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CLASSICAL AND NEW MICROBIAL INDICATORS OF DRINKING WATER IN DAKAHLIA GOVERNORATE

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ABSTRACT

This study aims to compare different sources of water in Dakahlia governorate whether tap or underground water and to assess the sources of such water in terms of microbiological and it detects the classical and new indicators of water pollutants, as well as the detection of certain pathogens, and then isolate and identify some of these pollutants. The samples were collected from six different cities from six areas namely; El-Mansoura, Aga, Met-Ghamer, El-Sembelaween, Belqas and El-Mansala in Dakahlia, Egypt during four season; winter, spring, summer and autumn at 2006/2007. Total bacterial count at 22°C, at 37°C, total coliform, faecal coliform, faecal streptococci, total yeast, *candida* spp., *Aeromonas hydrophila*, acid fast bacteria, staphylococci, *Salmonella* spp., total *vibrio* spp. and *Listeria monocytogenes* were studied.

Keywords : classical and new microbial indicators, pathogenic microbial indicators, tap water, ground water and Dakahlia governorate.

INTRODUCTION

In the past decade, there has been growing concern about the safety of public water supplies. Water disinfected at 0.5 mg/l of free residual chlorine for 30 min at a pH less than 8, with turbidity of less than one of NTU, would constitute minimal health risk to consumers. It was assumed that current water quality standards were sufficient to protect the public against the risk of gastrointestinal disease. However, there is non-trivial endemic level of unreported gastrointestinal diseases due to the consumption of tap water. The primary aim of the guidelines for drinking water quality is the protection of public health. The guideline values recommended are not mandatory limits and must be considered in the context of local or national environmental, social, economic and cultural conditions. The standards that individual countries will develop can thus be influenced by national priorities and economic factors (WHO, 1996).

Because of the importance of water, the pattern of human settlement throughout history has often been determined by its availability. Fertile Nile river valleys with abundant water supplies were the centers for beginning civilizations. With over population, demand for water has increased dramatically, and its uses have become much more varied. Good-quality of drinking water may be consumed in any desired amount without side effect on health. Such water is called “potable water". It is free from harmful levels of impurities such as bacteria, viruses, minerals, and organic substances. It is also aesthetically acceptable and is free of unpleasant impurities, such as objectionable taste, color, turbidity, and odor. The most common problems in household water supplies may be attributed to hardness, iron, sulphides, sodium chloride, acidity, and disease-producing pathogens, such as bacteria and viruses (Saleh *et al.,*, 2001).

Drinking water microbiological quality is primarily determined by using “indicator organisms”, whose presence indicates faecal contamination. The presence of the indicators is often a key in assessing potential public health risks due to pathogens and is used in drinking water quality regulations and guidelines in many countries. Fast and reliable test results will help operators to take quick action when water quality degrades and poses health risks for the public. To obtain fast and reliable results, water testing laboratories tend to: test indicator organisms that directly confirm faecal contamination and simplify testing procedures and reduce turnaround time. It was recognized that *Escherichia coli* was a reliable indicator for faecal contamination rather than total coliform (TC). However, the presence of TC in finished drinking water provides an indication of either a failure in the disinfection process, or a strong growth of bio-film in the distribution system, or that the water is prone to surface water infiltration (Dunling and Wanda, 2008). Effort recently has been directed toward evaluating the yeast Candid as an alternative sanitary indicator organism in wastewater and fresh water. Total yeasts and total staphylococci can be used as a useful indicator of pollution, where they had significant correlation with classical bacterial indicators, physio-chemical characters and phytoplankton biomass (Ali *et al.,*, 2000). This work aims to study the comparison among the different sources of drinking water in Dakahlia whether groundwater, or purification plants and to know the extent of contamination and detection of microbial pathogens and the viability of the water for human consumption.

