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Research article

Determining the Magnitude of Iodine Deficiency and Its Associated Risk Factors among Pregnant Women Visiting Jimma University Specialized Hospital for Antenatal Care

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Abstract

Background: Iodine is essential for the synthesis of thyroid hormones. In pregnant women thyroid hormones is required for development and maturation of brain and neurological network of the fetus. Iodine deficiency during pregnancy has a negative effects on the pregnancy and pregnancy out comes. The fetal brain is particularly vulnerable to maternal hypothyroidism in iodine deficiency. Thus, lack of iodine in women prior to and during pregnancy could result to giving birth to children with irreversible brain damages.

Objective: The main aim of this study was to determine the magnitude of iodine deficiency and its associated risk factors among pregnant women visiting Jimma University Specialized Hospital for antenatal care.

Methods: A hospital based cross-sectional study on maternal iodine deficiency in JUSH, Jimma, and South West Ethiopia was conducted from May to July 2011. By using systematic random sampling technique, a total of 423 pregnant women visiting JUSH for antenatal care were involved in the study. Maternal iodine level was determined based on urinary iodine (UI) excretion. Each pregnant woman was subjected to both physical examination and urine testing for iodine level. Cross tabulation and other statistically tests was used to assess the association between iodine intake and UIC.

Results: 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. This indicates that pregnant women were moderately iodine deficient.

Conclusion: pregnant women of the study area were iodine depleted. The findings presented in this report indicate that the iodine supplementation of the salt should be maintained in the area. Nutrition education along with universal salt iodization program in the study area was urgently required.

Key words: Pregnant Women, Urinary Iodine, Deficiency, Prevalence, Dietary Supplements.

Introduction

Iodine is an essential micronutrient primarily obtained through the diet, but it is also a component of some medications. The human body contains'15–20 mg of iodine, of which 70–80% is concentrated in the thyroid gland. Iodine is essential for the synthesis of thyroid hormones. Thyroid hormones play an important role in cellular metabolism, early growth and development of most organs; especially of the brain.[1] During pregnancy there is a high need of iodine because of an increase in maternal thyroid hormone production to maintain maternal euthyroidism and transfer thyroid hormone to the fetus early in the first trimester, before the fetal thyroid is functioning, iodine transfer to the fetus, particularly in later gestation; and an increase in renal iodine clearance. [2, 3, 4]

Iodine deficiency is the world's single most significant cause of preventable brain damage and mental retardation.[5] Lack of iodine in women prior to and during pregnancy could result to giving birth to children with irreversible brain damages. Maternal iodine deficiency can also lead to spontaneous abortion, still births and miscarriage, increased prenatal mortality, and it also causes a variety of disorders in the new born and children including congenital anomalies, psychomotor defects, impaired mental functions, mental retardation, decreased IQ, learning function and work

performance. Neonatal and juvenile thyroid deficiency results in dwarfism, increased infant mortality, deaf-mutism, spastic weakness and paralysis. [6, 7, 8]

Pregnant women in developing countries have been reported to have low intake of mineral and vitamin.6 In an Ethiopian study, the overall prevalence of goiter in seven provinces of Shoa Region was found to be 32.7 percent, while the incidence in the female population of Merhabete Province was as high as 60%. 9 Pregnant women and children in developing countries, like Ethiopia are vulnerable to iodine deficiency. This is because of their poor socio economic status, poor nutritional status especially in the rural population, lack of iodinated salt supplementation, lack knowledge, geographical location, poor ground water iodine, lack of adequate medical care, and lack of sufficient health professionals in the population. Urinary iodine is the most reliable indicator of the iodine-deficiency status in a given community because it is reflective of the current intake of iodine in the diet. Therefore, this study was designed to determine iodine intake status of pregnant women from urine which was the most sensitive indicator of the current urine iodine.

Materials and Method

A cross-sectional study design was conducted from May 2011 and July 2011 to determine the prevalence of iodine deficiency and its associated risk factors in pregnant woman in Jimma University Specialized Hospital (JUSH), located in Jimma city, 357 Kms Southwest of Addis Ababa. It provides services for approximately 9000 inpatient and 80000 outpatient attendances a year coming to this hospital from the catchment population of about 15,000 million people.

