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URINARY IODINE EXCRETION AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC AT UNIVERSITY OF MAIDUGURI TEACHING HOSPITAL, MAIDUGURI, NORTH-EASTERN NIGERIA: A PILOT STUDY

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ABSTRACT
Background: Worldwide, iodine deficiency in pregnancy remains the most common preventable cause of brain damage and mental retardation and urinary iodine excretion is a good marker of recent dietary iodine intake as most iodine ingested eventually appears in the urine(>90%) **Objective:** This study was aimed to assess the iodine status of pregnant women in their various trimesters attending antenatal clinic in a tertiary health care centre **Methods:** Measurement of urinary iodine is the most common method to monitor dietary iodine intake. Random urine was collect from pregnant women who were recruited consecutively in the antenatal clinic of UMTH, Maiduguri, during their routine antenatal visit. Urinary iodine was measured using Ammonium persulfate method **Result:** Median urinary iodine excretion for both the pregnant and nonpregnant generally fall in the category of mild iodine deficiency. Urinary excretion is generally low in all the three trimesters as compared to that of the controls but much lower in the first trimester. The result also showed that 84.6% of the pregnant women were iodine deficient among whom 2.7% have severe, 14.8% have moderate, and 67.1% have mild iodine deficiency and only 13.4% have optimal iodine status. 63.3% of the nonpregnant women were also iodine deficient (2.0% have severe, 22.5% have moderate, while 38.8% have mild) **Conclusion:** Result shows that iodine deficiency is still prevalent in northeastern Nigeria.

KEYWORDS: Urinary iodine excretion, Iodine status, Pregnant women, Antenatal clinic, Maiduguri, Nigeria.

INTRODUCTION
Iodine is a micronutrient essential for the synthesis of thyroid hormones. Thyroid hormones are required for brain development occurring during fetal and early postnatal life. Subsequently, sufficient maternal thyroid hormone is essential to secure the process of early growth and development of most organs, particularly the brain.[1] In pregnancy there is about a 50% increase in iodine requirement to achieve a dietary intake of 250ug/day[1]. This is because:[1] an increase in maternal thyroxine (T4) production to maintain maternal euthyroidism and transfer thyroid hormone to the fetus early in the first trimester, before the fetal thyroid is functioning;[2] iodine transfer to the fetus, particularly in later gestation; and[3] an increase in renal iodine clearance. Therefore, during pregnancy inadequate iodine intake, particularly in populations at risk, may then be observed even in high-income countries traditionally considered to be iodine sufficient. Multiple adverse effects on growth and development in humans due to iodine deficiency (Iodine deficiency disorders) are one of the most important and common human diseases, and, in the world today, iodine deficiency occurring in pregnancy remains the most common preventable cause of brain damage and mental retardation.[2] Therefore, the consequent implication of iodine deficiency during pregnancy is not only on the incident child but the family and the society in general. Though Nigeria[3,4] was honored with the universal salt iodization (USI) certificate award in 2007 for her pragmatic approaches in combating endemic IDD, pockets of researches carried out in different parts of the Country showed iodine deficiency is still prevalen[3,5-7].Globally[3], moreover, national representative survey data on iodine nutrition during pregnancy are limited though, maternal iodine deficiency, defined as median UIC <150μg/L, has been well documented in both developing and developed countries. In view of these facts, we decided to conduct a pilot study with the objective of assessing iodine status among pregnant women attending antenatal clinic at University of Maiduguri Teaching Hospital, Maiduguri, North-eastern Nigeria. This is first of its kind in this part of the country. These pregnant women attending antenatal clinic are an important target group for IDD surveillance due to their high vulnerability, and their representation of the community.

SUBJETCS AND METHODS

Subjects

Pregnant women were recruited in the antenatal clinic of UMTH, Maiduguri, during their antenatal visit. Those who had complained other than routine antenatal check were excluded from the study. Also excluded were pregnant women with obvious goitre, renal insufficiency, and known thyroid disorders. They were recruited at random irrespective of duration of the pregnancy.

