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Cross-sectional Survey of Goiter Prevalence and Household Salt Iodization Levels in Assosa Town, Beni Shangul-Gumuz Region, West Ethiopia

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Abstract

Background: Interruption of iodization of salt is reported to accelerate thyroid dysfunction in goiter endemic areas

Objective: To determine household goiter prevalence among children aged 6-12 years, together with salt iodization levels.

Methods: A cross sectional household (HH) survey was conducted in Assosa town, Beni Shangul Gumuz region, west Ethiopia, from May 10- May 20/2012 G.C. A total of 395 HH, in which children aged 6-12 years resided were sampled. The HH were selected from a list of all house numbers in the town by using simple random sampling technique. The data was collected using standard questionnaire and data collection format. At each selected HH, interview of mothers/care givers was conducted, thyroid enlargement was ascertained by palpation and thyroid size was graded according to the joint criteria of WHO/UNICEF/ ICCIDD, and salt iodization level was qualitatively determined by the use of rapid test kit (RTK) which was then compared against the national standard that states salt iodine content of at least 15 part per million (PPM) be considered as adequately iodized and that below 15 PPM as inadequately iodized.

Result: A total of 395 children were included in the study, of which 205(52.2%) were males. The mean age and standard deviation (SD) of the children was 8.86+2.01years. The overall prevalence of goiter was 104(26.3%). The prevalence of HH with adequately iodized salt, inadequately iodized salt, and non-iodized salt were 103(26.1%), 219(55.4%) and 73(18.5.0%) respectively. During data analysis, 37(35.9%) of HH with non-iodized salt samples had also child having goiter, 50(22.8%) of HH with salt iodine <15PPM also contained child having goiter, and 7(9.6%) of HH having >15 PPM salt iodine also had child having goiter.

Conclusions: In Assosa town, the prevalence of goiter was high. The prevalence of HH with non-iodized salt was high. Majority of children having goiter were living in HH having inadequately iodized salt- during the study period.

Keywords: Benishangul-Gumuz; Rapid iodine test; Goiter prevalence

Introduction

Between 1994 and 2006, the number of countries that carried out a urinary iodine national survey increased to 94, and survey data on iodine deficiency now covers 91.1% of the world population [1].

In 2013, as defined by a national or subnational median urinary iodine concentration of 100-299 µg/L in school-aged children, 111 countries have sufficient iodine intake. Thirty countries remain iodine-deficient; 9 are moderately deficient, 21 are mildly deficient, and none are currently considered severely iodine-deficient. Ten countries have excessive iodine intake [2]. International efforts to control iodine-deficiency disorders are slowing, and reaching the third of the worldwide population that remains deficient poses major challenges [3].

It is estimated that almost half of Ethiopia's 80 million population faces iodine deficiency disorder (IDD), raising alarm in the Horn of Africa nation. Of the 35 million people at risk, 40 percent are believed to have contracted goiter, a swelling of the thyroid gland in the neck [4]. It is recommended that a total goiter rate or TGR (number with goiters of grades 1 and 2 divided by total examined) of 5% or more in schoolchildren 6 to 12 years of age be used to signal the presence of a public health problem. In 2005, the importance of IDD elimination was again recognized when the World Health Assembly adopted a resolution committing to reporting on the global IDD situation every three years [5].

Recent surveys using RTKs and verifying their results with titration find that they can distinguish adequately iodized salt (>=15ppm) from slightly iodized (<15 ppm) in areas with a high prevalence of salt iodization. However, in areas where prevalence of salt iodization is low RTKs should only be used to distinguish any salt iodization from no salt iodization due to low specificity. Improved Iodised salt test kit, for measuring iodine content of salt iodised/fortified with potassium iodate (KIO3). Because of their ease of use and low cost, UNICEF recommends them for qualitative and semi-quantitative assessment of salt iodization in household surveys or for spot checks of food quality [6].

A study done in Nepal, from August 2009 to July 2010 where salt iodine content was estimated by iodometric titrations and rapid test kit methods, the rapid test kits showed comparable results but they had variable specificities and negative predictive values. So, their primary use is in field studies, when a large number of salt samples need to be analyzed in a population [7]. The World Health Organization (WHO) and the Micronutrient Initiative state that in order to achieve

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sustainable elimination of iodine deficiency at least 90% of households must be using salt and that the salt must have an iodine content of 15 parts per million (ppm) or more. Because of their ease of use and low cost, UNICEF recommends them for qualitative and semi-quantitative assessment of salt iodization in household surveys or for spot checks of food quality [8].