MATERIALS AND METHODS

Source of water samples:

Tow different types of water namely, tap water and ground water were used. 288 samples were used for microbiological examination; 144 sample for each source. The samples were collected from six different cities namely; El-Mansoura, Aga, Met-Ghamr, El-Sembelaween, Belqas and El-Manzala. Water samples were collected during winter, spring, summer and autumn at 2006 year. Samples taken for microbiological examination were collected in 100 ml sterile glass bottles, preserved in ice-box and examined within 8 hours. One ml of sodium thiosulphate was added to the bottle samples of chlorinated drinking water in order to eliminate chlorine residual. All analyses were carried out in the Microbiological laboratory of Microbiology Department, Faculty of Agriculture, Mansoura University, Mansoura city, Egypt.

Microbiological examination:

Total bacterial count :

Poured plate method was used, Three plates were incubated at 37 °C for 24 h and other three plates were incubated for 48 h at 22°C**.** (APHA, 1998).

The classical bacterial indicators

Total coliform count

Most Probable Number (MPN) for coliforms was carried out by the multiple tube fermentation method. Mac Conkey broth medium was used for Presumptive test (APHA, 1998). Confirmed test from positive presumptive tubes, inoculation was made onto Eosin Methylene Blue (EMB) agar plates. The metallic sheen colonies as well as a typical coliform colonies were recorded as positive confirmed test from a standard culture of *E. coli* as control (APHA, 1998). Confirmed organisms (typical coliform colonies) were transferred into MacConkey broth and onto agar slants. The density of total coliform was computed from Swaroop`s tables (Swaroop, 1951).

Faecal coliform count

The direct MPN-technique which adopted by El-Abagy *et al.,*, (1980) was employed.

Faecal streptococci count

The determination of MPN-index for faecal streptococci (Enterococcus faecalis) was carried out as described by (APHA, 1998).

The New indicators

Staphylococci count

Staphylococci was determined as described in (APHA, 1998)

Salmonella count

The enumeration of salmonella was performed using the bismuth sulfite agar medium. Colonies producing diffusible black pigment across the membrane filters with or without metallic sheen were counted and considered as salmonellae count (Engelbrecht *et al.,* 1977).

Vibrio count

Vibrios group was detected in alkaline peptone water (pH 9) as a selective medium from raw water (single strength) and drinking water (double strength) after inocubated at 37°C for 24 hrs (Kaper *et al.,*, 1979).

Acid fast bacterial count

Acid fast bacterial count was detected in Enriched tuberclosis (TB) agar medium as a selective medium from different sources of water. The fixed colonies were stained by Brook`s acid fast staining technique modified by Engelbrecht *et al.,* (1977). Pink to red colonies were counted and calculated as acid fast (count (cfu)/ 100 ml of original sample).

***Aeromonas hydrophila* count**

An aliquot from each sample (0.1 ml) was streaked onto *A. hydrophila* agar plates and incubated at 37°C for 24 hrs, after which the grown yellow colonies were counted as *A. hydrophila* count/100 ml of original sample (Rippey and Cabelli, 1979).

***Listeria monocytogenes* count:**

Listeria selective agar as mentioned by Shaban and El-Taweel (1999) was used in enumeration of Listeria group. The plats were incubated for 1-2 days at 37°C and the typical Listeria colonies were counted. Biochemical reactions were carried out for the Listeria identification according to Fenlon (1985).

Yeast count .

Malt yeast extract agar medium was used (APHA, 1998).

Candida count .

Candida was detected in Littman oxgall agar medium. After which yeast colonies were counted and the data were presented as count/100 ml of sample (Engelbrecht *et al.,* 1977).

RESULTS AND DISCUSSION

Tap water samples :

Total bacterial count:

Table 1 show that, total bacterial counts in tap water during 2006/2007. At 22°C varied from 13 to 91 cfu/1 ml, the highest value was in the summer in Manzala but the lowest value was during autumn in Mansoura city. Means of total bacterial count in the summer was the highest count and the lowest one was in the autumn were 52.6 and 37.1 cfu/1ml, respectively. On the other hand, the highest count of total bacterial count at 37°C was during the summer in Manzala (79 cfu/1 ml) and the lowest was in the winter in Mansoura (13 cfu /1 ml). Among of all water samples of different sites the detected value of total bacterial count at 22°C and at 37°C were greater in summer and lowest count were in the autumn. Means of total bacterial count at 37°C were 40.5, 34.3, 32.6 and 36.6 cfu /1 ml in the summer, autumn, winter and spring, respectively. In addition, all samples of different sites of Mansoura and Meetghamer were lower in total bacterial count at 22°C and at 37°C than other sites. Nsanze *et al.,* (1999) reported that, all four types of bottled mineral water investigated in the United Arab Emirates (UAE) contained some bacterial contamination. There were more than 10 different species of contaminating bacterial agents. *Acinetobacter lwoffii* was the most frequent isolate.

