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MONITORING THE SANITARY CONDITION OF GROUND WATER USED IN SOME POULTRY FARMS IN GIZA GOVERNORATE

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SUMMARY

One hundred and twenty ground water samples were collected from some poultry farms located in different areas of Giza governorate. The collected samples were subjected to chemical analysis and microbiological examinations.

The mean values for the pH was ranging between (6.98 ± 0.10 and 7.35 ± 0.45), ammonia (0.008 ± 0.02 and 0.1 ± 0.2 mg/l.), nitrite (0.01 ± 0.03 and 1.08 ± 2.05 mg/l.), nitrate (0.03 ± 0.07 and 4.26 ± 7.88-mg/l.), phosphate (0.001 ± 0.003 and 0.48 ± 0.95-mg/l.), chloride (38.46 ± 8.95 and 730.2 ± 645.10 mg/l.), and total hardness (139.46 + 46.05 and 781.28 ± 519.19 mg/l.).

Regarding the microbial findings, the mean values for the total fungal and bacterial counts ranged from 1.46 ± 2.18 to 11.3 ± 11.14 CFU/ml. and 17.33 ± 49.80 to 340 ± 193.39 CFU/ml. respectively, while the total coliform counts ranged from 0.6 ± 2.24 to 72 ± 186.52 coliform colony/ 100 ml.

Seemingly, the obtained results of high amount of minerals and microbial findings in the investigated ground water samples were attributed to the variable sources for water pollution in these suburban areas, such as septic tanks, cesspools, unhygienic disposal of sewage and different wastes, improper construction of wells, overuse of fertilizers and herbicides and the agriculture runoff. The exception of that was the area of 6 October in which the human activities are far away from farm buildings and water sources.

Accordingly it is recommended that periodical monitoring of water supply in all poultry farms is important, especially in suburban areas, while the

poultry producers should be aware of the nature of the land in which their farms are located. Also, renewal, re-sitting, reconstruction or increasing the well depth is a decision that should be taken in the correct time.

INTRODUCTION

One of the primary conditions to maintain poultry and animal health is the hygienic suitability in poultry and animal farms..

A safe, adequate and constant source of good clean water is a critically important component for efficient and successful poultry production. Quality of water depends upon its nature and degree of pollution to which the source has been subjected.

pH, nitrogen levels, hardness, mineral levels and microbial contents are among factors which might alter the drinking-water quality leading to impact in water consumption of birds, poor performance, nonspecific disease conditions or even mortalities in livestock (Barton, 1996, Carson, 2000, Balnave, 2002 and Watkins, 2003).

The ground water quality can vary greatly depending upon the well location, depth and sealing, the direction of underground water flow, the installation of septic tanks, spray fields and fertilizers, disposal pits and sewage effluents (Chapman, 1996, Swick, 1998, Damron, 2002 and Widory et al. 2004).

However, a regular water sanitation and water line cleaning program in poultry farms can provide protection against the build-up of bio-films in which many detrimental bacteria and viruses may hide from disinfectants for a long time (Damron, 2002 Tablante et al., 2002 and Watkins, 2003).

The water quality evaluation should comply with the regulations stated by the World Health Organization (WHO), the Environmental Protection Agency (EPA) and the American Public Health Association (APHA) (King, 1996).

The present study was planned to monitor the sanitary condition of ground water used in some poultry farms in Giza governorate, for assessment of its quality according to the WHO, EPA and APHA standards.

MATERIALS and METHODS

1- Water samples:

A total of 120 water samples were collected along the period of investigation from the driven wells of the examined poultry farms located in different nine areas in Giza governorate

(Abou-El-Noumrous, Abou-Rawwash, Abou-Seer, Dah-Shour, EL-Badrasheen, EL-Saff, 6 October, Sakkara and Shoubra-Mant).

The driven wells were locally inspected for construction and detection of any possible source of water pollution. Also, the surroundings of poultry farms as the agriculture, animal and human activities were noticed in these suburban districts.