According to DHS 2011 (Demographic Health Survey of Ethiopia) at national level 15 percent of HH were using iodized salt. Urban households are more likely to use iodized salt (23 percent) than rural households (13 percent). At the regional level Benishangul-Gumuz and Addis Ababa have the highest proportions of households using iodized salt (40 percent and 30 percent, respectively), whereas the Dire Dawa and Harari regions have the lowest (6 percent). Households in the highest wealth quintile are twice as likely to use iodized salt as households in the lowest two wealth quintiles [9]. Ethiopia launched a salt iodization program in 2011. The objective of this study was to evaluate the concentration of iodine in salt 2 years after the national proclamation that all salt for human consumption should be iodized [9].

Materials and Methods

The Benishangul-Gumuz is one of the nine regional states of Ethiopia, situated in the west part of the country. Its boundaries are three other regions and The Sudan. Assosa –the main town of the region is located 687 km away from Addis Ababa to the west. The estimated population of Assosa town was 30,146. The town comprises of 4 kebeles (the smallest administrative unit) with a total of 6,697 residential houses with an average 4.5 persons per HH, and young children accounted for 18.6% of the total population [10].

This cross sectional study was conducted during May 10-20/2012, when schools were temporarily closed, the source population was all people residing in the town during the survey and the sampling unit was households. The study population were all sampled households in which at least one child aged 6-12 years was residing.

The sample size was calculated using single proportion formula and prevalence of goiter 46.6% [10], margin of error 5%. This resulted in sample size of 383. Because the estimated total number of children aged 6-12 years in the town was 5607, using finite population correction formula the sample size was 359. Adding 10% to 359 for non-response, the final sample size required was 395. Taking into consideration the fact that young school children accounted for 18.6% of the total population and average household size of 4.5 [10], the calculated sample was allocated to each kebele proportional to the size of children aged 6-12 years. At each Kebele list of all house-numbers was obtained and house numbers were drawn using random number Table. The sampling frame is shown in Table 1

Regarding the instruments, interview of mothers/caretakers, and determination of thyroid size by palpation, testing of sample salt for iodine content using RTK for salt with potassium iodate.

The questionnaire used was that of field guide, and included personal information about the mother/caregiver, the child, socio-economic and demographic variables, knowledge, attitude and practices related to iodized salt, and Table for filling the result of thyroid examination. There was also separate data collection format for each HH on which results of salt iodine test.

Each HH was identified by the help of the guider and the presence of 6-12 children was first checked, if there was no school child aged 6-12 in HH, the next HH was included. At each household the mother/care giver was the respondent. One of the data collectors interviewed the mother/care taker and this same data collector proceeded to examine the child. In cases more than one child between ages of 6 to 12 years was present; in a household the elder one was included in the study. The thyroid size was graded according to the joint criteria of WHO/UNICEF/ICCIDD [1]. Meanwhile, the other data collector conducted salt iodine test using the same guide.

Eight data collectors, four males and four females who were school teachers and had previous experience, linguistic proficiency chosen. Also four guiders who work in respective kebele during the survey were included to help in identifying random households. Also the principal investigator served as supervisor. In order to ensure the quality of the data, training was given for the eight data collectors and four guiders for two days on the questionnaire, interview, and goiter examination. Also, practical session on interviewing, goiter examination and using bottles of 10-50 ml, containing a stabilized starch-based solution (Rapid test kits) for salt iodine test was demonstrated and practiced. Supervision was conducted by during data collection.

Data was analyzed using SPSS version 16. Data was cleaned coded and entered. Descriptive statistics for child related variables, mother/caregiver socioeconomic and demographic variables calculated. Response to KAP related with iodized salt was calculated that is:

- Proper Knowledge: If respondent answers 50% or more of the knowledge questions correctly, otherwise improper
- Proper attitude: If respondent answers 50% or more, based on six types of iodized salt related attitude inquiries correctly, otherwise improper
- Proper practices: If respondent shows 50% or more of the practice questions correctly, otherwise improper

Proportions of children with their respective grades were calculated, and proportion of HH with various salt iodine level were calculated. Bivariate analysis using goiter as dependent and child related variables as independent, goiter as dependent and mother/care giver related variables as independent, salt iodine level as dependent and child related variables as independent salt iodine level as dependent and mother/care giver related variables as independent done.