In this study, sample size was determined using single population proportion formula. Taking the overall prevalence of iodine deficiency 50% to obtain the maximum sample size at 95% certainty and a maximum discrepancy of +5% between the sample and the underlying population; an additional 10 % was added to the sample size as a contingency to increase power. Thus, a minimum number of 423 pregnant women were required in the study.

Sampling procedure was done by subjecting each pregnant woman to both physical examination and urine testing who were available at the time of the study. The pregnant women who were checked by the physician and those with chronic diseases (i.e. chronic renal failure and HIV/AIDS) were excluded from the study. Data collection was done as the following methods:

a) Survey of the study population

By using standard questionnaire information regarding the socio-demographic variables, frequency of goiterogenic food intake, types of salt used were collected.

b) Collection of urine sample and analysis of urinary iodine concentration

Urinary iodine is the most reliable indicator of the iodine-deficiency status in a given community because it is reflective of the current intake of iodine in the diet.[10] Median urinary iodine was usually considered as an indicator of iodine nutritional status of a population.

For biochemical assessment of iodine status, about 5 ml urine samples from pregnant women were collected in a properly labeled and sterilized screw caped plastic bottle. These bottles were immediately transferred to the thermo cool box containing ice bags and were transported to the biochemistry laboratory. The samples were kept at 4^{o}c in a refrigerator with all precautionary measures until analysis. Analysis of urinary iodine was done using spectrophotometer at the Biochemistry laboratory of Jimma University.

Analysis of urinary iodine was based on ammonium per sulfate method which was suggested and approved by WHO/UNICIEF/ICCIDD.[11] WHO/ UNICIEF/ ICCID have made some guidelines regarding categorizing individuals in to different iodine nutritional groups based on urinary iodine level. Accordingly, < 20 µg iodine/L urine indicate a case of sever iodine deficiency, 20-49.9 µg iodine/L urine indicate a case of moderate iodine deficiency, 50-149.9 µg iodine/L urine indicate a case of mild iodine deficiency, 150-250µg iodine/L urine indicates a case of adequate or sufficient level, >250µg iodine/L urine indicate a case of above requirement and ≥500µg iodine/L urine indicates a case of excessive level of iodine. [12, 13]

Pregnant women was characterized as non iodine deficient when iodine concentration in urine sample exceeded 250–300µg/L/, mildly deficient when concentration was <150µg/L, moderate when the iodine was <20-49µg/L and severe when the value of iodine fell below 20µg/L.[14,15] All the necessary efforts were taken to prevent the release of toxic fumes during urine testing for iodine level. The current protocol did not involve activities that deal with infectious biological agents or blood collection and processing.

c) Assessment of health status

For each pregnant woman the Body Mass Index (BMI) was measured by the data collectors and the score was recorded. BMI (kg/m^2) of the pregnant women classified as low (below 19.8), normal (19.8 to 26.0) and high (26.0 to 29.0) [16] Iron nutritional and the health status of each pregnant woman was assessed by estimating their hemoglobin, and total red blood cell counts. Pregnant women was characterized as normal (Hb >11g/dl) and anemic (Hb <11g) by using cut-off values.[17]

To assure the quality of the data high emphasis was given in designing data collection instrument for its simplicity. The questionnaires and measuring instruments were pre-tested and important modifications were made. All variables in the survey were coded and entered using SPSS for Windows Version 16.0. Presence of association between physical examination, urinary excretion of iodine, other socio-demographic factors and hemoglobin values were analyzed by using selected statistical methods and presented using OR. The presence of significant association between dependent & independent variables were examined. P-value less than 0.05 were considered as significant.

Ethical clearance for the study was obtained from the research and publication committee of the College Public Health and Medical Sciences of Jimma University through the Biomedical Department. The objective of the study and advantages obtained from the study was made understood for the medical director of JUSH, Physician and the pregnant women. A written permission was obtained from clinical director of JUSH prior to the data collection and consent from the study participants. Finally, written informed consent was obtained from each pregnant woman.

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Results and Discussion

Results

Basic Socio Demographic characteristics of respondents: A total of 423 pregnant women who fulfilled the inclusion criteria were studied. The mean (±SD) age of the study participants was 24.7± 4.36 years while 189 (44.7%) of them lied in the age group of 20 to 24 years. More than half, 315(74.5%) of the participants residence were Jimma and about 204 (48.2%) of the study subjects were Muslim. Two hundred fifty eight (61%) of the pregnant women were Oromo, about a half, 204 (48.2%) were junior high school followed by those who had elementary education (35%), 220 (52%) were House wife followed by governmental employee (28.1%), and about 156 (36.9%) of the pregnant women had monthly income of 500-1000 birr (Table1).

