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Assessment of Cadmium, Lead and Iron in Hand Dug Wells of Ilaro and Aiyetoro, Ogun State, South-Western Nigeria

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Abstract

Cadmium, lead and iron in hand dug wells were assessed in Ilaro and Aiyetoro area of Ogun state. The mean ± S.D of the results obtained were cadmium 0.017±0.016 mg/l, lead 0.229±0.061 mg/l; Iron 1.076±2.393 mg/l. It was observed that all the parameters were higher than the standard limits specified for drinking water by WHO. Hence, the well water in the study location is unsuitable for drinking.

Keywords: Hand dug well, mean, standard limits.

Introduction

Adequate water resources for future generations are not only a regional issue but also a global concern. Global environment now consists of numerous natural and artificial metals. Metals have played a critical role in industrial development and technological advances. Most metals are not destroyed; indeed, they are accumulating at an accelerated pace, due to the ever-growing demands of modern society[1]. Quality drinking water is essential for life. Unfortunately, in many developing countries of the world, including Nigeria, good, portable and hygienic water has become a scarce commodity[2] as only a small proportion of the populace has access to treated water. Hence, there is indiscriminate use of rainwater and ground water source for drinking and other domestic usage in most communities in the study area without prior knowledge of the quality of such water. These as led to health risks which is synonymous with the study area. Therefore, it becomes so important and necessary to investigate whether the levels of these inorganic contaminants (Cd, Pb and Fe) in hand dug wells in Ilaro and Aiyetoro are sufficient to affect the health of the inhabitants of the areas under investigation.

Study Area: The Ilaro and Aiyetoro are among the major towns in Ogun state, Southwestern Nigeria (figure 1). Ilaro town is about 50 km from Abeokuta, the Ogun State capital, and about 100 km from Ikeja, the capital city of Lagos State. While Aiyetoro is about 35km northwest of Abeokuta. Ilaro and Aiyetoro are situated in a flat and sloppy terrain in deciduous- derived savannah zone of Ogun State. The climate is sub-humid tropical with a longtime average annual rainfall of 1,350mm. The landform is that of eroded pediment plain with well-incised valleys forming a trellis pattern. The soils are developed over a deeply weathered layer of sedimentary rocks consisting of false bedded sandstones which underlies the area. The sediments are of lower cretaceous rocks or Abeokuta form.

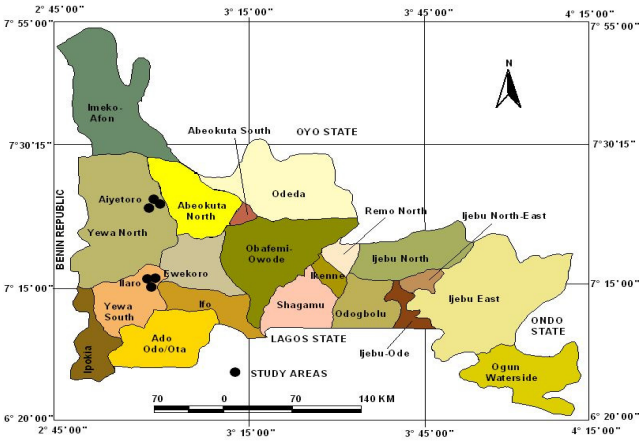

Figure-1
Ogun State showing the Study Areas

Material and Methods

Ten water samples each randomly selected from these study areas were analyzed for Cd, Pb and Fe from hand dug wells from the two locations during the rainy season when ground water intrusion is high. The well water samples were collected following standard procedure for sampling. The choice of the sampling locations was based on closeness to dumping site, proximity to residential area, closeness to cesspool, septic tanks and burial ground. The samples were tested for heavy metal (Cd, Pb and Fe) using Atomic Absorption Spectrophotometer (AAS).

Result and Discussions

Tables 1 and 2 showed the summary of the results of heavy metal concentration in hand dug wells in the study area. It was observed from result that most of these wells were not suitable for domestic purposes for which they are presently used for in some of the residential area in the study area. 82% of tested samples contain detectable amount of cadmium with concentration above the maximum contaminant level (0.003mg/l) suggested by[3] (fig.2). This is of concern because cadmium has carcinogenic properties as well as long biological half life[4] leading to chronic effect as a result of accumulation in the liver and renal cortex[5,6]. It can also cause kidney damage as well as produce acute health effects resulting from over exposure to high concentrations[7].