2- Sampling technique:

Water samples were collected in clean and dry polythen-plastic bottles of one-liter capacity intended for chemical examination, and a pre-sterilized screw capped glass bottle for microbiological examination.

The driven well was pumped mechanically for five minutes, before the water sample obtained in the bottle, which closed tightly, labeled and then transferred to the laboratory in an icebox within 4 hours to be examined (APHA), 1989.

3- Water examination:

The collected water samples were subjected to chemical and bacteriological examination according to the American Public Health Association (APHA), 1989.

Test	Method
pH	Electrometric pH meter (Schott-Gerate-W.Germany)
Ammonia	Direct Nesslerization
Nitrite	Diazotization method
Nitrate	VISCOLOUR® Nitrate 50, Test kit *(HANNA Instrument)*
Phosphate	Stannus chloride method in the form of orthophosphate (the total reactive phosphorus)
Chloride	Argentometric method
Total Hardness	EDTA Titrimetric method

3-1- Chemical examination:

The following methods were used to determine the level of the investigated chemicals, which have a significant importance in poultry rearing according to the issues of WHO and EPA.

3-2- Microbiological examination:

The total fungal and bacterial colony counts were determined using pour plate method as described in APHA, 1989. Sabouraud's dextrose agar medium (Oxoid) was used for fungal count and the Tryptone glucose extract

agar medium (Oxoid) was used for bacterial count.

The total coliform count (MPN) was determined using "multiple tubes fermentation technique" according to APHA, 1989.

Results are recorded in tables (1 - 3) and figures 1 & 2.

RESULTS and DISCUSSION

The chemical parameters in water samples obtained from nine locations in Giza governorate were represented in tables (1 & 2) and fig. (1).

pH:

The pH in the examined ground water ranged from 6.5 to 8.5 with mean value ranged from (6.98 ± 0.10) in 6 October to (7.35 ± 0.45) in EL-Badrasheen.

The obtained results are in accordance with that of Abu-Zeid, 1988, Aref, 1989, Moubarak, 1989, Yousef et al., 1990, EL-Kabbany, 1997 and Fawzy, 1998. The recommended pH level for poultry drinking water is 6.0 - 8.0 (Lack, 1988, Qureshi, 1988 and Watkins, 2003).

Chloride:

The chloride ions in the examined ground water ranged from 20 to 2175 mg/l. The mean values of chloride ions were higher than 250 mg/l. (maximum acceptable level recommended by EPA, 2004) in 4 areas (El-Saff, EL-Badrasheen, Abou-El-Noumrous & Dah-Shour) (730.28 ± 645.10, 358.7 ± 309.5, 278 ± 148.27 and 271.8 ± 301.14 mg/ml. respectively) and this agree with the results recorded by Aref, 1989, Yousef et al., 1990 and Samaha and EL-Bassiouny, 1991.

Chloride ions were lower than 250 mg/l. in 5 districts (Abou-Seer, Abou-Rawwash, Sakkara, Shoubra-Mant, & 6 October) (206.25 + 179.57, 176.66 + 96.26, 126.07 + 95.6, 116.42 + 57.6 & 38.46 ± 8.95 mg/ml. respectively) and this is nearly in the same manner recorded by Fahmy, 1964, Abu-Zeid, 1988, Moubarak, 1989, EL-Kabbany, 1997 and Fawzy, 1998.

Total hardness:

The total hardness in the examined ground water ranged from 75 to 2200 mg/l. The mean values of total hardness in all locations ranged from (307.5 ± 234.4 mg/ml.) in Abou-Seer to (781.28 ± 519.19) in EL-Saff and all these values are higher than 180 mg/l. which is the limit of hard water as recommended by WHO, 1998 and Blake and Hess, 2001, except in case of water samples of 6 October area which had a mean of 139.46 ± 46.05.

This finding of high total hardness is nearly similar to the findings reported by Hafez and Abd El-

Wahab, 1978, Abu-Zeid, 1988, Moubarak, 1989, EL-Kabbany, 1997 and Fawzy, 1998. On the other hand, the result of low total hardness recorded in 6 October is in agreement with the results reported by Aref, 1989 (in Sharkia province) and Samaha and EL-Bassiouny, 1991.