Table 1: Frequency of Socio- demographic variables and urinary iodine level of the pregnant women attending ANC at JUSH, Jimma town, south west Ethiopia, 2011.

Socio-demographic Variables	Urine Iodine Concentration(µg/L)**				
	Iodine deficient (N %)	Normal (N %)	Total (N %)	χ2	P-value
Age (years)					
15-19	22(88.0)	3(12.0)	25(5.9)		
20-24	166(87.8)	23(12.2)	189(44.7)		
25-29	142(91.0)	14(9.0)	156(36.9)	2.154	0.827
30-34	31(88.6)	4(11.4)	35(8.3)		
35-39	13(81.2)	3(18.8)	16(3.8)		
>=40	2(100.0)	-	2(0.5)		
Residence					
Jimma	279(88.6)	36(11.4)	315(74.5)		
Manna	12(92.3)	1(7.7)	13(3.1)		
Seka	10(83.3)	2(16.7)	12(2.8)	1.713	0.887
Agaro	9(81.8)	2(18.2)	11(2.6)		
Dedo	9(90.0)	1(10.0)	10(2.4)		
Others*	57(91.9)	5(8.1)	62(14.7)		
Religion					
Orthodox	147(87.0)	22(13.0)	169(40.0)		
Muslim	185(90.7)	19(9.3)	204(48.2)	1.368	0.713
Protestant	31(88.6%	4(11.4)	35(8.3)		
Catholic	13(86.7)	2(13.3)	15(3.5)		
Ethnicity					
Oromo	232(89.9)	26(10.1)	258(61.0)		
Amhara	68(84.0)	13(16.0)	81(19.1)		
Tigray	4(100.0)	-	4(0.9)	4.036	0.401
Gurage	33(94.3)	2(5.7)	35(8.3)		
Others*	39(86.7)	6(13.3)	45(10.6)		
Literacy					
Illiterate	71 (92.2)	6 (7.8%)	77 (18.2)		
1-8	148(91.9)	13(8.1)	161(38.1)	5.395	0.067
9-12 and above	157(84.9)	28(15.1)	185(43.7)		

Monthly income (Eth. Birr)					
≤100	20(90.9)	2(9.1)	22(5.2)		
101-500	121(91.7)	11(8.3)	132(31.2)		
501-1000	145(86.3)	23(13.7)	168(39.7)	2.827	0.587
1001-1500	74(90.2)	8(9.8)	82(19.4)		
≥1500	16(84.2)	3(15.8)	19(4.5)		

* Yebu, Asendabo, Merewa, Bedabuna, Gojab, Sekoro, and Tepi

Obstetric History of Respondents

Gravidity ranged from one to nine, 144 (34.0%) were primigravidae and 279 (66.0%) grand multigravidae. Among 423 pregnant women, 120 (28.4%) were never gave birth before and 303 (71.6%) were having one or more birth before. Gestational age at recruitment was the first trimester for 75 women (17.7%), second trimester for 197 (46.6%) and third trimester for 151(35.7%) (Table 2). Overall prevalence of iodine deficiency was 88.9% and of this, 156 (36.9%) were mild, 168 (39.7%) were moderate deficient, and 52 (12.3%) were severe iodine deficient. The median urinary iodine of the pregnant women was 48µg/L **(Table 2).**

Distribution of Hemoglobin and BMI of Pregnant Women

By using cut-off values of Hemoglobin, about 364 hematocrit values were examined for pregnant women. Anemia was found in 106 (29.1%) of the pregnant women and of this, 90 (84.9%) were iodine deficient. Among the total (423) of pregnant women, 277 (65.5%) had normal body mass index, 93(22%) had low body mass index, and 53(12.5%) had high body mass index **(Table 2).**

Table 2: Frequency of Obstetric History, Hemoglobin and BMI of pregnant women attending ANC at JUSH, Jimma town, south west Ethiopia, 2011.