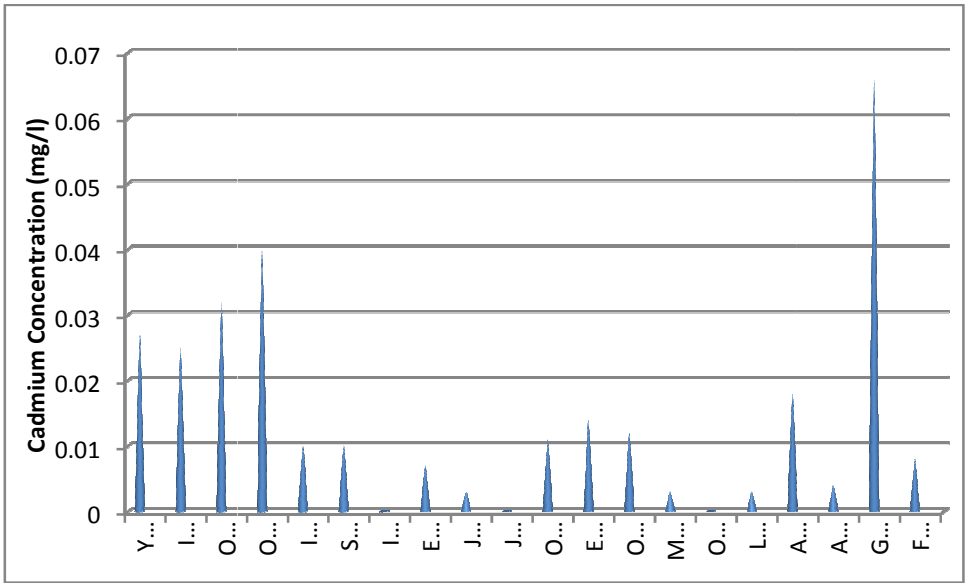

Figure-2
Cadmium levels in water samples

Table-1
Heavy Metals Concentrations in Water Samples

Sample Code	LOCATION	CORDINATE	Cadmium (Mg/l)	Iron (mg/l)	Lead mg/l
S01	Yidi road, Aiyetoro	N07.24684, E003.04405	0.027	0.049	0.279
S02	Idagba, Aiyetoro	N07.24353, E003.03804	0.025	0.271	0.109
S03	Oke-Oyinbo I, Aiyetoro	N07.24171, E003.00322	0.032	0.144	0.230
S04	Oke-Oyinbo II, Aiyetoro	N07.24126, E003.03219	0.040	3.619	0.132
S05	Idofoyi I, Aiyetoro	N07.24045, E003.02893	0.010	ND	0.181
S06	Saala, Aiyetoro	N07.23607, E003.03031	0.010	ND	0.102
S07	Ilupeju, Aiyetoro	N07.24071, E003.03539	ND	ND	0.199
S08	Eemado, Aiyetoro	N07.23775, E003.02617	0.007	0.009	0.294
S09	Joga, Aiyetoro	N07.23247, E003.02571	0.003	ND	0.224
S10	Joga, Ilaro road, Aiyetoro	N07.22881, E003.02604	ND	0.131	0.208
S11	Oke- ola, Ilaro	N06.89821, E003.00829	0.011	ND	0.249
S12	Express, Ilaro	N06.89228, E003.99855	0.014	0.024	0.221
S13	Orita, Ilaro	N06.88520, E003.00235	0.012	0.134	0.303
S14	Musa Street, Ilaro	N06.89123, E003.01600	0.003	ND	0.262
S15	Otegbeye, Ilaro	N06.89525, E003.01499	ND	ND	0.317
S16	Lesli, Ilaro	N06.88650, E003.01347	0.003	0.049	0.236
S17	Aderogu, Ilaro	N06.88329, E003.01118	0.018	0.041	0.196
S18	Akiniku, Ilaro	N06.88723, E003.02233	0.004	0.039	0.284
S19	Gbogodi, Ilaro	N06.87657, E003.00357	0.066	8.406	0.261
S20	F.P.I, Ilaro	N06.88972, E003.98886	0.008	ND	0.291

Table-2
Statistical summary of the investigated heavy metal in well at the study area

Variables	Mean ± S.D (Range)	MCL	No above MCL	% above MCL
Cadmium (mg/l)	0.017 ± 0.016 (0.003-0.066)	0.003 mg/l	14	82%
Lead (mg/l)	0.229 ± 0.061(0.102-0.317)	0.01mg/l	20	100%
Iron (mg/l)	1.076 ± 2.393 (0.009-8.406)	0.3 mg/l	2	16.67%