Ammonia:

Ammonia in the examined ground water ranged from zero to 0.50 mg/l., with mean value ranged from (0.008 ± 0.02 mg/l.) in Abou-Seer and Sakkara to (0.10 ± 0.20 mg/l.) in Abou-El-Noumrous. This result is nearly in accordance with the results recorded by Lionel et al., 1986 and Abu-Zeid, 1988.

Nitrite:

Nitrite in the examined ground water ranged from zero to 5.0 mg/l., with mean value ranged from (0.01 ± 0.03 mg/l.) in Shoubra-Mant to (1.08 ± 2.05 mg/l.) in Abou-El-Noumrous. This result is nearly in accordance with the results recorded by Lionel et al., 1986, Abu-Zeid, 1988 and Moubarak, 1989.

Nitrate:

Nitrate in the examined ground water ranged from zero to 20.0 mg/l., with mean value ranged from (0.03 ± 0.07 mg/l.) in Shoubra-Mant to (4.26 ± 7.88 mg/l.) in Abou-El-Noumrous. This result is nearly similar to the results recorded by Lionel et al., 1986 and Samaha and EL-Bassiouny, 1991.

According to the EPA, 2004 the maximum acceptable level for nitrate is 25 mg/l. and for nitrite is 4 mg/l. in drinking water of poultry.

Although, the nitrogen compounds (represented by ammonia, nitrite and nitrate), are present naturally in surface water, their concentrations are generally low in ground water because they are absorbed to soil particles (APHA, 1989).

The over use of artificial fertilizers, the disposal of wastes as from animal farming and changes in land use are the main factors for the increase in nitrogen compounds in ground water supplies (WHO, 1998).

The importance of ammonia is the indication of faecal contamination and its oxidation to nitrite and nitrate (WHO, 1995).

Phosphate:

Phosphate in the examined ground water ranged from zero to 2.50 mg/l., with mean value ranged from (0.001 ± 0.003 mg/l.) in Abou-Seer to (0.48 ± 0.95 mg/l.) in Abou-El-Noumrous. This result is nearly similar to the results recorded by Abu-Zeid, 1988 and Moubarak, 1989.

Source of phosphate in water may be the fertilizers and detergents (Kemmer, 1988) and its high level in water may indicate sewage contamination (Schwarts, 1977 and Qureshi, 1988).

Microbiological examination:

Table 3 and Fig. 2 represented the microbial count in water samples.

Total fungal count:

The total fungal count in the examined ground water ranged from <1 to 50 CFU/ml., with mean value ranged from (1.46 + 2.18 CFU/ml.) in 6 October to (11.3 + 11.14 CFU/ml.) in EL-Saff.

Total bacterial count:

The total bacterial count (at 37°C) in the examined ground water ranged from <1 to 900 CFU/ml., with mean value ranged from (17.33 ± 49.8 CFU/ml.) in 6 October to (340 ± 193.39 CFU/ml.) in Abou-El-Noumrous.

Total coliform count:

The total coliform count in the examined ground water ranged from <1 to 920 coliform colony/100 ml., with mean value ranged from (0.6 ± 2.24 coliform colony/100 ml.) in 6 October to (72 ± 186.5 coliform colony/100 ml.) in EL-Saff.

According to the Environmental Protection Agency (EPA, 2004) the total bacterial count and the coliform count of water intended for drinking poultry must be fewer than 100 bacterial colony per milliliter and fewer than 50 coliform per milliliter, but with zero level of *E.coli*.

The total bacterial count is lower than that recorded by Abu-Zeid, 1988, Moubarak, 1989, EL-Kabbany, 1997 and Fawzy, 1998, but it is nearly similar to that reported by Fahmy, 1964.

The coliform count is nearly in the same manner reported by Lionel et al., 1986, Abu-Zeid, 1988 and Moubarak, 1989.

