

**Level of Concentration of Iodine in Salt and proper Utilization Methods at House Hold and Associated Factors in Selected District of Arsi zone Ethiopia 2016.**

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**Abstract**

**Introduction:** When iodine intake falls below recommended levels due to various factors, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormone. Survey made by Ethiopian public health institute, of the total population, 26% have endemic goiter and more than 62% are at risk of Iodine deficiency disorder.

**Objectives:** To assess level of concentration of iodine in salt and proper utilization at house hold level and associated factors in Arsi Zone, Ethiopia 2016.

**Methods:** A community-based cross-sectional study implemented among communities of Arsi zone. Data entry and analyses were carried out using Epi info version 3.5.4 and SPSS version 20, respectively. Bivariate and multivariate logistic regression analysis was performed significant level and association of variables tested by using 95% confidence interval (CI) and odds ratio. And P-value less than 0.05 was considered as statistically significant.

**Result:** a total of 681 participants were participated. The availability of adequately iodized salt ( $\geq 15$  parts per million) in the study area 14.4% and

52.7% House hold salt samples have iodine levels below the minimum slandered set by the quality and standard authority of the country. Sixty six percent of the respondent adds salt in the early beginning and in the in middle of cooking. Multivariate analysis showed that using ever heard about iodine salt 2.2 (AOR (95% CI) = 2.2 (1.08, 4.29)), Having goiter problem (AOR (95% CI) = 2.7 (1.48, 5.23)), utilizing for long time (AOR (95% CI) = 3.18 (1.7, 5.9) were determinant factors for availability of adequately iodized salt at household level.

**Conclusions.** Level of iodine concentration in salt at house hold level was very low. Therefore, communities in the study area should be sensitized about importance of iodized salt and its proper handling at the household level.

**Key word:** iodine concentration; proper utilization; House hold; Arsi zone; Ethiopia

### **Introduction**

Nutritional disorders are among the main cause of morbidity and mortality in developing countries including Ethiopia. The major problems are protein-energy malnutrition and micronutrient deficiencies such as iodine deficiency disorder (WHO, 2004).

Iodine deficiency disorder remains significant public health problem in many countries. Recent studies have shown that over 200million people in the world are affected by the most visible symptoms of iodine deficiency disorder (UNICEF, 2013). Globally, 30%of the world's populations is affected by Iodine deficiency disorder (IDD) and more than 150,000million people are affected in Africa alone. In Ethiopia, one out of every 1000 is cretin, and about 50,000 peri-natal death are occurring annually due to iodine deficiency disorder, 26% of the total population have goiter and 62% of the

population is at risk of Iodine deficiency disorder. According to national survey made by the previous Ethiopian public health nutrition institute (UNICEF).

According to the study conducted by .C.Winssu, 2008 ,in some pocket areas of the country, the prevalence of goiter is found to be 50-95% (considers that if the goiter rate is above 5% in the population it is a public health problem). From the various survey conducted in many parts of Ethiopia, IDD has become one of the biggest public health concerns. From range of surveys of goiter prevalence showed that it is getting hold of the upper hand of micronutrient deficiency with particular predilection to the highlands and inland areas with the prevalence ranging from 0.4% to 63%. The number of cretins was estimated to be 37,000 (Wisnu C, 2008).

It is well documented that the sustainable elimination of IDD requires a strong will, wider awareness and cooperation among those who hold the key to the solution to this problem, for the effective implementation of any control program, and for its success, it is essential that people's access to iodized salt be ensured (Gondar Town, 2012). There is also need to increase IDD awareness among the public in order to create demand for iodized salt and strong participation in IDD activities, the study was envisaged because of the observation by clinical staff that hyperthyroidism seemed common in rural people from the Eastern Free State, and the speculation was that this was perhaps due to iodine deficiency (Toba Tek).

During HSDP IV, the MOH developed and implemented the National Nutrition strategy and Program to tackle this micronutrient deficiency disorders, in addition, MOH create health education strategy through mass-media to increase awareness on utilization of iodized salt by the citizen. However, in spite of these efforts the achievement of the program is not as

expected, for instance, according to the Ethiopian Demographic and Health Survey (EDHS) 2011, only 15.4 percent of the households were using iodized salt. Beside this there is no specific studies that show the factors for underutilization of iodized salt in study area (EDHS, 2011). Therefore, it is crucial to assess level of concentration of iodine in salt and proper utilization methods at household level and associated factors in selected woredas of Arsi zone, Oromia Region, Ethiopia.

Objective of this study is to assess level of concentration of iodine salt at household level and associated factors in selected woredas of Arsi zone, Oromia region, Ethiopia 2016.