NOTE: MCL is Maximum Contaminant Level set by WHO (2006) for drinking water

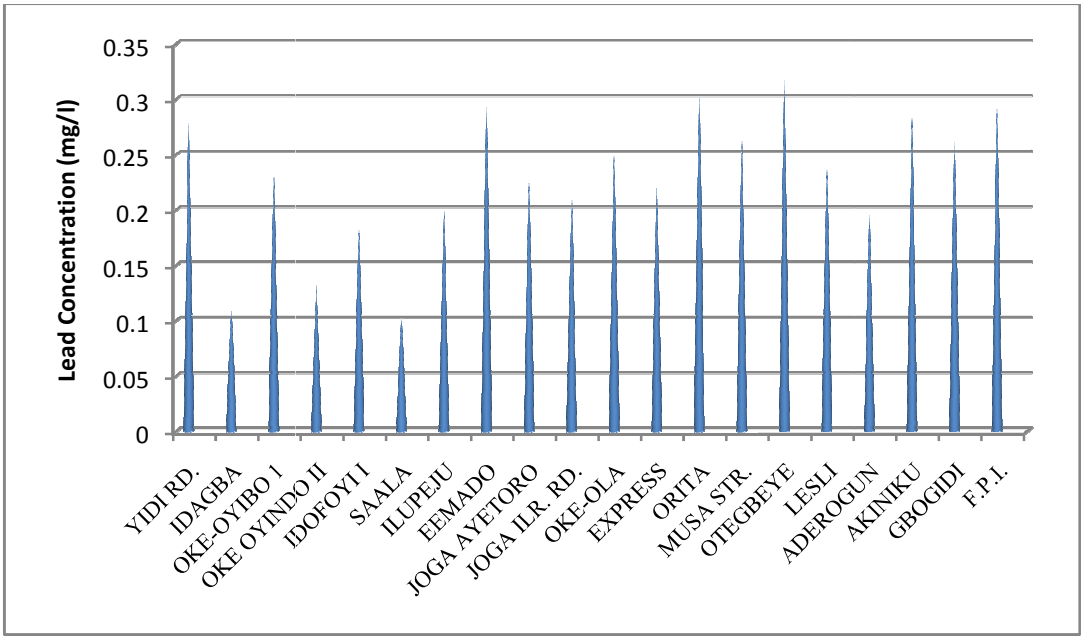

Figure-3
Lead levels in water samples

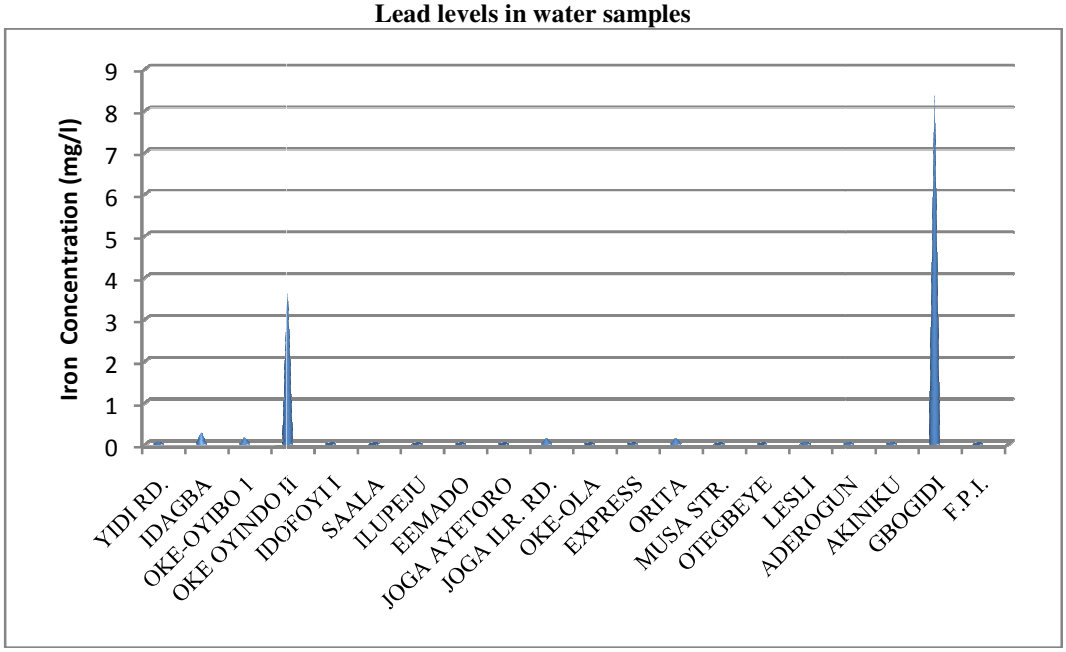

Figure-4
Iron level in water samples

Furthermore, the result showed that all water samples contained lead concentration that does not conform to the maximum contaminant level 0.01mg/l. The lead concentration in well samples in the study area fell in the range of 0.102mg/l - 0.317mg/l concentration (figure. 3). This result is of great concern as lead has been recognized for centuries as a cumulative general metabolic poison[7,8]. It is a neurotoxin and it is responsible for the most common type of human metal toxicosis. Also studies have linked lead exposures even at low concentration and increases in blood pressure[9] as well as with reduced intelligence quotient in children[10] and with attention disorders[11]. Thus the danger of lead poisoning becomes very critical and real for the users.