Methods

Measurement of urinary iodine is the most common method to monitor dietary iodine intake. Urinary iodine excretion is a good marker of recent dietary iodine intake as most iodine absorbed in the GIT eventually appears in the urine (about 90%)[3,8]. A morning spot urine sample was collected randomly during the antenatal visit. Urine sample was collected into a new universal container and immediately preserved in a cooler with ice chips; these were subsequently refrigerated at 4^{o}C until analysis. Urinary iodine was measured using Ammonium persulfate method as described by Pino[9], *et al* and modified by Sandell and Kolthoff[10]. Urine was digested with ammonium persulphate. The iodine in the urine sample catalyzed the reduction of ceric (i) ammonium sulfate (yellow colour) to the cerous (ii) (colourless) in the presence of arsenic (iii) acid. The degree of reduction in colour intensity of the yellow ceric ammonium sulfate is proportional to the iodine contents in the urine sample

Statistical analysis

Pregnant women were categorized into trimesters using duration of pregnancy obtained during recruitment. The range, mean, and median of urinary iodine for each trimester and control were determined. We also compared individual result of urinary iodine excretion with WHO/ICCIDD/UNICEF iodine nutrition scale and subjects were categorized into mild, moderate, severe or optimal iodine status and percentage for each category were determined

RESULTS

This study of UIC in the pregnant women is an effort to assess the sustainability of the supply and consumption of iodized salt, particularly in the war zone, North-Eastern Nigeria. In this pilot study, a total of 198 women (13 pregnant women were in their first trimester, 68 in their second trimester while 68 were in their third trimester, and 49 were non-pregnant women) participated in the study.

Table 1 shows iodine nutrition for the general population and that of pregnant women scale by WHO/ICCIDD/NUICEF for guidance for comparison and interpretation of results.[3]

Table 1: WHO/ICCIDD/UNICEF Iodine nutrition scale

Median urinary iodine concentration(ug/day)	Corresponding approximate iodine intake(ug/day)	Iodine Nutrition	Median UIC in pregnant women(ug/L)	
<20	<30	Severe	<150	
20-49	30-74	Moderate deficiency		Insufficient
50-99	75-149	Mild deficiency		
100-199	150-299	Optimal	150-249	Adequate
200-299	300-499	More than adequate	250-499	Above requirement
>299	>499	Possible excess	>500	Excessive

Source: WHO, 2001[3]

The mean±SD and median±SD urinary iodine concentration are shown in table 2. The results, as compared with WHO/ICCIDD/UNICEF Iodine nutrition scale, show that median urinary iodine excretion for either the pregnant or non-pregnant women generally fall in the category of mild iodine deficiency. Urinary iodine excretion is lowest during the first trimester and it also showed that urinary iodine excretion in all the trimesters are lower compared to the nonpregnant women (controls), despite renal adjustment in urinary iodine excretion during pregnancy. Iodine deficiency is real in this part of the country.

Table 2: Mean and median urinary iodine concentrations in subjects.

Variables	UIC(ug/L)		
	Mean±SD	Range	Median±SD
Control	85.02±46.75	38.27 to 131.77	75.00±46.75
First trimester	56.54±27.79	28.75 to 84.33	50.00±27.79
Second trimester	69.71±42.99	26.72 to 112.27	60.00±42.99
Third trimester	67.65±39.95	27.70 to 107.60	62.50±39.95

Results in table 3 showed that 84.6% of the pregnant women were iodine deficient among whom 2.7% have severe, 14.8% have moderate, and 67.1% have mild, iodine deficiency, and only 13.4% have optimal iodine status. Even among the non-pregnant women,63.3% have iodine deficiency (2.0% have severe, 22.5% have moderate, and 38.8% have mild); hence iodine deficiency is still prevalent in northeastern Nigeria.

Table 3: Distribution of subjects according to WHO/ICCIDD/UNICEF Iodine nutrition scale[3]

UIC(ug/day)	Pregnant women	Non-pregnant women
<20(Severe iodine deficiency)	4(2.7%)	1(2.0%)
20-49(Moderate iodine deficiency)	22(14.8%)	11(22.5%)
50-99(Mild iodine deficiency)	100(67.1%)	19(38.8%)
100-199(optimal iodine)	20(13.4%)	17(34.7%)
200-299(more than adequate)	2(1.3%)	1(2.0%)
>300(Excess iodine)	1(0.7%)	0(0.0%)
total	149(100%)	49(100%)

DICUSSION

In Nigeria in 1993[5], a national goitre rate of 20% was reported and 20 million Nigerians were estimated to be affected by IDD (UNICEF, 1993)[11]. Similarly, the Participatory Information Collection Study(1993)[5], using thyroid hormone concentrations as indicators of iodine status reported an iodine deficiency prevalence of 65.6% in South-East, 41% in the South-West, 43% in the North-West of Nigeria. As part of the strategies to reduce the prevalence of IDD in Nigeria, the Universal Salt Iodization (USI) programme was introduced in 1995, and the update from the report of the Nigeria Demographic and Health Survey (NDHS, 2003)[12] showed that almost all Nigerian households (97%) consumed adequately iodized salt.

