



Examination of Faecal Caliform Presence in Groundwater in Ghana (A Case Study in Ketu South Municipality)

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ABSTRACT: Samples were taken from wide-dam, open wells and compared with piped city water. Well water from both districts showed widespread contamination with faecal bacteria. This study revealed high Faecal and Total coliforms in all the samples with varying numbers. The high coliforms content of the eight hand-dug wells poses a health risk and renders the water unsuitable for human consumption. The presence of pathogenic organisms in the water could be attributed to pit latrine in the vicinity that extent their influence on these water qualities, since they are sited close to them. © JASEM

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Introduction

Water-borne diseases are diseases that are transmitted through the direct ingestion of water contaminated with pathogens. In this case, the organisms normally reside and can survive in polluted water. Most of the diseases caused here are diarrhoeal diseases and may involve bacteria, viruses or protozoa or a combination of all. Transmission of water-borne diseases can be prevented by assuring access to a sufficient quantity of disinfected water, proper disposal of human waste, and improved hygiene. The pollution of groundwater, which remains the main source of supply in drinking water in the study area, is steadily increasing. Pathogenic bacteria exist at soil surfaces and this could be introduced into the water by anthropogenic activity. Rainfall is a major factor affecting vertical and horizontal movement of bacteria in soil. Surface runoff carries bacteria significant distances downstream causing serious threats to ground and surface waters.

In Albanian capital, where drinking water having microbiological pollution posed a major problem, Angjeli *et al.* (2000) investigated a link between contamination of drinking water and domestic sewage.

According to Gelinas *et al.* (1996), bacteriology and physiological quality of well water from 2 districts of Conakry was determined during the 1994 dry season. (Ahiabor and Amoako 2015) reported that conservation of high-quality water resources for domestic supply becomes increasingly important as a

result of drastic rise in population growth. They again argued that the above assertion can undoubtedly provide a strong argument for the necessity to protect groundwater against contamination. It should be noted, however, that the protection of particular groundwater resources is also dependent on whether it is considered as a key source of domestic water in the long-term.

Water supplies and sanitation management is a basic dimension of sustainability. However, water resources at large are poorly protected and managed, especially in the under developed nations lending credence to the fact that water supply issues cannot be sustainably resolved without also providing proper sanitation (Ahiabor and Amoako 2015).

MATERIALS AND METHODS

In this research, water samples from the hand-dug wells were collected for six months; three in the dry season and three in the wet season. At each sampling site, water samples were collected from wells, which served as the main source of drinking water for the people.

Analyses were carried out at two different laboratories. Faecal Caliform analyses were carried out in Ecological Laboratory which is located at the Department of Geography and Resource Development, University of Ghana.

RESULTS AND DISCUSSION

Table 1: Total Coliform (count/100ml) at the sampling sites

SITE	DRY SEASON			WET SEASON			MIN	MAX	MEAN DRY SEASON	MEAN WET SEASON
	NOV	DEC	JAN	APR	MAY	JUN				
XE	124	100	460	100	124	101	100	460	228	108.3
DK1	42	40	80	40	60	76	40	80	54	58.67
DK2	1456	1408	2560	440	424	442	424	2560	1808	435.3
AD1	348	312	220	220	342	265	220	348	293.3	275.7
AD2	1328	1164	1240	340	1221	1542	340	1542	1244	1034
GK	100	100	80	0	70	84	0	100	93.33	51.33
AG	1272	972	1680	420	982	788	420	1680	1308	730
AS	1216	1378	1280	1200	1214	1543	1200	1543	1291	1319
	WHO									0
GWC										0

GWC (1997) *Maximum Limits Recommended for drinking and domestic uses of water*

WHO (1993) *guide for drinking water Standard not available*

Table 2: Faecal Coliform (count/100ml) at the sampling sites

SITE	DRY SEASON			WET SEASON			MIN	MAX	MEAN DRY SEASON	MEAN WET SEASON
	NOV	DEC	JAN	APR	MAY	JUN				
XE	36	0	300	80	90	60	0	300	112	76.67
DK1	0	0	20	20	24	56	0	56	6.667	33.33
DK2	476	428	500	100	102	124	100	500	468	108.7
AD1	172	100	80	80	162	156	80	172	117.3	132.7
AD2	572	404	280	120	342	346	120	572	418.7	269.3
GK	26	30	0	0	5	10	0	30	18.67	5
AG	456	228	600	200	212	342	200	600	428	251.3
AS	408	500	200	380	412	322	200	500	369.3	371.3
	WHO									0
	GWC									0

GWC (1997) *Maximum Limits Recommended for drinking and domestic uses of water*

WHO (1993) *guide for drinking water Standard not available*

For water to be considered risk free to human, the total bacteria and *E. coli* in water sample should be zero and total heterotrophic bacteria (THB) count should not exceed 500cfu/ml (WHO, 2004). This study revealed high Faecal and Total coliforms in all the samples with varying numbers. The high coliforms content of the eight hand-dug wells poses a health risk and renders the water unsuitable for human consumption. The presence of pathogenic organisms in the water could be attributed to pit latrine in the vicinity that extent their influence on these water qualities, since they are sited close to them. Ground water flow is either lateral or vertical. During lateral flow, filtration does not occur and could carry faecal pollution for much longer distance (Cairncross, 1987).

The hand-dug wells water in the districts were characterized by high total and faecal coliforms. The abundance of the TC, FC underwent high spatial and temporal fluctuations. The box plot (fig. 16) for the eight sampling sites showed that total coliform recorded the maximum number throughout the period.

In a similar work done by Umar (2008), in Asamankese in the Eastern Region of Ghana he found high microbial indicators in the wells. The study related the level of contamination of water to the

lateral distance between pit latrine and wells. This corroborates the high counts of microbial loads obtained in hand-dug wells in this study. Results confirm the important role of runoff in bacterial transport on soil surfaces. They show *E. coli* survive in semiarid areas for a long time and increases potential of contamination (Ashour and Hung, 2000).

The sanitation survey revealed that most of the wells did not have cover slabs. Well water was usually drawn using various receptacles (plastic or aluminum buckets) with varying degrees of hygiene. (Plate 1)

Conclusion and Recommendation: The construction and depth of the hand-dug wells could further explain contamination levels. The depth of the eight hand-dug wells studied ranged from 2.5m to 20.5m. The interior lining of the wells were defective as they were fissured and five out of eight were without concrete lining. Ideally, wells should be constructed with concrete ring pipes but due to financial constraints only the upper part of about 2m were cemented thus making it permeable to seepage. It could be discussed that all the studied hand-dug wells were sited within a 15m or less radius from the pit latrine. The current situation predisposed the well water to bacterial contamination.

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