The total fungal count was carried out to support the bacterial count results as the yeast species are highly resistant in water even under high chlorination (APHA, 1989).

The significance of the investigated chemicals on the health and performance of birds is clarified as the following:

The acidic pH water can affect digestion, corrodes watering equipment, incompatible with medicines and vaccines, while high pH water impacts the effectiveness of chlorination (Watkins, 2003).

Table (1): Levels of some investigated chemical pollutants in ground water samples obtained from poultry farms related to different areas in Giza governorate.

Area	No. of samples	pH			Chloride (mg / l.)			Total Hardness (mg / l.)		
		Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD
1-Abou-El-Noumrous	5	6.8	7.5	7.1 ± 0.23	165	570	278 ± 148.27	220	660	528 ± 165.57
2-Abou-Rawwash	9	6.8	7.5	7.07 ± 0.18	65	385	176.66 ± 96.26	105	700	396.11 ± 169.47
3-Abou-Seer	12	6.8	8	7.15 ± 0.33	20	470	206.25 ± 179.57	80	850	307.5 ± 234.40
4-Dah-Shour	12	6.8	8	7.14 ± 0.35	50	1025	271.83 ± 301.14	190	1170	498 ± 239.81
5-EL-Badrasheen	21	7	8	7.35 ± 0.45	50	1085	358.71 ± 309.50	185	800	414.85 ± 155.46
6-EL-Saff	25	6.8	8	7.18 ± 0.34	35	2175	730.28 ± 645.10	200	2200	781.28 ± 519.19
7- 6 October	15	6.8	7.2	6.98 ± 0.10	20	50	38.46 ± 8.95	75	250	139.46 ± 46.05
8-Sakkara	14	6.5	8.5	7.14 ± 0.50	25	335	126.07 ± 95.62	100	640	336.5 ± 160.22
9-Shoubra-Mant	7	6.5	7.3	7.0 ± 0.23	20	200	116.42 ± 57.61	200	610	345.14 ± 127.27

± SD: Standard Deviation. Min.: Minimum. Max. : Maximum. mg / l.: milligram per liter water.

Table (2): Levels of some investigated chemical pollutants in ground water samples obtained from poultry farms related to different areas in Giza governorate.

Area	No. of samples	Ammonia (mg/1.)			Nitrite (mg/1.)			Nitrate (mg/1.)			Phosphate (mg/1.)		
		Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD
1-Abou-El-Noumrous	5	Zero	0.50	0.10 ± 0.20	0.01	5.0	1.08 ± 2.05	1.30	20.0	4.26 ± 7.88	0.01	2.50	0.48 ± 0.95
2-Abou-Rawwash	9	0.01	0.20	0.02 ± 0.06	0.20	0.50	0.07 ± 0.16	0.015	2.25	0.30 ± 0.68	0.01	0.50	0.11 ± 0.18
3-Abou-Seer	12	Zero	0.10	0.008 ± 0.02	0.01	0.10	0.019 ± 0.03	0.25	2.0	0.47 ± 0.78	Zero	0.01	0.001 ± 0.003
4-Dah-Shour	12	Zero	0.25	0.019 ± 0.06	0.015	2.50	0.52 ± 0.90	1.25	15.0	1.94 ± 4.07	0.02	2.10	0.22 ± 0.58
5-EL-Badrasheen	21	0.10	0.25	0.02 ± 0.06	0.1	2.50	0.52 ± 1.12	0.015	2.50	1.83 ± 3.25	0.10	0.50	0.09 ± 0.15
6-EL-Saff	25	0.10	0.25	0.06 ± 0.12	0.01	2.50	0.70 ± 1.98	0.33	15.0	2.15 ± 4.88	0.10	2.0	0.18 ± 0.48
7- 6 October	15	Zero			Zero	1.0	0.06 ± 0.25	Zero			0.01	0.20	0.014 ± 0.05
8-Sakkara	14	0.01	0.10	0.008 ± 0.02	0.01	5.0	0.87 ± 1.77	0.01	15.0	3.59 ± 6.91	0.01	0.25	0.06 ± 0.09
9-Shoubra-Mant	7	Zero	0.10	0.01 ± 0.03	0.02	0.10	0.01 ± 0.03	0.20	0.20	0.03 ± 0.07	0.10	0.20	0.07 ± 0.09

± SD: Standard Deviation. Min.: Minimum. Max. : Maximum. mg / l.: milligram per liter water.

