Journal of Occupational Safety and Environmental Health
A Publication of the Society for Occupational Safety and Environmental Health

PARASITOLOGICAL QUALITIES OF WATER FROM WELLS LOCATED NEAR MUNICIPAL WASTE DUMP SITES IN PARTS OF ZARIA, NIGERIA.

***Yahaya, O., Umoh, V.J., Ameh, J.B. and Tijjani, M.B**
Department of Microbiology, Ahmadu Bello University, Zaria, Nigeria.
***Corresponding author's e-mail:** ocholiahmed@yahoo.com*

Abstract
Billions of people on a global scale lack potable drinking water, increasing their vulnerability to diarrhoeal and parasitic diseases. A total of 186 well water, soil from dump sites and liquid waste close to sampling well were obtained from parts of Zaria. Using the concentration sedimentation techniques the samples were centrifuged at 500rpm for 5 minutes and examined microscopically. A total of 41(32%) samples contained helminthes eggs/ova were counted out of 128 well water samples tested. The results showed a significant difference between the wet and dry season. Adequate treatment of well water as well as public health education is highly recommended.
Keywords: Health, Helminthes, infection, municipal solid waste, well water.

Introduction
Nigeria has a high population density (>120 million) accompanied by relatively poor infrastructure, especially in the urban centers. Available sanitary facilities cannot sustain the population leading to contamination of surface water with faecal materials. Worldwide, contaminated water causes an estimated 6 to 60 billion cases of gastrointestinal illness annually, majority of which occur in the rural areas of developing nations where water supply is polluted with a variety of microorganisms, and where adequate sanitation is unavailable (Laurie *et al.*, 2004).The solid and liquid waste management involves risk, either to the workers directly involved or to the nearby residents. The health risks from waste are caused by factors including the nature of raw waste, the nature of the waste decomposition, the handling and the disposal of wastes, the environmental health risks to residents is due to prolonged exposure time. Solid waste composition is largely affected by the income generating activities in the country and the level of industrialization. The income level affects the main ingredients in the solid waste, particularly the level of packaging (paper, plastic, cartons, cans and bottles). Hazardous materials in solid waste include, syringes, bloody materials, and other infectious medical wastes such as bloody bandages and cotton swabs, are commonly found mixed with municipal solid waste collected in developing countries (Barrera and Navarro, 1995; Kerrison, 1997); and in countries where more than 30% of the industrial wastes were appropriately discharged to open dumps (De Koning *et al.*, 1994).

Human faecal matter is common in solid wastes, in the poorest countries, because of a paucity of sanitation systems, people defecate along roadside ways and on open lots, night soil is deposited in open drains, and waste resulting from street and drain cleaning contain faeces. Homes where buckets or bedpans are used, the human waste is often packed in plastic bags or wrapped in Newspapers before discarding with the solid waste. Waste picking is high risk because tuberculosis, bronchitis, asthma, dysentery, parasites and malnutrition are most commonly experienced among waste pickers based on health studies of waste pickers conducted in Bangalore, Manohar, and New Delhi, India (Huisman, 1994). At metro Manilas main open dump, in 1981, 750 waste pickers studied revealed that 40% had skin disease and 70% had upper respiratory ailments.

The commonly found protozoa in polluted waters include *Giardia lambia, Cryptosporidium spp, Entamoeba coli* and *Entamoeba histolytica*. Madena and Schijuen (2001) reported that the

annual load of *Cryptosporidium* and *Giardia* in domestic water in the Netherlands was about 3.2 $x10^{13}$ and 3.2 x 10^{14} respectively. The routes of infection with these pathogens are mainly home contact, food and water. An important mode of *Cryptosporidium spp* transmission to human is believed to be via drinking and recreational waters and can remain viable for several months (Bessonov, 1992, Fayer *et al.,* 1998). Wild life and sewage out flow can also cause watershed contamination (Hansen and Ongerth, 1991; Atwill *et al*., 1997, State *et al*., 1997, Ewa-Daniel, 1999; Kucznyska and Shelton, 1999). Giardiasis, a water borne disease caused by *Giardia lambia*, and *Entamoeba coli* and *Entamoeba hystolytica*, which causes diarrhoea and fulminating dysentery could become a common problem if polluted water and food are consumed (Simone *et al.*, 2003). Stott *et al.* (1997) reported that raw wastewater examined was found positive for all the above mentioned protozoan cysts.