Finally, the result water analysis showed that 60% of tested samples have detectable amount of iron with concentration ranging from 0.009mg/l - 8.406mg/l (fig.4) as against the WHO acceptable limit for portable water of 0.3mg/l. Water containing iron is known to cause deleterious effect on human health. Excessive iron in water makes water turbid, discoloured (brownish colouration) and imparts an astringent taste to water.

Table-3 showed the comparison of the heavy metal contamination in the sampled wells in the two study locations. Although the metals concentrations in water samples were generally above the maximum contaminants level, cadmium concentration is higher in Ilaro wells (0.019 mg/l) than in Aiyetoro wells (0.015mg/l). Also, the lead concentration in Aiyetoro wells (0.262 mg/l) is higher than that of Ilaro wells (0.195 mg/l). Finally, the iron Level in Aiyetoro wells (1.280 mg/l) is higher than in Ilaro wells (0.704 mg/l).

Table-3
Comparison of Statistical Mean For Ilaro and Aiyetoro

Metal	Aiyetoro	Ilaro	MCL
Cadmium (mg/l)	0.015	0.019	0.003
Lead (mg/l)	0.262	0.195	0.01
Iron (mg/l)	1.280	0.704	0.3

Conclusion

The can be concluded that wells in the area are contaminated with cadmium, lead and iron. This implies that the well water in the study location is unsuitable for drinking. Hence, there is need for that Periodic water sampling and analysis, where affordable, water must be treated before consumption and Public enlightenment on water quality should be encourage to foretell the looming danger from water contamination/pollution.

References

1 Mendie U., The Nature of Water. In: The Theory and Practice of Clean Water Production for Domestic and Industrial Use, Lagos: Lacto-Medals Publishers, 1-21. **(2005)**

2. IDLO, Water Tenure Reform and Pubic Access to Water as a Basic Need, *Int. Dev. Law Org. Voice of Dev. Jurists Series* **(2006)**

3. World Health Organization, Guideline for drinking water quality, Third edition, WHO press, Geneva, Switzerland, Geneva 21-25 September 1992, 398 (**2006**)

4. Orisakwe O.E., Igwilo I.O., Afonne O.J., Maduabuchi J.U., Obi E. and Nduka J.C. Heavy metal hazard of sachet water in Nigeria, *Arch. Environ. Occup. Hlth.,* **61 (5),** 209-213**(2006)**

5. Hammer M.J. and Hamme M.J., Jr., Water quality in: Water and Waste water Technology, 5th Edn. New Jersey: Prentice-Hall, 139-159 (**2004)**

6. Akpoveta O. Vincent, Egharevba Felix, Medjor O. Weltime, Microbial Degradation and its Kinetics on Crude Oil Polluted Soil, *Res. J. Chem. Sci.,* **1(6),** 8-14 **(2011)**

7. Adepoju-Bello A.A. and Alabi O.M., Heavy metals: A review, *The Nig. J. Pharm.*, **37**, 41-45 **(2005)**

8. Gabriel Ike Obiefuna and Donatus Maduka Orazulike, The use of Anion Geochemistry in Mapping Groundwater Facies of Yola Area, NE Nigeria, *Res. J. Chem. Sci.,* **1(6),** 30-41 **(2011)**

9. Zietz B.P., Lap J. and Suchenwirth R., Assessment and Management of tap water contamination in lower saxon, German, *Int. J. Env. Hlth Res,* **17(6)**, 407-418 **(2007)**

10. Needleman H.L., The current status of childhood low-level lead toxicity, *Neuro tox.,* **14**,161-166 **(1993)**

11. Yule W. and Rutter M, Effect on children behavior and cognitive performance: aritical review, In Dietary and Environmental lead (Pb): Human health effect. R. Mahaffey, (Ed.), New York: Elesvier, 211-251 (**1985**)

12. Needleman H.L., Schell A., Bellinger D., Leviton A. and Allred E. N., The long-termeffects of exposure to low doses of lead in childhood, An 11-year follow-up report, *New Eng. J. of Med.,* **322(2)**, 83–88 **(1990)**

13. World Health Organization, Guideline for drinking water quality, Revision of the 1984 guidelines final task group meeting Geneva 21-25 September **(1993)**

14. World Health Organization WHO, Guideline for drinking water, 2nd edition vol. 2 Health criteria and other supporting information. Geneva, Switzerland, 940-9, Addendum to **2**, 281-3 (**1996)**

15. World Health Organization, Water for Pharmaceutical Use. In: Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials. 2nd Updated Edn. World Health Organisation, Geneva, **2**, 170-187. **(2007)**