Ethical Clearance was given by the Ethical Committee of College of Public Health and Medical Sciences, letter of cooperation was written by Beni Shangul-Gumuz Regional Health Bureau to each kebele of the town and verbal consent obtained from each respondent.

Results

Socio-demographic description of children

A total of 395 children were included in the study of which 205(52.2%) were males. The mean age and standard deviation (SD) for the children was 8.86+2.01 years. The mean age (SD) of males and females was 8.85(2.02) and 8.87(2.04) respectively. The mean number (SD) of children between ages of 6 to 12 years per household was 1.29+0.67. The distributions are shown in Table 2.

Household characteristics

With regard to the socioeconomic, demographic character of HH, the mean age (SD) of mothers/caregivers was 31.38+ 7.74 years and ranged from 13 to 70 years. The average HH size (SD) was 5.28+1.9 and ranged from 2 to 13. Of the total respondents, 377 (95.4%) were

females with 15 (3.8%) of them household heads. HH characteristics are shown in Table 3.

Prevalence of goiter

The overall prevalence of goiter was 104(26.3%). The prevalence of goiter was found to increase with increasing age of the children. With regard to prevalence of goiter by age, sex, residence and number of children aged 6-12 years per HH, the prevalence of grade I &II goiter becomes equivalent within age 10-12. About 26(61.9%) of young children having grade I goiter and 41(66.1%) of young children having grade II goiter were residing in HH in which they were the only young child aged 6-12 years old respectively, as shown in Table 4.

Prevalence of goiter by household characteristics

The prevalence of goiter among HH with monthly income 800 or less Birr/month was 45(34.3%) while among HH with monthly income above 800 Birr per month was 59(22.5%). The prevalence among illiterate caregivers' HH was 21(27.3%) while among those of literate was 83(26.1%) as shown in Table 5.

Pattern of cassava consumption

Among all HH with the experience of cassava consumption, 40(63.5%) consumed not more than once a week and for a duration of not more than five years as shown in Table 6.

The overall proportion of HH with zero iodine content was 106(27.0%), and those with iodine content between zero and 15 PPM 208 (52.9%). Only 79 (20.1%) of HH fulfilled the national standard of >15 PPM. The distribution of adequately iodized salt and mother's sociodemographic characteristics is shown in Table 7.

When three levels of salt iodine were cross tabulated with goiter grades, there was tendency of aggregation of goiter to the lower level of salt iodine as shown below in Table 8.

With regard to child related variables age and residential area were significantly associated with the occurrence of goiter. This is shown in Table 9 below.

Regarding sociodemographic and economic factors associated

Kebele	Population			Number of HH	Number of 6-12	Sample
	Male	Female	Total			
01	4241	3862	8103	1801	1507	106
02	3079	2896	5975	1328	1111	78
03	4291	4172	8463	1881	1574	111
04	3701	3904	7605	1690	1415	100
Total	15312	14834	30146	6,700	5607	395

Table 1: Sampling.

Age group	Sex			M:F within age group
	Male No. (%)	Female No. (%)	Total No. (%)	
6	35(8.9)	32(8.1)	67(16.9)	1.09
7	32(8.1)	25(6.3)	57(14.4)	1.28
8	26(6.5)	28(7.1)	54(13.7)	0.93
9	24(6.1)	26(6.5)	50(12.7)	0.92
10	41(10.4)	30(7.6)	71(18.0)	1.37
11	20(5.1)	24(6.1)	44(11.1)	0.83
12	28(7.1)	24(6.1)	52(13.2)	1.17
Total	206(52.2)	189(47.8)	395(100)	1.09

Table 2: Showing distribution of children by one year age group and sex, Assosa town, Benishangul-Gumuz regional State May 2012.