Solid waste composition is largely affected by the income level of the country and the level of industrialization. Many disease outbreaks have been attributed to contact link between waste dumps site and surface/underground waters. In the early 1970's about 1500 solid waste samples collected and analyzed from 33 Indian cities, *Trichuri trichura,* and *Ascaris lumbricoides* were commonly present (Torres *et al.,* 1991). Stool samples from solid waste collectors and a control group of similar economic background reveal 98% of the solid waste collectors were positive for parasites, while only 33% of the control groups were positive (Bhide and Sundaresan, 1984). Similar stool specimens collected from children working at or whose family worked at the dump site in Bangkok showed that 65% were infected by one or more parasites. Hookworm (*Ancyclostoms duodenale* or *Necator americanus*) was the most prevalent (14%). Of the Helminth's infections, *Giardia lambliae* infection was most prevalent (Konnoth, 1991).

In an experiment carried out in order to determine the profile of potentially pathogenic enteric parasites and bacterial agents in municipal refuse dumps in Ibadan, Nigeria, common parasitic agents of importance to both human and veterinary were found. High degrees of contamination of solid waste dump-site with bacterial and parasitic agents were observed to include *Ascaris lumbricoides, Entamoeba histolytica*, *Strongyloides,* (Adeyeba and Akinbo, 2003). In Olinda, Brazil, Squatters on a site previously used as dump ground showed that 263 out of 270 respondents had intestinal parasites, 150 had three types of parasites and 93 had 2 types. The most common infestation was with *Ascaris lumbricoides* (De-Coura and Ghdji, 1990). Intestinal Nematode like *Ascaris, Trichuris,* hook worm, and *Teania* has been found in polluted water (Stott *et al*., 1997). The concentration of the enlisted helminthes eggs ranges from 100 to 10000 (10^2 - 10^4) per gram of faeces. Diseases by helminthes are endemic where waste water is commonly in use (Habbari *et al.,* 1999). This study is aimed at studying the parasitological qualities of well water located around municipal solid waste in parts of Zaria.

Materials And Methods

***Study Areas*:** The two urban settlements studied were Sabon Gari and Zaria city. Zaria is located on a plateau at a height of about 2200 feet above sea level in the centre of Northern Nigeria and more than 400 miles away from the sea. Zaria (11^o 3^1 N, 70 42^1 E) possesses a tropical continental climate. The tropical climate is more pronounced during the dry season, especially in December and January. The mean daily maximum temperature shows a peak in April and a minor one in October. Zaria lies within a region which has a tropical savanna climate with distinct wet and dry seasons. The tropical annual rainfall in Zaria is not high (Mean is about 44.4 inches). The vegetation of the area assumes various shades of green in wet season and turns brown, pale or yellow in the dry season (Mortimore, 1970).

***Well water samples collection*:** Sterile 250ml bottles were used in collecting representative water samples from wells using the container (guga) locally made and used in fetching water from the wells. Water collected was covered, and placed in a cooler with ice and transported to the

laboratory for analysis within 6 hours of collection. Similarly 1000ml capacity bottles were used to collect well water samples for physicochemical analysis. All samples were collected between 8.30 am and 10.30 am; and analyzed at the postgraduate laboratory, Department of Microbiology, A.B.U. Zaria.

***Solid waste sample collection*:** The surface soils were collected from waste dumpsites located near wells (W1 to W16), using sterile stainless spoon to a depth of 3cm into a sterile polythene bags. Samples were transported in a cold pack to the laboratory for analysis that was carried out within 6 hour of collection.

***Detection of helminths/ eggs/ larvae*:** The concentration wet mount method was used. The method is designed specifically for the recovery of protozoa cyst, oocyst, spores, helminths and nematode eggs and larvae. The formalin ethyl acetate sedimentation concentration procedure was followed (Habbari *et al.,* 1999). Using the recommended speed and time (500rpm for 10 minutes), 1ml of sample was mixed with 9 ml of neutral buffered 10 percent formaldehyde solution and then with 4 ml of ethyl acetate. Samples were shaken in inverted position for 30 seconds and then centrifuged at 500 rpm for 10 minutes. Sediments were examined by tapping the tube at the bottom before dropping with Pasteur pipette on a glass slide. Ova were identified according to the key proposed by WHO (1993). Counting of helminthes was done by direct microscopic count using the 40× and 60× objectives respectively.