Table (3): Microbial count in ground water samples obtained from poultry farms related to different areas in Giza governorate.

Area	No. of samples	Total Fungal Count (CFU/ml)			Total Bacterial Count (at 37°C) (CFU/ml)			Total Coliform Count (Coliform colony /100ml)		
		Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD
1-Abou-El-Noumrous	5	1	20	8.2 ± 6.55	150	700	340 ± 193.39	<1	280	58.2 ± 110.94
2-Abou-Rawwash	9	2	22	11 ± 7.60	5	350	175 ± 119.02	<1	17	6.44 ± 5.83
3-Abou-Seer	12	<1	30	9.3 ± 10.58	<1	700	235 ± 223.09	<1	17	6.41 ± 6.92
4-Dah-Shour	12	<1	15	4.58 ± 3.96	<1	600	187.58 ± 168.38	<1	43	10.58 ± 13.21
5-EL-Badrasheen	21	<1	45	9.5 ± 9.61	1	500	178.6 ± 161.61	<1	170	13.71 ± 35.77
6-EL-Saff	25	2	50	11.3 ± 11.14	20	900	291 ± 206.87	<1	920	72 ± 186.52
7- 6 October	15	<1	8	1.46 ± 2.18	<1	200	17.33 ± 49.80	<1	9	0.6 ± 2.24
8-Sakkara	14	<1	20	8.5 ± 6.67	<1	700	211.4 ± 207.40	<1	170	3.71 ± 6.08
9-Shoubra-Mant	7	<1	15	6 ± 6.21	<1	500	140.3 ± 179.38	<1	26	6 ± 8.89

CFU: Colony Forming Unit. ± SD: Standard Deviation. Min.: Minimum. Max. : Maximum.

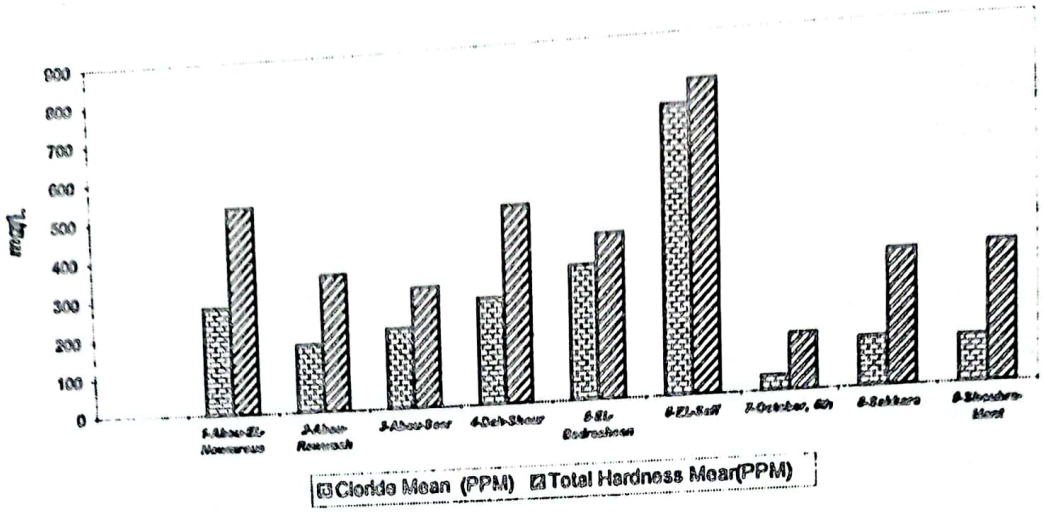

Fig. 1: Mean values of chloride and hardness in different localities in Giza governorate