Variable	No. (%)
Mother's/Caregiver's age group	
≤ 20	20 (5.1)
21-25	73 (18.7)
26-30	119 (30.4)
31-35	90 (23.0)
36-40	59 (15.1)
41-45	13 (3.3)
46-50	9 (2.3)
51-55	3 (0.8)
≥ 56	5 (1.3)
Total	391(100)
Marital status of the Caregiver	
Married	373 (94.4)
Unmarried	2 (0.5)
Divorced	5 (1.3)
Widowed	15 (3.8)
Total	395 (100)
Ethnicity of Caregiver	
Amhara	178 (45.1)
Oromo	94 (23.8)
Berta*	82 (20.8)
Tigre	17 (4.3)
Others	8 (2.0)
Shinasha*	6 (1.5)
Gurage	5 (1.3)
Gumuz*	4 (1.0)
Total	395 (100)
Religion of Caregiver	
Orthodox	189 (47.8)
Muslim	146(37.0
Protestant	50 (12.7)
Catholic	9 (2.3)
Other	1 (0.3)
Total	395 (100)
Household size	
2-5	250 (63.3)
6-13	145 (36.7)
Total	395 (100)
Monthly Family income(Birr/month)	
≤ 400.00	31 (7.8)
401.00-800.00	101 (25.6)
801.00- 1600.00	142 (35.9)
1601.00-3000.00	56 (14.2)
>= 3001.00	65 (16.5)
Total	395 (100)
Mother's Occupation	
House wife	274 (70.1)
Private organization worker	84 (21.5)
Trader	13(3.3)
Others	20(5.2)
Total	391(100)
Father's Occupation	
Government employee	190 (50.0)
Daily laborer, minor works, etc	51 (13.4)
Merchant	43 (11.3)
Farmer	22 (5.8)
Minor business	21 (5.5)
Others	64 (16.3)
Total	391(100)
Mother's Educational Level	
Illiterate	77 (19.5)
< 6th Grad	68 (17.2)
≥ 6th Grad and above	250 (63.3)
Total	395 (100)
Father's Educational Level	
Illiterate	32 (8.1)
< 6th Grad	54 (13.7)
≥ 6th Grade	309 (78.2)
Total	395(100)

Table 3: Showing Household Characteristics, Assosa town, Benishangul-Gumuz Regional State, May 2012.

SDV	Goiter			
	Yes		No	Total
	Grade I	Grade II		
Age				
6-9	12(3.0)	28(7.1)	188(47.6)	228(57.7)
10-12	30(7.6)	34(8.6)	103(26.1)	167(42.3)
Total	42(10.6)	62(15.7)	291(73.7)	395(100)
Sex				
Male	20(5.0)	35(8.9)	151(38.2)	206(52.2)
Female	22(5.6)	27(6.8)	140(35.4)	189(47.8)
Total	42(10.6)	62(15.7)	291(73.7)	395(100)
Kebele				
01	18(4.5)	18(4.5)	70(18.0)	106(26.8)
02	7(1.8)	12(3.0)	59(14.9)	78(19.7)
03	12(3.0)	25(6.3)	74(18.7)	111(28.1)
04	5(1.3)	7(1.8)	88(22.3)	100(25.3)
Total	42(10.6)	62(15.7)	291(73.7)	395(100)
Child 6-12/HH				
1	26(6.6)	41(10.4)	233(59.0)	300(75.9)
≥2	16(4.0)	21(5.3)	58(14.7)	95(24.1)
Total	42(10.6)	62(15.7)	291(73.7)	395(100)

Table 4: Showing Distribution of Goiter Grade by age, sex, residence and number of 6-12/HH, Assosa town, Benishangul Gumuz Region. May 2012.