Results and Discussion

A total of 186 samples from well water, solid waste, and liquid waste samples were examined for both seasons from both Zaria City and Sabon Gari. Out of this number 96 were from well water (48 each from both Zaria city and Sabon Gari), 36 (37.5%) were positive for ova or larvae of helminths. A total of 15 samples were positive for *Ascaris sp*, 5 *Trichuris* sp, 2 *Shistosoma* sp, 6 *Fasciola* sp, 2 hookworm larvae, 5 *Strongyloides sp*, 1 hookworm eggs.

A total of 72 solid waste samples were collected for this study, (30 from Zaria city and 42 from Sabon Gari) all the samples were positive for helminths. The frequency of isolation were as follows, In Zaria city, 18 (60%) were positive for *Ascaris*, 6 (20%) had *Trichuri*, 1 (3%) had *Shistosoma*, 16 (53%) had *Fasciola*, 5 (30%) for *Strongyloide*s, 2 (6.6%) had hookworm eggs. In Sabon Gari, 13 (30.9%) had *Ascaris*, 2 (4.8%) had *Trichuris* and hookworm eggs each, 5 (11.9%) had *Shistosoma*, 12 (28%) had *Fasciola*, 1 (2.4%) had hookworm larvae, 4 (9.5%) had *Strongyloides*. A total of 18 liquid waste samples were collected from both Zaria city and Sabon Gari.

The level of helminths is expected to be much higher in all the samples considering the level of waste dump but the contrary was observed, composting process leading to increase heat production may have reduced their numbers. The frequent isolation of *Fasciola* sp a common parasite with sheep and cattle from well water and the solid waste shows that there is frequent deposition of animal waste around the wells particularly on the dump site which frequently cross contaminate the wells. Habbari *et. al*. (1999) reported that *Ascaris* and other helminthes were higher in children living in areas where waste water irrigation was used compared to control group in Morocco. Similar study was carried out in India, and was found that 47% of sewage farm workers were positive for Ascariasis. In Ibadan Nigeria, municipal refuse dumps had a high number of common parasitic agents of importance to both human and veterinary (Adeyeba and Akinbo, 2003).

This is particularly not surprising since adequate sanitary measures are not observed around wells. Nearly all the well water samples examined contained pathogens under study during the study periods.

The results show that well water contain more pathogens during the wet season than the dry season, this is probably because during the dry seasons, the volume of water is usually low with an over exploitation and excessive fetching. During the wet season, many waste materials from the surrounding waste are washed into these wells as runoffs or sipping without any method of runoff control available to protect the wells thereby increasing the parasite counts. A total of 16 wells were used for this study most of which were public wells and two (2) controls. The wells were used for all purposes, including drinking, cooking, and domestic activities as well as watering of animals. All the wells were located in an open space between households usually in open land where municipal solid waste are also openly deposited. All the wells considered for the study were carefully selected based on their nearness to the waste dump sites and municipal liquid waste flow path. Their environment was usually littered with wastes and lacked proper drainage. The situation is particularly worrisome because of the heavy presence of waste materials which also continue to receive many more by the day and wells close by are likely to be under the influence of continued pollution and are physically unpleasant to the eyes. The visual and odorous characteristics of the environment tend to be those that have greatest impact upon the public's assessment of the water quality. The observations made reveal that the liter, rubbish (bottles, can, plastics and polythene waste.), and the runoff derived waste tend to impair the quality of water. Faeces could be seen around the wells, domestic waste could be seen discharged directly from residential houses into and around the wells. Both children and animals were seen to defecate and urinate around the wells.

Conclusion and Recommendations

In the light of the above results, the following conclusions can be drawn. The survey of all the well water quality in the two study areas in both seasons has demonstrated high levels of helminths, which high values can be deleterious to the health. All the wells showed a significant presence of helminths, indicating that animals and human waste are significant source of well water pollution. In view of this study, it is suggested that the poor quality of well water in the study areas could be controlled by improving the sanitary and drainage systems, run-off control systems should be put in place as absence of such control systems has led to water quality problems in the areas. There is need for further investigations of the wells on a routine bases. The waste should be properly disposed and further accurate evaluation and level of spread of the waste should be studied. Adequate treatment of well water as well as public health education is highly recommended.

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