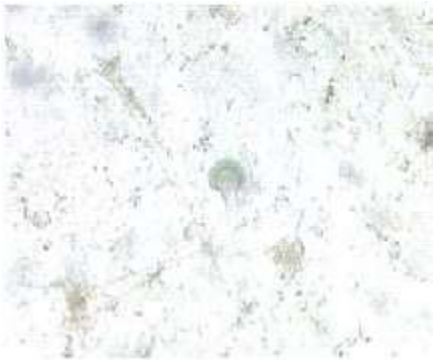

Fig. 2. *Aspergillus flavus* under light microscopy (100X)

Table 2. Isolated fungi from drinking water samples in Dammad City

Isolated	Drinking Water Samples			
	1	2	3	4
Aspergillus falvus	+	+	+	+
Aspergillus fumigatus	+	-	-	+
Aspergillus niger	+	+	+	+
Penicillium sp.	+	-	-	+
Rhizopus sp.	-	+	+	+
Trichoderma sp.	+	-	+	+

DISCUSSION

Groundwater is the main water source for Dammaad city inhabitants. Recently, the problems of water contaminated with sewage are increasing especially in (north, south, east, and west) of the Dammadcity. World Health Organization for drinking water standards, Counts of faecal indicators (faecal coliform and faecal streptococci) ranged between 2-142 cfu/100 ml in wells. Bacterial pathogens including *Salmonella, Shigella* and *Vibrio* spp. were detectable in all wells, indicating heavy contamination of the groundwater with domestic sewage[12]. Drinking water is derived from two basic sources: surface waters, such as rivers and reservoirs, and groundwater. All water contains natural contaminants, particularly inorganic contaminants that arise from the geological strata through which the water flows and, to a varying extent, anthropogenic pollution by both microorganisms and chemicals. In general, groundwater is less vulnerable to pollution than surface waters. In some countries, badly sited latrines and septic tanks are a significant source of contamination, especially of wells [5]. Drinking water systems supplied by untreated groundwater were examined to determine whether coliform or heterotrophic plate count bacteria are capable of growing. Filterable bacteria were present in 42% of the 46 groundwater sources examined by using nonselective media (R2A and full strength m-HPC agars). Pseudomonads were the most frequently identified group of filterable bacteria detected. *Flavobacterium*, *Alcaligenes*, *Acinetobacter* and *Achromobacter* isolates were also identified [4]. At present there is a need to better understand the composition and significance of fungal and bacterial populations in the source of drinking water. In our study the majority of fungi detected in water samples are *Aspergillus flavus, Aspergillus niger, Rhizopus* sp, *Aspergillus fumigatus*, and *Penicillium* sp.In most instances these fungi cause no problems for healthy adults, although there may be a potential risk for immunocompromised individuals. Hundred sixty eight water samples taken and 20 surface-related samples from taps and showers in the BMT unit and from the main pipe supplying the paediatric department were taken on 16 different days over an 8-month period. Filamentous fungi were recovered from 94% of all the water samples taken inside the hospital *Aspergillus fumigatus* was recovered from 49% [14]. Our results confirm direct correlation between bacterial fungal contaminations of drinking water due to wastewater entry on water system during drains in Dammad city. Essential Parameters are those measures that define minimum service standards (continuity, quality of, leakage targets) and which seek to pursue the objective of increasing population access and service level to a reasonable minimum target such as a single tap within the house or yard. Drinking-water quality standards and their implementation through actions by both the supply agency and others, including information sharing and public reporting. The regulation of ancillary services, which impact directly upon supply or quality (including for example, those which may impact upon both water security through leakage and safety through proper practice against contamination). Public health functions (including ongoing public health oversight and response to occurrences endangering public health) Licensing of materials and chemicals used in the production and distribution of drinking water (such as pipes and treatment chemicals) and of household devices such as taps should be under control. These different functions can be translated into a set of regulations and standards that would typically be incorporated into a regulatory framework.

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