Variables		**Frequency (N)**	**Percent (%)**
Gravidity			
	1	144	34.0
	2-4	245	58.6
	>=5	34	8
Parity			
	1	120	28.4
	2-4	104	24.5
	5	14	3.2
Trimesters			
	First	75	17.7
	Second	197	46.6
	Third	151	35.7
Hemoglobin(g/dl)*			
	7-9	29	8.0
	10-12	205	56.3
	13-15	130	35.7

Body Mass Index (Kg/m^2) **		
Low (<19.8)	93	22.0
Normal (19.8-26.0)	277	65.5
High (26.0-29.0)	53	12.5

*Anemia is defined as Hb <11g/dl for children and pregnant women, [20] and< 12g/dl for adolescent girls.[17]
**BMI (kg/m2) of the pregnant women classified as low (below 19.8), normal (19.8 to 26.0) and high (26.0 to 29.0) [16]

Bivariate Analysis of the Study

Socio- demographic variables and Urinary Iodine concentration of the Pregnant Women

The iodine deficiency among the pregnant women was higher (91%) within the age group of 25-29 years. The association between age and urinary iodine excretion of pregnant women were not significant (**$\chi 2 = 2.154$ P = 0.827**) (Table 1). According to their residence, iodine deficiency was higher 279 (88.6%) among pregnant women who came from Jimma followed by pregnant women from manna 12(92.3%) were iodine deficient. But we didn't found significant association between residence and iodine deficiency among pregnant women **($\chi 2 = 1.713$, P = 0.887).** (Table 1)

In terms religion Muslims were dominant. There was no significant association between religion and iodine deficiency among pregnant women **($\chi 2 = 1.368$ P = 0.713).** However iodine deficiency was more prevalent in pregnant women whose monthly is < 100birr, there was no significance association between monthly income and urinary iodine concentration of the pregnant women (**$\chi 2 = 2.827$ P = 0.587**). **(Table 1)**

Urinary Iodine Level of Pregnant Women

The urinary iodine level reveals the iodine nutritional status of an individual. This is because 90% of iodine in the circulation will be filtered out by the kidney in a person having normal physiological function. Therefore urinary iodine status is a clear cut indicator of iodine nutritional status.[12]

Urinary iodine level and trimester of pregnancy

Iodine intake status of the pregnant women of the pregnant women was measured based on UI excretion. Among 75(17.7%) pregnant women whose gestational age was first trimester 64(85.3%) were iodine deficient and 11(14.7%) were having sufficient iodine. Among 197(46.6) pregnant women whose gestational age was second trimester 177(89.8%) were iodine deficient and 20(10.2%) were having sufficient iodine. Among 151(35.7) pregnant women whose gestational age was third trimester 135(89.4) were iodine deficient and 16(10.6) were having sufficient iodine. Iodine deficiency was slightly higher (85.3%) in the first trimester of pregnancy when compared to the second and third trimester of pregnancy. But the association is no significant. (**$\chi 2 = 1.184$ p = 0.553**). (**Table 3**)

Table 3: Gestational of Pregnancy and Urinary Iodine level of Pregnant Women utilizing ANC service at JUSH, Jimma, south west Ethiopia 2011.

Urinary Iodine concentration(µg/L)*	**Gestational age of pregnancy**			**Total (N%)**
	First trimester	**Second trimester**	**Third trimester**	
<20	10(19.2)	26(50.0)	16(30.8)	52(12.3)

20-49	27(16.1)	68(40.5)	73(43.50)	168(39.7)
50-149	27(17.3)	839(53.2)	46(29.5)	156(36.9)
150-249	11(23.4)	20(42.6)	16(34.0)	47(11.1)
Total (N %)	75(17.7)	197(46.6)	151(35.7)	423(100.0)

* >500= Excessive, >250 = Above requirement, 150-249 = Sufficient, 50-149 = Mild Deficient, 20-49 Moderate Deficient, <20 Severe Deficient.[14, 15]

Cabbage intake and Urine iodine concentration of the pregnant women

Iodine deficiency was higher among pregnant women consuming cabbage more than three times a week. This table showed that there is a significant association between normal and iodine deficient pregnant women and the frequency of cabbage intake (**X^2 =36.742 P = 0.000**). **(Table 4)**