## **Methodology**

### **Study Area and period**

The study was undertaken in Arsi Zone Oromia region, Ethiopia from May 2016 to June 2016. Asella is the capital town of Arsi Zone, which is located 175kms South East of Addis Ababa. Administratively, the zone is divided into 24, woredas and 2 administrative towns (Assela town-the capital of the zone which is located 175 km South east of Addis Ababa and Bokoji town) away from having an area of 23,679.7km<sup>2</sup>. Based on 2007 Housing and population census, the total population of Arsi was projected to be 3,280,667 million in 2016, of which 90% of the population is estimated to be rural residents. The average altitude ranges from 1700 to 4000 meters above sea level. The average temperature varies from 10 to 24<sup>0</sup>C. Muslim and orthodox Christians are the two predominant religions in the district. Agriculture is the main economic source of the population. Since these areas is fall under high attitude prevalence of goiter is a little beat higher compared to another zone.

**Study design:** A community based cross-sectional study design was carried out to assess Level of iodine concentration in salt and associated factors for the proper utilization of iodized salt at household level

**Target population:** All households in Arsi Zone Oromia region are the target population.

### **Sampling technique**

Multi-stage sampling technique was carried out. Simple random sampling technique was applied for woredas and kebeles and systematic random sampling was applied for households and then food handlers in selected households was interviewed using structured questioner for availability and utilization of iodized salt in the household. Furthermore, one tea spoonful of salt from each household had been taken and tested using rapid test method.

### **Sample size:**

Sample size (n) required for this particular study was determined by using single population proportion (p) by taking the proportion of iodine salt utilization which was 29% and 5% level of significance and 5% margin of error the sample size was 294, by considering 10% non response rate and design effect of two the final sample size was 695

### **Data collection tools**

Data was collected using structured questionnaire by face to face interviewing technique. The data collectors for this survey were Nurses and Health officers who are graduated from Arsi University but not employed to any health institution during the survey was used. The questioner was contained information on socio-demographic/economic characteristics, educational status, knowledge, environmental factors, and availability and utilization of iodized salt. To assess the use of adequately iodized salt at the

household level, interviewers were asked the residence of the households to provide a teaspoon of salt used for cooking. The salt was tested for iodine using the rapid test kit methylene benzimidazole (MBI Kits International).

**Quality control measure:**

The quality of data was controlled starting from the time of questionnaires preparations. The questionnaire was developed by reviewing relevant literatures on the subject to ensure reliability. First the questionnaire which was prepared by English was translated into Afaan Oromo. To ensure the consistency of the tool it was translated back to English by different people (Experts) who are fluent in English language. Training was given for supervisors and data collectors on the purpose of study and procedures of data collection for 2 days prior to study. After completing the training, trainees were conducted a pre-test at non study health facility.

Finally, we discussed on problem they encountered during pre-test like redundancy of words and flow of idea and Correction measures were taken by discussing with the research team. During data collection, the supervisor was received questioners from data collectors and review for completeness, accuracy, and consistency. Validity and reliability of the rapid test kit (MBI Kits International) was checked using standard and labeled salt sample.

**Variables of the study****Dependent variables**

Utilization of adequately iodized salt at household level

**Independent variables**

*Socio economic and demographic factors*

History of pregnancy, child birth any still birth, thyroid problems such as goiter.

Iodine sources, iodized salt and use, consequences of IDD in pregnant women, children and adults

Type of salt used, date and month of manufacturing.

Iodized salt or plain salt, brand of salt.

Method of storage and iodine level of household salt in PPM (parts per million)

**Data management and analysis**

After data collection, each questionnaire was checked for completeness and consistency by supervisors at spot. The data was entered by Epi info version 3.5.3 statistical package and then transferred to SPSS version 20 for analysis. Association between dependent and independent variables were entered in to multiple logistic regression. Variables having P – value  $\leq 0.2$  in the bivariate analysis was entered in to multiple logistic regression model for control of confounding. Odds ratio with 95% CI was used to show association. P value of  $< 0.05$  was considered statistically significant in the multivariate analysis. Adequately iodized salt at household level was defined as salt sample which has  $\geq 15$  parts per million of iodine. Participants who scored above the mean for the knowledge questions is considered as having good knowledge about iodized salt utilization.

**Ethical Issues:**

An ethical clearance was obtained from Arsi University, Moreover, Supportive letter was given from Arsi zonal Health department, woreda administrative, and Keble Administrative respectively. Finally, the objective of the study and the procedure was explained to the study participants that no harm was happen on them when the study was conducted. Norm of the community was considered and respected in the process. Information from the respondent was treated confidentially (Name of the study participant or the household was not mentioned in the research process or information obtained from the household is kept secret and used only for this research).