Table 1. Values of total bacterial counts in tap water of Dakahlia governorate at 2006/2007.

Examined locations	cfu / 1 ml at 22°C				cfu / 1 ml at 37°C			
	Su	Au	Wi	Sp	Su	Au	Wi	Sp
Mansoura	21	13	19	18	15	14	13	17
Aga	52	42	48	42	44	41	40	33
Meetghamer	27	24	25	24	19	18	17	21
Senbilaween	39	26	33	29	33	23	19	25
Belqase	86	53	57	64	53	48	47	52
Manzala	91	63	86	76	79	62	60	72
Su, Summer Au, Autumn Wi, Winter Sp, Spring								

Obtained results are in good agreement with recently published data (Osman, 2006) and show that, the average of the total bacterial count at 22°C and 37°C were ranged from 20 to 44.67 cfu/100ml and from 23.7 to 74.2 cfu/100ml , respectively.

The classical bacterial indicators:

There was no detectable faecal coliform and faecal streptococci count in tap water during 2006/2007.

Table 2 shows that, among all tap water sample, the detection counts of total coliform group were almost greater during summer (66 cfu /100 ml). However, samples of tap water in Mansoura site contains the lowest number of total coliform count (9 cfu /100 ml) during autumn. Osman (2006) reported that, all samples of tap water were free from total coliform groups. There was no detectable faecal coliform in all tested samples in tap water during 2006/2007. Obtained results are in good agreement with recently published data (Osman, 2006) and show that, all samples of tap water were free from faecal streptococci group.

Reid *et al.,* (2003) studied the quality of drinking water from private water supplies in UK and they found that, total coliforms and faecal coliforms in the kitchen tap were 13 and 14 cfu/100ml, while it were 51 and 31 cfu/100ml in well water, respectively.

New indicators count (total yeast, *candida* and *A. hydrophila*):

Data of new indicators of pollution were recorded in Tables 3 and 4 for samples collected from tap water of different sites in Dakahlia governorate. Total yeast counts, Candida, A. hydrophila counts, acid fast bacteria and staphylococci count were determined during the period of study. Among all tap water samples, the detection counts of total yeast were almost greater in the summer (42.5 cfu /100 ml). However, in the autumn and spring samples were the lowest number (34.5 cfu /100 ml) . In Mansoura and Meetghamer, samples recorded the lowest values of total yeast counts comparing to the samples of all sites especially Manzala which recorded the highest values of total yeast. Osman, (2006) found, the highest average of yeast and fungi count was recorded in tap water of Shubbera site followed by El-Giza and Helwan site being 14.83 & 5.5, 14.17 & 4.17 and 8.67 & 4 cfu/100ml, respectively. Table 3 also presents the lowest value being 12 cfu /100 ml, and it was during the autumn in Mansoura, and the highest value was 62 cfu /100 ml, in the summer in Manzala.

Concerning the number of *A. hydrophila* in tap water during 2006/2007, data presented in Table 3. *A. hydrophila* counts varied from 41 to 255 cfu /100 ml, the highest value was in the summer in Manzala but the lowest value was in the autumn in Mansoura city. Massa *et al.,* (2001) reported that, *Aeromonas* spp. were not detected in any of the water samples either by the direct or enrichment method. Similar results were reported by other authors (Hunter and Burge (1987), Van der Kooij (1988) and Havelaar *et al.,* (1990) Drinking water has been shown to be a source of *Aeromonas*, their presence are attributable to ineffective disinfection at the treatment plant, or a result of after growth within the distribution systems (Gavriel *et al.,* 1998). Kilpatrick *et al.,* (1987) and Schubert (1991) confirmed the presence of *A. hydrophila* in drinking water along with other Enteropathogens (*e. g*. salmonellas, enteropathogenic *E. coli*) reflecting contamination of the environment. Aeromonads are generally, readily killed by chlorine and other commonly used water disinfectants. Aeromonads are capable of growth in relatively low-nutrient environments. Thus, the presence of Aeromonas in drinking water does not indicate faecal pollution but may reflect deteriorating water quality (WHO, 1996).