Types of salt utilized and Urinary iodine concentration of pregnant women

Among 45(10.6%) pregnant women who used iodated salt in their diet 29(64.4%) were iodine deficient and 16(35.6%) were normal. Among 237(56.0%) pregnant women who used non iodinated salt in their diet 228(96.2%) were iodine deficient and 9(3.8%) were normal. Among 141(33.3%) pregnant women who used iodated salt in their diet 377(89.1%) were iodine deficient and 46(10.95) were normal. **(Table 4)**

The association between types of salt consumed by the pregnant women and UI excretion of the pregnant women were highly significant **($\chi 2$ = 42.880 P= 0.000).**

Hemoglobin and Urinary iodine level of pregnant women

Among 28(7.70%) pregnant women whose hemoglobin level 7-9, 24(85.75) were iodine deficient and 4(14.3%) were having adequate iodine. Among 206 (56.6%) pregnant women whose hemoglobin level 10-12, 181(87.9%) were iodine deficient and 25(12.1%) were having adequate iodine. Among 130(35.7%) pregnant women whose hemoglobin level 13-15, 118(90.8%) were iodine deficient and 12(9.25) were having adequate iodine. The association of hemoglobin and iodine status of pregnant women was not significant. **($\chi 2$ = 0.950 P = 0.622)** (**Table 4**)

BMI and Urinary iodine concentration of the pregnant women

Among 93(22.0%) pregnant women who had low BMI 83(89.2%) were iodine deficient, among 277(65.5%) pregnant women who had normal BMI 247(89.2%) were iodine deficient, and 53(12.5%) pregnant women who had normal BMI 46(86.8%)were iodine deficient. High prevalence of iodine deficiency (89.2%) was observed in pregnant women whose BMI is low. The association between BMI and UI concentration was not significant. **($\chi 2$= 0.270 P = 0.874)** (**Table 4**)

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Table 4: Frequency of Gestational Age, Cabbage Intake, Salt Use, Hemoglobin, Body Mass Index and Urinary Iodine Level of The Pregnant Women Attending ANC At JUSH, Jimma Town, South West Ethiopia, 2011.

Variables	Urinary Iodine concentration(µg/L)*		Total (N %)	χ2	P-value
	Iodine Deficient (N %)	Normal (N %)			
Trimester of the current pregnancy					
First	64(85.3)	11(14.7)	75(17.7)		
Second	177(89.8)	20(10.2)	197(46.6)	1.184	0.553
Third	135(89.4)	16(10.6)	151(35.7)		
Frequency of cabbage intake					
Every day	40(88.9)	5(11.1)	45(10.6)		
3 times/day	123(93.9)	8(6.1)	131(31.0)		
2 times/day	162(92.6)	13(7.4)	175(41.4)		
1times/day	47(74.6)	16(25.4)	63(14.9)	36.742	0.000
Never	4(44.4)	5(55.6)	9(2.1)		
Types of salt used					
Iodinated	29(64.4)	16(35.6)	45(10.6)		
Ordinary	228(96.2)	9(3.8)	237(56.0)	42.880	0.000
Both	120(85.1)	21(14.9)	141(33.3)		
Hemoglobin (g/dl)					
7-9	24(85.7)	4(14.3)	28(7.70)		
10-12	181(87.9)	25(12.1)	206(56.6)	0.950	0.622
13-15	118(90.8)	12(9.2)	130(35.7)		
BMI of pregnant women(Kg/m^2)**					
Low	83(89.2)	10(10.8%	93(22.0)	0.270	0.874
Normal	247(89.2)	30(10.8)	277(65.5)		
High	46(86.8)	7(13.2)	53(12.5)		

*<150µg/L Iodine deficient and >150µg/L Iodine sufficient[14,15]
**Low (BMI of 19.8), Normal (BMI of 19.8 to 26.0) and High (BMI of 26.0 to 29.0) [16]
***Anemia is defined as Hb <11g/dl for children and pregnant women,[20] and< 12g/dl for adolescent girls.[17]

Discussion

In the present finding, prevalence of iodine deficiency (Urine iodine < 150µg/L) was 88.9% and of this 12.3% were severely deficient (<20 µg/L). The median urinary iodine of 48µg/L obtained indicated that the pregnant women were moderately deficient by WHO/ICCIDD/UNICEF scale.[14,15] Median urinary iodine level is a valuable indicator of the iodine nutritional status of the entire population. In the present study the median urinary iodine concentration was 48µg/L i.e. below 150µg/L. The present study was in agreement with earlier national wide reports which showed the median urinary iodine of 24.5µg/L. Previous studies by Cherinet A. in 2007 [18] in the Oromia region suggested a median urinary iodine level of 25 µg/L, indicating a case of very severe iodine deficiency in the population. Earlier reports done in Abia state of Nigeria.[19] showed that the median UIC of 58.67µg/L. this is slightly high than the present study.