SDV	Goiter		
	Yes	NO	Total
Age of Mother			
<30	50(12.8)	162(41.4)	212(54.2)
>30	54(13.8)	125(31.9)	179(45.8)
Total	104(26.6)	287(73.4)	391(100)
Kebele			
01	36(9.1)	70(17.7)	106(26.8)
02	19(4.8)	59(14.9)	78(19.7)
03	37(9.4)	74(18.7)	111(28.1)
04	12(3.0)	88(22.3)	100(25.3)
Total	104(26.3)	291(73.7)	395(100)
Marital Status			
Married	97(24.6)	276(69.9)	373(94.4)
Others	7(1.8)	15(3.8)	22(5.6)
Total	104(26.3)	291(73.7)	395(100)
Ethnicity of Mother			
Non indigenous	76(19.2)	227(57.5)	303(76.7)
Indigenous	28(7.1)	64(16.2)	92(23.3)
Total	104(26.3)	291(73.7)	395(100)
Religion of Mother			
Christians	63(15.9)	186(47.1)	249(63.0)
Moslems	41(10.4)	105(26.6)	146(37.0)
Total	104(26.3)	291(73.7)	395(100)
Household Size			
2-5	57(14.4)	193(48.9)	250(63.3)
6-13	47(11.9)	98(24.8)	145(36.7)
Total	104(26.3)	291(73.7)	395(100)
Mother's Occupation			
Housewife	73(18.5)	194(49.1)	267(67.6)
Other	31(7.8)	97(24.6)	128(32.4)
Total	104(26.3)	291(73.7)	395(100)
Father's Occupation			
Govt. Employee	46(11.6)	146((37.0)	192(48.6)
Other	58(14.7)	145(36.7)	203(51.3)
Total	104(26.3)	291(73.5)	395(100)
Income(Birr/month)			
≤800	45(11.4)	86(21.9)	131(33.3)
>800	59(15.0)	203(51.6)	262(66.7)
Total	104(26.4)	289(73.5)	393(100)
Mother's Education			
Illiterate	21(5.3)	56(14.2)	77(19.5)
Literate	83(21.0)	235(59.5)	318(80.5)
Total	104(26.3)	291(73.5)	395(100)
Father's Education			
Illiterate	13(3.3)	19(4.8)	32(8.1)
Literate	91(23.0)	272(68.9)	363(91.0)
Total	104(26.3)	291(73.5)	395(100)
Ever consumedCassava?			
Yes	20(5.0)	43(10.9)	63(15.9)
No	84(21.3)	248(62.8)	332(84.1)
Total	104(26.3)	291(73.5)	395(100)
Salt Iodine			
<15PPM	89(22.5)	227(57.5)	316(80.0)
≥15PPM	15(3.5)	64(16.2)	79(20.0)
Total	104(26.3)	291(73.5)	395(100)

Table 5: Showing Prevalence of goiter by Household Characteristics, Assosa town, Benishangul Gumuz Region. May 2012.

Duration	Frequency		
	≤ One per week	One or more per week	Total
Less than Five Years	40(63.5)	10(15.8)	50(79.4)
Five or more Years	4(6.3)	9(14.3)	13(20.6)
Total	44(69.8)	19(30.1)	63(100)

Table 6: Showing frequency and duration of cassava use, Assosa town, Benishangul Gumuz Region., May 2012.

Variable	<15 PPM	>15PPM	Total
Mother's age			
<30	171(44.0)	40(10.3)	211(54.2)
>30	139(35.7)	30(10.0)	178(48.8)
Total	310(79.7)	79(20.3)	389(100)
Kebele			
01	81(20.5)	25(6.3)	106(26.8)
02	75(19.0)	3(0.76)	78(19.7)
03	90(22.9)	21(5.3)	111(28.1)
04	70(17.7)	30(7.6)	100(25.3)
Total	316(80.0)	79(20.0)	395(100)
Marital Status			
Married	295(74.7)	78(19.7)	373(94.4)
Other	21(5.3)	1(0.25)	22(5.6)
Total	316(80.0)	79(20.0)	395(100)
Ethnicity of Mother			
Non Indigenous	234(59.2)	69(17.5)	303(76.4)
Endogenous	82(20.8)	10(2.5)	92(23.3)
Total	316(80.0)	79(20.0)	395(100)
Religion of Mother			
Christians	187(47.3)	62(15.7)	249(63.0)
Moslems	129(32.7)	17(4.3)	146(37.0)
Total	316(80.0)	79(20.0)	395(100)
HH size			
2-5	200(50.6)	50(12.7)	250(63.3)
6-13	116(29.4)	29(7.3)	145(36.7)
Total	316(80.0)	79(20.0)	395(100)
Mother's Occupation			
Housewife	234(59.2)	50(12.7)	267(67.6)
Other	82(20.8)	29(7.3)	128(32.4)
Total	316(80.0)	79(20.0)	395(100
Father's Occupation			
Government Emp.	137(34.7)	55(13.9)	192(48.6)
Other	179(45.3)	24(6.1)	203(51.4)
Total	316(80.0)	79(20.0)	395(100)
Income(Birr/month)			
≤800	124(31.5)	7(1.8)	131(33.3)
>800	190(48.3)	72(18.3)	262(66.7)
Total	314(79.8)	79(20.1)	393(100)
Mother's Education D			
Illiterate	75(19.0)	2(0.5)	77(19.5)
Literate	241(61.0)	77(19.5)	318(80.5)
Total	316(80.0)	79(20.0)	395(100)
Father's Education D			
Illiterate	30(7.6)	2(0.5)	32(8.1)
Literate	286(72.4)	77(19.5)	363(91.9)
Total	316(80.0)	79(20.0)	395(100)
Knowledge			
Improper	75(19.0)	18(5.5)	93(23.5)
Proper	241(61.0)	61(15.4)	302(76.5)
Total	316(80.0)	79(20.0)	395(100)