## Result

### Socio demographic characteristic of the study subjects

A total of 681 study subjects were included in this study with the response rate of 98%. The mean age and standard deviation of the study subjects was 38 years  $\pm$  12.49 years. Of six hundred eighty-one respondents, 492(72.2%) were Oromo by ethnicity, regarding religion 411 (60.4%) were Orthodox Christians. Concerning marital status 474 (69.6%) were married and followed by widowed which accounts 12.2% and around 55.8% of study subjects were came from rural area. Around four hundred (58.7%) were housewives, and 180 (26.4%) had attended secondary school level in education. Three hundred nine (57.5%) of them have family size 2- 5, and monthly income 185(27.2%) of participants had 501-1000 Ethiopian Birr (Table 1).

Table 1: Socio demographic characteristics of participants at selected woredas of Arsi Zone, Ethiopia, 2016.

Variable	Frequency	Percentage
<b>Sex</b>		
Male	57	8.4
Female	624	91.6
<b>Age</b>		
18–24	69	10.1
25–34	203	29.8
35–44	187	27.5
45–54	121	17.8
55–64	75	11
$\geq 65$	26	3.8
<b>Residence</b>		
Urban	301	44.2
Rural	380	55.8



<b>Ethnicity</b>		
Oromo	492	72.2
Amhara	160	23.5
Tigrie	15	2.2
Gurage	11	1.6
Others	3	0.4
<b>Religion</b>		
Protestant	143	21
Orthodox	411	60.4
Muslim	126	18.5
Catholic	1	0.1
<b>Marital status</b>		
Single	57	8.4
Married	47	69.6
divorced	42	6.2
Widowed	85	12.5
Separated	23	3.4
<b>Educational status</b>		
Cannot read and write	234	34.4
Can read and write only	81	11.9
Elementary Grades 1–8	180	26.4
Secondary high school	89	14.5
College and above	87	12.8
<b>Occupation</b>		
Farmer	86	12.6
Housewife	400	58.7
Government employee	83	12.2
Private employ	77	11.3
Unemployed	24	3.5
Others	11	1.6
<b>Income</b>		
<500	174	25.6
501-1000	185	27.2
10001–2000	183	26.9
2001–3000	72	10.6
>3000	67	9.8
<b>Family size</b>		
<2	122	18
2- 5	309	45.4
>5	250	36.7

### Knowledge, of study participants regarding iodine salt utilization

Concerning knowledge of study participant about iodine salt utilization, nearly half (50.7%,) of study participants had good knowledge of iodized salt utilization. From this, more than half them (59.4%) pointed out that iodine salt is important to prevent goiter. About 34.9% of respondents did not know the effects of iodine deficiency, 46.2% reported that the taste of iodized salt is different from that of common salt (Table2). Concerning source of information on iodized salt, 36% of the respondents obtained information from health care workers.

Regarding of goiter and its cause, more than half of study subjects (58.9%) ever heard of goiter and around 33.6% of them indicted that goiter come from iodine deficiency. All most around 59.4 % of study participant mentioned that goiter is preventable by eating iodized salt.

Table 2 Knowledge of study participants regarding iodine salt utilization in selected woredas of Arsi Zone, Ethiopia, 2016

<b>Variable</b>	<b>Frequency</b>	<b>percentage</b>
<b>Ever heard about iodine deficiency</b>		
Yes	345	50.7
No	336	49.3
<b>Source of information</b>		
From health care workers	196	36
From TV and Radio	159	29
From relatives/friends	69	12.7
From children	30	5.5
From newspapers/magazines	9	1.7
Other	80	1.5
<b>Do think that long time deficiency of iodine has effect on your body</b>		
Yes	55	8.1
No	338	49.6
I don't know		

<b>how do you personally prevent iodine deficiency disorder in your family</b>		
By eating vitamins	22	6.4
I use iodized salt	206	60
I use foods enriched by animal products	28	8
Avoiding of eating cabbage and 'boyee'	5	1.4
cleaning the surrounding	77	22.4
Do not know	6	1.7
<b>Effect of iodine deficiency on health</b>		
Goiter	229	40
Mental retardation	34	6
Cretinism	22	38
Abortion	9	1.6
Do not know	200	34.9
Others	79	13.8
<b>Ever heard of goiter</b>		
Yes	401	58.9
No	280	41.1
<b>What are the possible causes of goiter?</b>		
From iodine deficiency	260	33.6
Hereditary	121	15.6
From infection	23	0.3
From poisoning	107	13.8
From evil	96	12.4
Others	167	21.6
<b>Is it possible to prevent iodine deficiency</b>		
Yes	405	59.4
No	133	19.5
Don't know	144	21.1
<b>Have you ever heard about iodized salt?</b>		
Yes	316	46.3
No	365	53.7
<b>Source of information</b>		
From health care workers	196	36
From TV	159	29
	69	12.7