According to the study conducted in east Hungary iodine deficiency was found in 57.1% of the pregnant women, and was severe in 15.6%. The volume of the thyroid gland was enlarged in 19.2% of individuals.

Nodular goiter was found in 17 Women (5.4%).[12,20] This result was less than that of the present study. This is may be because of lack of iodized salt supplementation, lack of awareness about the effects of iodine deficiency by the study population and topographic factors of the study area. The present finding was also in agreement with report done in Lahore on pregnant women during first trimester which showed that 202(79.5%) were iodine deficient (UI <100mg/L) mostly (68.8%) of mild (UI 50-99mg/L), moderate iodine deficiency (UI < 50mg/L) was found in 63(24.8%) pregnant women. Among all pregnant women 80(31.5%) had slightly visible goiter and only 87(34.2%) currently taking iodized salt.[21]

A correlation was found to be existing between the income statuses of the household the prevalence of iodine deficiency. Pregnant women whose monthly income < 100birr, were more iodine deficient than pregnant women whose monthly income is >1500birr. The higher iodine deficiency in poor category may be because of poor nutritional intake, including less consumption of meat, use of non iodized salt, lack of medical attention etc. There were some reports that iodine deficiency prevalence rate is more in economically poor populations as compared to high economy community. This suggests that living standard is having a direct relation with iodine nutritional status and thereby with goiter prevalence. [18, 22]

A direct correlation was established between the frequency of cabbage intake and prevalence of iodine deficiency. Among various goitrogens, cabbage is the cheapest, popular, easily available and locally cultivated one. Therefore this study is focus mainly on the cabbage intake by the pregnant women and its consequence in relation to iodine deficiency in pregnant mother. [6]

Among people who take cabbage on regular routine, i.e. every day had a the high percent of iodine deficiency as compared to pregnant women who had not taken cabbage ever.This indication is highly significant with a P-value of 0.000. The present study is in line with the previous studies. Chesney[23] found that rabbits fed largely on cabbage develop goiter. A study was conducted by Chernet Abuye in 2008[24] regarding the impact of cassava (a goitrogenic food) intervention on goiter development in various regional states of Ethiopia.

As per this study in Oromia region, which includes jimma town and its areas, the mothers who take cassava regularly showed high (39.5%) goiter prevalence compared to non users (30.3%). This data is supportive to our present findings. This is because; goitrogens contain thiocyanate and isothiocyanate that inhibit the uptake of iodine to the thyroid follicular cells and also blocks the thyroid peroxidase enzyme. In the presence of goitrogen iodination of thyroglobulin protein will be affected, inducing in poor thyroxine production.

A direct correlation was made between trimester of pregnancy and urinary iodine concentration and urinary iodine was slightly lower in the first trimester of pregnancy than the second and third trimester of pregnancy. This result was consistent with other reports[20, 21] and it indicates that at the first half of gestation, there is high need of iodine. There was no significant association between trimesters of pregnancy and UIC (**P = 0.166).**

Iodine deficiency was more prevalent among non iodized salt user pregnant mother than iodized salt user pregnant mother. The association between iodized salt usage and iodine status of pregnant women was highly significant with P value of 0.000. There was no significant association between age, residence, ethnicity, and religion and iodine status of the pregnant women.

Conclusion

To summarized, high prevalence of iodine deficiency among pregnant women in the study area were identified. This is because of their poor socio economic status, poor nutritional status especially in the rural population, lack of iodinated salt supplementation (non use of iodized salt), lack of health awareness programs, lack knowledge, geographical location(topographic factors) of the study area, low percentage of iodine in drinking water and high intake of goitrogens, lack of adequate medical care, and lack of sufficient health professionals in the population, etc, may be considered as reasons behind it. Health education about causes and detrimental effects of iodine deficiency and methods of prevention should be the main focus for the intervention programs of this study. The government has to take immediate initiative to supply iodized salt/capsule; free or subsidized rate to built-up a healthy generation.

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