Although Ujowundu[4], *et al*, in their study in the Southeastern part of Nigeria demonstrated a progressive decrease in the mean Urinary iodine excretion from the first to the third trimester, our study showed the lowest value in the first trimester. Our result could be due to less number of women participatory in the first trimester or due to the usual changes associated with first trimester such as hyperemesis gravidarum(frequent vomiting and loss of appetite) resulting in decrease intake.

In conditions of adequate iodine supply, ≤ 20% of absorbed iodine is taken up by the thyroid. In chronic iodine deficiency, this fraction can exceed 80% and can result into reduced urinary iodine excretion as noted in this study despite the usual renal adjustment of iodine excretion during pregnancy[2, 3].Therefore, result of this study could also mean that our patients were iodine deficient even before they became pregnant, median UIE of the nonpregnant (controls) women is on mild deficiency side, resulting in increased thyroid uptake and reduced urinary excretion. Salt iodization has been a remarkably successful intervention as it is feasible, cheap, safe, rapidly effective and widely accepted. Similarly, iodized salt is the most appropriate measure for iodine deficiency control because it is used by all sections of a community, is consumed at roughly the same level throughout the year and because its production is often confined to a few centres which facilitate quality control at the level of production.Consequently, the level of household iodized salt coverage is used as an important indicator for assessing the progress of these programmes, and the proportion of households consuming adequately iodized salt has increased to some degree in every region of the world. In Nigeria, 97% of households consume adequately iodized salt.[12] Government commitment, advocacy, promotion and effective monitoring have been key components of the significant progress in Nigeria. However, findings in this study are worrisome since 84.6% (17.5% moderate deficiency) of pregnant women and 63.3% of non-pregnant women have some degree of iodine deficiency. Only 13.4% of the pregnant women and 34.7% of the non-pregnant women met the WHO criteria of adequate iodine nutrition (see table 1).The result implied presence of iodine deficiency in this part of the country. The iodine deficiency observed in pregnant women in this area is in conformity with a food and nutrition consumption survey which indicated that in spite of universal salt iodization attainment in Nigeria, 30.7% of mothers had varying degree of iodine deficiency(NPC, 2004)[13].Contrary observation was made in 2009[4] when a similar study was conducted in the South-Eastern part of Nigeria showing 80% of the pregnant women studied had optimal iodine nutrition, none had severe iodine deficiency, and only 2% had moderate and 12% had mild, iodine deficiency. They concluded that iodine deficiency has been eliminated as a public health problem.However, in 2011[7], same authors in the same region of the country conducted a similar study and revealed that 36% of the pregnant women had moderate, while 64% had mild, iodine deficiency and they concluded that iodine nutrition was not adequate in any of the women.The results of the 2 studies above indicated that there is insufficient continuity in the supply of adequately iodized salt in the same region in the country. Findings in present study concur with results of the study in 2011 and that of Negeri[14], *et al*, conducted in Ethiopia, where a total prevalence of Iodine deficiency among 423 pregnant women was 88.9% and of this 52(12.3%) were severe iodine deficient. The median urinary iodine of pregnant women was 48μg/L. Their study indicates that pregnant women were moderately iodine deficient. In present study 67.1% had mild and 14.8% had moderate and 2.7% had severe, iodine deficiency. This study revealed that iodine deficiency is still present in Maiduguri several years after the introduction of iodized salt. This could be the result of insufficient supply of adequately iodized salt or insufficient iodization of the salt supplied to the community or other environmental factors could play a critical role. Typically goitrogenic agents are found in staple food stuff grown in the region e.g., maize, sorghum, sweet potatoes, and cassava. The assessment, monitoring and evaluation of the iodine contents of salts imported and those produced within the country is currently poor. It is not unlikely that households' salt may not contain the recommended level of iodine. Findings in this study may also not be impossible that only a handful of households purchase iodized salt for domestic use. This however needs to be evaluated through further study. It is also noted in Epidemiological concepts related to the notion that the iodine intake in a given country may vary unexpectedly from one area to another[15,16]This occurs in areas with mild to moderate iodine deficiency because of significant differences in iodine contents of food and water, or due to goitrogenic substances in food. However, in this region the perineal war may have contributed to the findings in this study as it was similarly noted in Sierra Leone[17] that, war and conflict were a major disruption of local production of iodized salt and subsequent decreased in the ability of households to access iodized salt.Of note is that large differences in levels of iodized salt consumption remain. Consequently, despite remarkable progress in many countries, approximately 38 million newborns in developing countries risk the lifelong consequences of brain damage associated with iodine deficiency annually. Even in developed countries for example, in countries of western and central Europe about 80% of salt is consumed in processed foods such as in bread, sausages, canned and other ready-to-eat foods, as so-called "hidden salt"[18]. Consequently, if this hidden salt is not iodized, it is extremely difficult for a population to achieve adequate iodine intakes. The trend in some segments of the population to consume "cottage salts" and "plain" sea salt can also contribute to reducing the consumption of iodized salt. Often only table salt or cooking salt is mandated to be iodized, and, as noted above, this represents an ever declining source of dietary salt. Where iodization of this type of salt is still voluntary, this represents a real constraint to achieving the elimination of iodine deficiency. This is worth noting in Nigeria due to inhomogeneous distribution of population and it is noted in Epidemiological concepts related to the notion that the iodine intake in a given country may vary unexpectedly from one area to another [15,16]. It is well known that different sets of barriers and challenges to USI exist in both developing countries and developed countries. Subsequently, action at country and local levels is, therefore, important. Increasing iodine deficiency in developed countries, particularly in pregnant women, requires the governments of these countries to address this problem. To ensure adequate iodine nutrition during pregnancy and lactation, women should be provided with iodine supplements if iodine nutrition is not optimal. Further study in this region is required when such recommendations may be pronounced in this region.