Table 2. Value of classical count of bacterial indicators in tap water of Dakahlia governorate at 2006/2007

Examined locations	Total coliform (cfu / 1 ml)			
	Su	Au	Wi	Sp
Mansoura	14	9	12	11
Aga	34	26	31	29
Meetghamer	19	13	17	15
Senbilaween	33	20	28	25
Belqase	34	39	44	41
Manzala	66	47	53	49
Su, Summer Au, Autumn Wi, Winter Sp, Spring				

Table 3. Values of new indicators counts of total yeast, *Candida* and *A. hydrophila* in tap water of Dakahlia governorate at 2006/2007.

Examined locations	Total yeast (cfu /100 ml)				*Candida* (cfu / 100 ml)				*A.hydrophila* counts(cfu/100 ml)			
	Su	au	wi	sp	Su	au	wi	sp	Su	au	wi	sp
mansoura	15	10	13	11	19	12	17	17	45	41	51	49
age	44	42	40	41	44	28	38	31	185	165	179	175
meetghamer	17	10	15	12	24	17	22	21	84	63	75	71
senbilaween	37	23	29	31	30	20	28	22	130	111	127	119
belqse	63	30	59	53	39	21	33	31	177	157	173	171
manzalz	79	72	63	59	62	42	57	45	255	200	222	220

Acid-fast bacteria and staphylococci count:

Table 4 shows the comparison between the count of acid fast bacteria and staphylococci in tap water of different site in Dakahlia governorate during 2006/2007. Among all water samples, the detection of acid fast bacterial counts were almost greater in the summer (47 cfu/100 ml) as given in Table 4. However, the autumn samples recorded the lowest value (35 cfu/100 ml) . In Mansoura samples, acid fast bacterial counts recorded the lowest value while the highest value was found in the samples of Manzala. Table 4 also presents the values of staphylococci counts in tap water. The lowest value was 17 cfu/100 ml, and it was in the autumn in Mansoura, and the highest value was 117 cfu /100 ml, in the summer in Manzala.

Vaerewijck *et al.,* (2005) reported that, In contrast to the notorious pathogens *Mycobacterium tuberculosis* and *M. leprae*, the majority of the mycobacterial species described to date are generally not considered as obligate human pathogens. The natural reservoirs of these non-primary pathogenic mycobacteria include aquatic and terrestrial environments. Under certain circumstances, *e.g*., skin lesions, pulmonary or immune dysfunctions and chronic diseases, these environmental mycobacteria (EM) may cause disease. EM such as *M. avium*, *M. kansasii*, and *M. xenopi* have frequently been isolated from drinking water and hospital water distribution systems.

Although the presence of EM in tap water has been linked to nosocomial infections and pseudo-infections, it remains unclear if these EM provide a health risk for immunocompromised people, in particular AIDS patients. In this regard, control strategies based on maintenance of an effective disinfectant residual and low concentration of nutrients have been proposed to keep EM numbers to a minimum in water distribution systems.