Attitude			
Improper	154(39.0)	2(0.5)	156(39.5)
Proper	162(41.0)	77(19.5)	239(60.5)
Total	316(80.0)	79(20.0)	395(100)

Table 7: Adequately iodized salt Use and Mother's Sociodemographic Characteristics of Respondents, Assosa town, Benishangul Gumuz Region. May 2012.

Goiter Grade	Iodine level			
	Zero	<15	>15	Total
Grade II	14	25	3	42
Grade I	23	35	4	62
No Goiter	66	159	66	291
Total	103	219	73	395

Table 8: Showing Cross Tabulation of Goiter and Iodine among HH, Assosa town, BenishangulGumuz Region. May 2012.

Variable	Goiter Yes, No. (%)	COR,95%CI P	AOR,95%CI P
Age			
6-9	40(17.5)	1	1
10-12	64(38.3)	2.92[1.84,4.64] 0.000	2.2[1.31,3.68] 0.003*
Sex			
Female	49(25.9)	0.961[0.61,1.50] 0.862	1.02[0.64,1.63] 0.931
Male	55(26.7)	1	1
Kebele			
01	36(34.0)	0.26[0.13,0.55] 0.000*	0.321[0.12,0.676] 0.003*
02	19(24.4)	0.42[0.19,0.94] 0.034*	0.446[0.198,1.006] 0.052
03	37(33.3)	0.273[0.13,0.6] 0.000*	0.34[0.172,0.770] 0.008*
04	12(12.0)	1	1
Child(6-12/ HH)			
1	67(22.3)	2.22[1.35,3.64] 0.002*	1.440[0.806,2.572] 0.218
≥2	37(38.9)	1	1

Table 9: Child Factors Associated with Goiter, Assosa town, Benishangul Gumuz Region. May 2012.

with goiter, only income was associated with goiter, however upon substitution of the salt iodine variable (<15 vs. 15 or more) with three level (no iodine, above zero but below 15, and 15 or more) the statistically significant association of each of two levels- no iodized and iodine level above zero and below 15) became clear, as shown in Table 10.

Almost all of the sociodemographic and economic variables were significantly associated with adequately iodized salt in HH. However upon adjustment, only income and maternal literacy wee statistically significant. The number of H with household size of two was small (only three), as shown in Table 11.

Discussion

In this study the overall prevalence of goiter was 104 (26.8%). The prevalence tended to rise with increasing age. The prevalence of grade I and Grade II become equivalent within age group is 10-12. The prevalence also varied with residence. Based on the national standard, the prevalence of HH having adequately iodized salt was 73(18.5%). This prevalence also varied with residence [11-15].

A study conducted in Nepal revealed the adequacy of RTK for community survey by showing that RTK had sensitivity 84.8%, 95% CI [82.0 – 88.0], a specificity of 68.3%, 95% CI [59.0 - 77.0], a positive predictive value of 92.7%, 95% CI [92.0 – 94.0] and a negative predictive value of 48.6%, 95% CI [40.0 – 57.0] as compared to the values of the iodometric titration [16-20]. Based on iodometric titration method, there was no salt sample with zero iodine level in the whole 707 samples) in the Nepal study, however.