REFERENCES

1. Glinoer D. The regulation of thyroid function during normal pregnancy: importance of the iodine nutrition status. Best Practice and Research in Clinical Endocrinology and Metabolism 2004; 18: 133-152
2. Zimmermann MB. The Effects of Iodine Deficiency in Pregnancy and Infancy. Paediatric and Perinatal Epidemiology, 2012; 26: 108-117.
3. WHO, UNICEF and International Council for the Control of Iodine Deficiency Disorders. Assessment of Iodine Deficiency Disorders and Monitoring Their Elimination: A Guide for Programme Managers 3rd edn[online]. http://whqlibdoc.who.int/publications/2007/9789241595827_eng.pdf (2007).
4. Ujowundu CO, Ukoha AI, Agha CN, Nwachukwu N and Igwe KO. Assessment of current iodine status of pregnant women in a suburban area of Imo State Nigeria, twelve years after universal salt iodization. African J Biochemistry Research, 2010; 4:006-012
5. The Participatory Information Collection Study, 1993.
6. Ojule AC and Osotimehin BO. Maternal and neonatal thyroid status in Saki, Nigeria. Afr J Med medSci 1998; 27: 57-61.
7. Igwe K. O., Ukoha A. I., NwaChukwu N. and Ujowundu C. O. Iodine nutrition for pregnant women in three major villages of Ohafia local government area in Abia State of Nigeria.African J Biochemistry Research, 2011; 5: 69-71, February
8. World Summit for Children-Mid Decade Goal: Iodine Deficiency Disorders. UNICEF-WHO Joint Committee on Health Policy. Geneva, United Nations Children's Fund. World Health Organization, 1994(JCHPSS/94/2.7)
9. Pino S, Fang S and Braverman LE. Ammonium persulfate: a safe alternative Oxidizing reagent for measuring urinary iodine. Clin Chem. 1996; 42: 239-243.
10. Sandell EB and Kolthoff. Micro determination of iodine by catalytic method. Micro Chem. 1937; 1: 9-25.
11. UICEF(1993). Regional goitre survey in school children, Nutrition Section, Lagos Nigeria.
12. Nigeria Demographic and Health Survey (2003). Infant feeding and children and women nutritional status. National Population Commission. Federal Republic of Nigeria pp.160
13. National Population Commission Nigeria (NPC) Nigeria (2004), ORC Macro use of iodized salt in Households. Nigeria Demographic Commission(Nigeria) ORC Macro, Calverton, Maryland USA, pp. 159-160
14. Negeri Z, Gobena T, Rajesh PN and Kassim M. Determining the Magnitude of Iodine Deficiency and Its Associated Risk Factors among Pregnant Women VisintJimma University Specialized Hospital for Antenatal Care. World J Medicine and Medical Science, 2014; 2: 1-16.

15. Sustainable Elimination of Iodine Deficiency. Progress since the 1990 World Summit for Children
16. Glen FM, David PH, and van der Haar F. Iodine deficiency: Consequences and progress toward elimination. Food and Nutrition Bulletin, 2003; 24(4). The United Nations University
17. Rohner F, Wirth JP, Woodruff BA, Chiwile F, Yankson H, Sesay F, et al. Iodine Status of Women of Reproductive Age in Sierra Leone and Its Association with Household Coverage with Adequately Iodized Salt. Nutrtients 2016; 8: 74.
18. Anderson M, de Benoist B, Darnton-Hill I, and DeLange F. Iodine Deficiency in Europe: A continuing public health problem. Iodine deficiency in Europe and Its Control: Current Status, progress and Recent Trends. World Health Organization 2007.