Table 4. Values of new indicators count of acid-fast bacteria and staphylococci in tap water of Dakahlia governorate at 2006/2007

Examined locations	Acid-fast bacterial (cfu / 100 ml)				Staphylococci (cfu / 100 ml)			
	Su	**Au**	**Su**	**Au**	**Su**	**Au**	**Su**	**Au**
Mansoura	39	27	39	27	39	27	39	27
Aga	55	36	55	36	55	36	55	36
Meetghamer	43	34	43	34	43	34	43	34
Senbilaween	49	30	49	30	49	30	49	30
Belqase	47	35	47	35	47	35	47	35
Manzala	39	51	39	51	39	51	39	51

Su, Summer Au, Autumn Wi, Winter Sp, Spring

Pathogenic indicators

Monitoring of different pathogens in water could be used as a tool to assess the health status of the community. Thus, *Salmonella* spp., total *Vibrio* spp. and *Listeria monocytogenes* counts were determined. Data showed that, there was no detectable *Salmonella* spp., total *Vibrio* spp. or *L. monocytogenes* in the tested tap water during 2006/2007. Obtained results are in good agreement with recently published data (Osman, 2006) and show that, all samples of tap water were free from salmonellae groups. Obtained results are in good agreement with recently published data (Osman, 2006) and show that, all samples of tap water were free from vibrio groups.

Microbiological examination of Groundwater:

Most of the ground waters were not treated or disinfected before pumping to the drinking water pipeline. Ground water contamination is nearly always the result of human activities. When groundwater becomes contaminated, it is difficult and expensive to make it pure. Liquid waste discharged on to soil initiates solute and microbial movement may contaminate groundwater.

Total bacterial count

The normal microbiological examination of groundwater is a determination of bacterial counts at 22 and 37°C, which shows general microbial status of water. Table 5 show that, total bacterial counts in ground water during 2006/2007 at 37°C varied from 0. 12 to 4.41 cfu x 10^4 / 100 ml, the highest value was in the summer in Manzala but the lowest value was in the winter in Mansoura city.

On the other hand the highest count of total bacterial count at 22°C was in the summer in Manzala (4.57 cfu x 10^4 / 100 ml) and the lowest was in the autumn in Mansoura (0.22 cfux10^4/100 ml). Among all ground water samples of different sites the detected counts of total bacterial counts at 22°C and at 37°C were greater in summer and lowest counts were in the autumn. In addition, all samples of different sites of Mansoura and Meetghamer were lower in total bacterial count at 22°C and at 37°C than other sites. Incubation at 37°C encourages the growth of bacteria that can thrive at body temperature and which, therefore, may be of animal organism.

Table 5. Values of total bacterial count in ground water of Dakahlia governorate at 2006/2007

Examined locations	Total bacterial count at 22°C (cfu x 10^4 / 1 ml)				Total bacterial count at 37°C (cfu x 10^4 / 1 ml)			
	Su	Au	Wi	Sp	Su	Au	Wi	Sp
Mansoura	0.46	0.22	0.34	0.29	0.29	0.24	0.12	0.21
Aga	3.87	2.81	3.64	3.20	3.61	3.30	2.40	2.93
Meetghamer	0.71	0.32	0.39	0.34	0.67	0.33	0.13	0.20
Senbilaween	2.77	2.41	2.61	2.57	2.36	2.40	2.10	2.47
Belqase	3.39	3.11	3.22	3.19	3.36	3.14	2.72	3.22
Manzala	4.57	3.63	4.21	4.20	4.41	3.92	3.11	3.30

Su, Summer Au, Autumn Wi, Winter Sp, Spring

Classical bacterial indicators

In addition to the determination of total bacterial count at 22 °C and 37°C, the water sample is also tested for faecal indicators bacteria, obtained results showed that all tested samples have not faecal streptococci. Table 6 shows the comparison between the results of total coliform and faecal coliform during 2006/2007. Table 6 presents the values of total coliform in ground water. The minimum value was 0.07 cfu x10^3/100 ml, in the autumn in Mansoura. The maximum value was 9.0 cfu x10^3/100 ml, in the summer in Manzala. Table 6 also presents the values of faecal coliform counts in groundwater. The lowest value was 0.30 cfu x10^2/100 ml, and it was in the winter in Masoura, and the highest value was 9.60 cfu x10^2/100 ml, in the summer in Manzala.