About 97(93.3%) of children with goiter were residing at HH with inadequately iodized salt (<15PPM).

Low income, maternal illiteracy, improper knowledge, and improper attitude about iodized salt were significant social factors in salt iodine based on the national standard. However even among high income, literate, proper knowledge and proper attitude majority were not using salt iodine>15PPM. This may indicate need for elaborate accessibility and availability and "visibility" of iodized salt.

Conclusion

- The prevalence of goiter increases with age
- There is significant variation in prevalence of goiter and/or level of iodized salt consumption between residences.
- There is congregation of goiter cases at HH with inadequately iodized salt.
- The national standard obscures valuable information by sharply dividing the scale as "above" and "below".

Recommendation

- Simultaneous study of goiter and ISU facilitates prevention and/or treatment by indicating current conditions and improving targeting.

HH Character	Goiter COR,95%CI	P	Goiter AOR, 95%CI	P
Maternal Age ≤30	1.36[0.87,2.13]	0.18	1.380[0.847,2.249]	0.196
Ethnicity endogenous	0.77[0.46,1.23]	0.32	0.706[0.330,1.12]	0.370
Religion Moslem	0.87[0.55,1.39]	0.56	1.112[0.583,2.163]	0.730
Household Size 2-5	0.35[0.05,2.54]	0.30	0.174[0.013,2.245]	0.180
MOC Housewife	0.83[0.51,1.38]	0.48	1.061[0.597,1.887]	0.839
FOC Govt. Employee	1.21[0.76,1.92]	0.41	0.936[0.529,1.657]	0.820
Income <800Birr/month	0.56[0.35,0.89]	0.01*	0.524[0.290,0.949]	0.033**
Mother Illiterate	0.84[0.49,1.45]	0.53	1.331[0.683,2.592]	0.400
Father Illiterate	0.49[0.23,1.03]	0.06	0.675[0.289,1.574]	0.363
Cassava consume	1.37[0.76,2.45]	0.288	1.021[0.480,2.171]	0.957
˙Salt Iodine <15PPM	1.84[0.98,3.44]	0.058	1.735[0.872,3.449]	0.116
Non iodized (zero)	0.19[0.08,0.45]	0.000*	0.202[0.081,0.501]	0.001**
Above zero &<15	0.28[0.12,0.65]	0.003*	0.326[0.36,0.781]	0.012**
15 or more	1		1	

Table 10: Household characteristics Associated with Goiter, Assosa town, Benishangul Gumuz Region. May 2012.

HH Character	Salt Iodine <15PPm COR,95%CI	P value	Salt Iodine <15 PPM AOR, 95%CI	P- Value
Maternal Age ≤30	0.847[0.517,1.388]	0.509	1.039[0.595,1.813]	0.893
Ethnicity Non endogenous	0.408[0.201,0.830]	0.013˙	0.631[0.257[1.548]	0.314
Religion Christian	0.391[0.219,0.700]	0.002˙	0.726[0.350[1.507]	0.391
Household Size 2-5	1.837[0.981,3.440]	0.058	3.950E-009	
MOC Housewife	0.345[0.207,0.574]	0.000˙	0.585[0.331,1.034]	0.065
FOC Govt. Employee	3.003[1.754,5.139]	0.000˙	1.551[0.827,2.908]	0.171
Income <800Birr/ month	0.149[0.06,0.334]	0.000˙	0.347[0.142,0.850]	0.002˙˙
Mother Illiterate	0.081[0.020,0.339]	0.001˙	0.193[0.044,0.844]	0.029˙˙
Father Illiterate	0.111[0.015,0.823]	0.032˙	0.436[0.03,3.620]	0.442

Table 11: Factors associated with adequately iodized salt, Assosa town, Benishangul Gumuz Region. May 2012.

- Appropriateness of the national standard for local should be evaluated.
- Means of recognizing adequately iodized salt by consumers should be evaluated and/or created
- Further study of social forces which play role in past and present consumption level are recommended

Limitations

- Measurement error of social variable, role of cassava consumption, alternative sources of iodine,
- Reversibility of goiter/"egg or chicken phenomena"
- Assessment of urinary iodine concentration

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