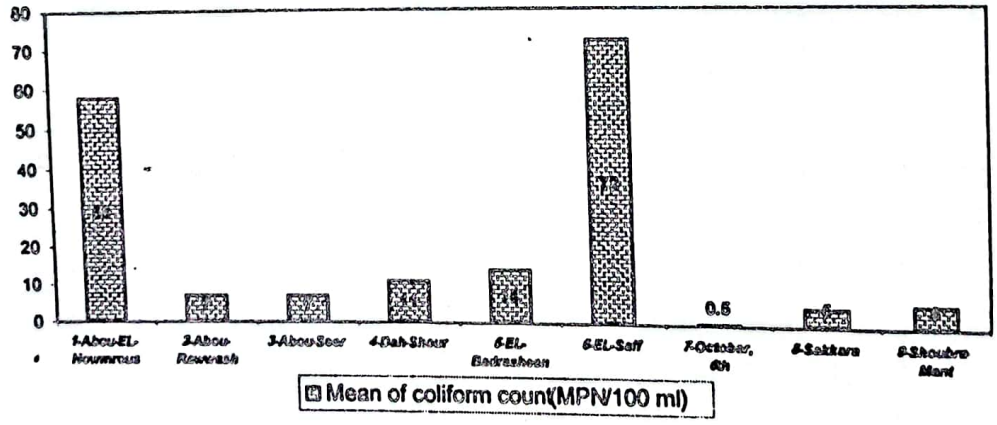

Fig. 2: Mean values of coliform count (MPN/100ml) in different localities in Giza governorate.

Chloride had an adverse effect on egg production in warm weather at a low level (60 mg/l.) as found by Damron and Flunker, 1993 and the high level may be a cause of ascitis in chickens (Samaha and EL-Bassiouny, 1991) beside the detrimental effect on birdsí metabolism (Waggoner et al., 1985 and Carter and Sneed, 1998).

High level of hardness is not commonly harmful to poultry unless certain ions are present in amounts, such as $MgSO_4$ which may cause an increase in water consumption, wet droppings and drop in production, while extreme hardness may diminish the effectiveness of medications, disinfectants and cleaning agents (Blake and Hess, 2001). This beside the build-up of deposits and the formation of scale in the components of the watering system.

Watkins, 2003 stated that 10 mg/l. nitrate in water can impact broiler performance. Also, Carter and Sneed, 1998 recorded a detrimental effect of as low as 1-mg/l. nitrite in drinking water, while the acute toxic effects of large doses of nitrite and nitrate are well documented, the significance of small amounts of nitrite is mainly due to the possible role of nitrite as a precursor of the carcinogenic N-nitroso compounds (Schweinsberg and Burkle, 1985).

Phosphate considered as a possible cause of liver damage in chickens (Carter and Sneed, 1998).

High bacterial count in drinking water of poultry is a cause of disturbing digestive system of the flocks (Lack, 1988) and results in failure of medications and subsequent drug resistance (Qureshi, 1988).

Conclusively, the high amount of minerals and microbial findings in the investigated ground water samples used in drinking poultry in Giza governorate may be attributed to the nature of these districts which could be considered as suburban areas in which people activities, animal and poultry farming are together with the agriculture activities without clear distinction.

Variable sources of water pollution could be noticed in these suburban areas, such as septic tanks, cesspools, unhygienic disposal of sewage and different wastes, improper construction of wells, overuse of fertilizers and herbicides and the agriculture runoff.

The exception of that was the area of 6 October in which the human activities are far away from farm buildings and water sources beside the good construction of deeply ground wells to avoid the agriculture activities as fertilizers and allow the continuous renewal of underground water.

Accordingly it is recommended that periodical monitoring of water supply in all poultry farms is

important. Put into consideration, the human and agriculture activities in suburban areas during water examination and during water use for birds. More attention for water components must be done during medication, vaccination or using of disinfectants. Renewal, re-sitting, reconstruction or make the well more deeply is a decision, which should be taken in the correct time.

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