Table 6. Values of classical bacterial counts indicators in ground water of Dakhlia governorate at 2006/2007

Examined locations	Total coliform (cfu x 10^3/100 ml)				Faecal coliform (cfu x 10^2 / 100 ml)			
	Su	Au	Wi	Sp	Su	Au	Wi	Sp
Mansoura	1.3	0.7	0.9	0.8	0.9	0.5	0.3	0.48
Aga	4.3	2.8	3.1	3.0	4.0	1.6	2.8	2.6
Meetghamer	1.6	0.9	1.6	1.3	1.8	1.0	1.5	1.7
Senbilaween	2.0	1.5	1.7	1.3	2.0	1.1	1.7	1.1
Belqase	2.8	1.6	2.6	1.7	3.0	1.5	2.8	1.8
Manzala	9.0	4.8	7.7	6.3	9.6	7.0	7.7	8.0

Su, Summer Au, Autumn Wi, Winter Sp, Spring

New indicators

Data of new indicators of pollution were recorded in Tables 7 and 8 for samples collected in groundwater during 2006/2007. Total yeast, *Candida* spp., *A. hydrophila*, acid-fast bacteria and staphylococci counts were determined during the period of study.

Total yeast, candida and *A. hydrophila* count

The detection counts of total yeast were greater during the summer (2.43 cfu x 10^3/100 ml) as given in Table 7 However, autumn samples contained the lowest number (1.93 cfu x 10^3/100 ml) . In Mansoura samples, total yeast counts were lower comparing to the samples of Manzala and counts were 0.11 and 5.51 cfu x 10^3/100 ml, respectively. Table 7 also presents the *Candida* spp. counts in groundwater, the lowest value was 0.005 cfu x10^2/100 ml, during the autumn in Mansoura, and the highest value was 4.85 cfu x10^2/100 ml, during the summer in Manzala.

Table 7. Values of new indicators count of Total yeast, *Candida* spp. and *A. hydrophila* in ground water of Dakahlia governorate at 2006/2007

Examined locations	Total yeast (cfu x 10^3/100 ml)				Candida (cfu x 10^2 / 100 ml)				*A. hydrophila* (cfu x 10^5 / 100 ml)			
	su	Au	Wi	Sp	Su	Au	Wi	Sp	Su	Au	Wi	Sp
Mansoura	0.15	.0.11	0.13	0.13	0.012	0.005	0.011	0.009	1.31	0.97	1.2	1.0
Aga	3.37	2.88	3.17	3.11	3.89	2.17	3.21	3.07	6.30	4.44	5.93	5.86
Meetghamer	0.33	0.31	0.49	0.44	0.95	0.73	0.86	0.81	2.0	1.11	1.97	1.93
Senbilaween	1.53	1.21	1.49	1.47	1.13	0.83	1.11	1.09	2.87	1.85	2.17	2.0
Belqase	3.52	3.17	3.46	3.40	2.76	2.0	2.61	2.50	4.12	3.22	4.0	3.67
Manzala	5.51	3.92	5.12	4.65	4.85	3.33	4.11	3.68	5.30	4.13	5.20	4.77

Su, summer Au, autumn Wi, Winter Sp, Spring

The numbers of *A. hydrophila* in groundwater isolated throughout this study are presented in Table 7. *A. hydrophila* counts varied from 0.97 to 5.30 cfu x 10^5/100 ml, the highest value was obtained during the summer in Manzala but the lowest value was recorded in the autumn in Mansoura city.

Massa *et al.,* (2001) reported that *Aeromonas* spp. were isolated from five of 20 examined wells, with cell numbers ranging from 26 to 1609/250 ml. In two wells the presence of *Aeromonas* spp. was not associated to the presence of faecal indicators, *i.e*. coliforms and faecal coliforms. El-Taweel (2003) reported that the high counts of *A. hydrophila* in the aquatic environments might be referred to the ground water polluted by surface seepage of sewage from septic tanks and sewers lines or from land application**.**

Acid-fast bacteria and staphylococci count

Acid-fast bacteria and staphylococci count which considered new indicators of water pollution are recorded in Table 8. Among all ground water samples, the counts of acid fast bacteria were greater during the summer (2.37 cfu x10^4/100 ml). However, the autumn samples recorded the lowest number (2.02 cfu x10^4/100 ml). In Mansoura samples, acid fast bacterial counts recorded the lowest values comparing to the samples of all sites especially in Manzala which recorded the highest values of acid fast bacteria. Concerning staphylococci counts in groundwater, the lowest value was 0.002

cfu x10^7/100 ml, and it was during the autumn and winter in Mansoura, while the highest value was 6.94 cfu x10^7/100 ml, which recorded in the autumn in Manzala. The obtained results were in harmony with Vaerewijck *et al.*, (2005).

Table 8. Values of new indicators count in ground water of Dakahlia governorate at 2006/2007

Examined locations	Acid-fast bacterial (cfu x 10^4 / 100 ml)				Staphylococci (cfu x 10^7 / 100 ml)			
	Su	**Au**	**Wi**	**Sp**	**Su**	**Au**	**Wi**	**Sp**
Mansoura	0.44	0.39	0.43	0.40	0.009	0.002	0.007	0.005
Aga	3.85	3.10	3.70	3.45	4.54	3.17	4.22	3.86
Meetghamer	0.76	0.69	0.75	0.74	0.046	0.031	0.04	0.039
Senbilaween	1.77	1.57	1.69	1.69	1.17	1.14	1.17	1.70
Belqase	2.30	2.19	2.23	2.21	5.46	3.81	5.37	4.71
Manzala	5.12	4.20	4.91	4.55	6.33	6.94	6.31	6.21

Su, Summer Au, Autumn Wi, Winter Sp, Spring

Pathogenic indicators

Table 9 presents the results of the values of *Salmonella* spp. counts in groundwater. The minimum value was 11 cfu x10^2/100 ml, recorded during the autumn in Mansoura samples, while the maximum value was 84 cfu x10^2/100 ml, which recorded during the summer in Manzala. There was no detectable total *Vibrio* spp. or *L. monocytogenes* in all the tested samples in ground water during 2006/2007.

Table 9. Values of pathogenic indicators count in ground water of Dakahlia governorate at 2006/2007.

Examined locations	*Salmonellla* (cfu x 10^2 / 100ml)			
	Su	**Au**	**Wi**	**Sp**
Mansoura	17	11	13	14
Aga	49	30	47	41
Meetghamer	27	19	25	21
Senbilaween	45	28	40	37
Belqase	37	44	51	49
Manzala	84	67	73	71

Su, Summer Au, Autumn Wi, Winter Sp, Spring

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دلائل التلوث الميكروبى التقليدية والحديثة فى مياه الشرب بمحافظة الدقهلية

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نظرا لأهمية وضرورة الماء لاستمرار حياتنا ونظرا إلى أنه يجب أن يتوفر هذا الماء بكمية كافية ونوعية جيدة للمستهلكين وينبغي بذل أقصى الجهود لتحقيق أفضل جودة لمياه الشرب ، وكذلك توفير الحماية الكافية والفعالة لمعالجة المياه الصالحة للشرب، لذلك تمت هذه الدراسة بهدف عمل مقارنة بين مصادر مياه الشرب بمحافظة الدقهلية سواء كانت مياه حنفية أو مياه جوفية ثم تقييم تلك المياه من حيث الخواص الميكروبيولوجية وذلك بالكشف عن وجود ملوثات المياه التقليدية والحديثة وكذلك الكشف عن بعض مسببات الأمراض.

تم جمع العينات من مصدرين مختلفين من المياه وهما ماء حنفية وماء جوفي. حيث تم أخذ عدد 288 عينة من 6 مواقع مختلفة وهى المنصورة، أجا، ميت غمر، السنبيلاوين، بلقاس والمنزلة وذلك خلال أربع مواسم هى الشتاء والربيع والصيف والخريف خلال 2007/2006 وقد تم دراسة التقييم الميكروبيولوجى للعينات على النحو التالى : تقدير الأعداد الكلية للبكتيريا على درجة حرارة 22°م ، 37°م ، بكتيريا القولون الكلية، بكتيريا القولون البرازية ، البكتيريا السبحية البرازية ، خميرة الكانديدا ، *A. hydrophila* ، البكتيريا الصامدة للأحماض والبكتيريا العنقودية، السالمونيلا ، الڤبريو والليستيريا

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