Radio	30	5.5
From relatives/friends	9	1.7
From newspapers/magazines	80	1.5
Do not know		
<b>Do you or your family members have goiter?</b>		
Yes	33	4.8
No	648	95.2
<b>In your opinion, do all types of salt have iodine?</b>		
Yes	80	11.7
No	307	45
Do not sure	281	43.2

**Iodine Level of Laboratory result in salt among household respondents**

Six hundred eighty one respondents were gave sample salt from their home, almost 359 (52.7%) of the respondents consumed salt with an iodine level of zero PPM and, whereas 32.9% utilized salt with an iodine content of less than 15 PPM and 14.4% of respondents were consumed iodine level of > 15 PPM respectively, as shown in Table 4.

Table 4: laboratory result of iodized concentration in salt among house hold respondents in Arsi zone 2016

<b>Variable</b>	<b>frequency</b>	<b>percentage</b>
<b>Would please give us two cups of salt</b>	681	100
Yes	0	0
No		
<b>Lab result of tested salt on titration</b>		
Zero ppm	359	52.7
<15 ppm	224	32.9

>15 ppm	98	14.4
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### Practice about iodine salt utilization

Fifty five percent of the households used iodized packed salt, out of which 14.4% was adequately iodized. The main reasons for not using packed iodized salt were lack of awareness (69%), being expensive (16.6%), unavailability (4.8%), being less salty (9.2%). Only few (7.2%) respondents exposed the salt to sunlight, 74.9% of the salt containers had cover and, 68.7% of the respondents store the salt in a dry place. Around 1.6% of study participants store the salt for more than six months at household after purchase. Nearly 34% of the study participants usually add salt late at end of cooking and after cooking, while 65.9% add salt in the early beginning and in the middle of cooking (Table 3)

Table 3 Practice about iodine salt utilization among study participants in selected woredas of Arsi Zone, 2016.

Variable	Frequency	Percentage
<b>In your opinion how they can verify the quality of the salt?</b>	363	53.3
Whitish color	217	31.9
Good taste	76	11.2
Powdered	25	3.6
Others		
<b>If they had a choice which salt would they buy?</b>	462	68.5
Iodized	114	16.9
Non-iodized	37	5.5
No preferences	68	9.1
Do not know		

<b>Why they don't use iodized salt</b>		
Do not know the benefit	152	22.3
It is expensive	113	16.6
Not available	34	4.8
It is tasteless	63	9.2
No adequate information	319	46.8
<b>Use of iodized salt to preserve food?</b>		
Yes	161	23.6
No	434	63.7
I do not preserve food	21	3.1
I do not know which type of salt do I use	65	9.6
<b>What type of salt do they buy ?</b>		
Unpacked (by weight)	303	44.5
Packed	378	55.5
<b>Place of salt storage</b>		
Dry place	468	68.7
Moisture area	196	28.8
Fire area	16	2.3
Exposed to sun light	1	0.1
<b>Do you think that Iodine changes taste of the salt?</b>		
Yes	260	38.2
No	421	61.8
<b>Duration of salt storage at household level</b>		
< 1 week	95	14
1 weeks-4 weeks	575	84.4
5 weeks-9 weeks	10	1.5
> 10 weeks	1	0.1
<b>What type of salt storage do you use?</b>		
Storage with cover	510	74.9
Storage without cover	93	13.7
Salt bag	71	10.4
Others	7	1

<b>Do you expose salt to sun light?</b>		
Yes	49	7.2
No	632	92.8
<b>How often do you buy salt?</b>		
Once in a week	353	51.8
Once in a month	320	47
Quarterly	8	1.2
<b>When do add salt to food?</b>		
at the beginning	211	31
in between cooking	238	34.9
at the end	223	32.7
on the food servings	9	1.3

### **Factors Associated with iodine concentration level in salt at household level**

The analysis on the presence of association between suspected factors and availability of adequately iodized salt discovered the following result. Being male respondent, ever heard about iodine salt, being goiter is common in the area, duration of salt utilization at home, and knowledge were significantly associated with availability of adequately iodized salt during bivariate analysis.

But only those respondents ever heard about iodine salt, goiter is common problem around their family, and longer duration of salt utilization at home, were significantly associated with availability of adequately iodized salt during multivariate analysis. Accordingly, those who ever heard about iodized salt were 2.6(AOR (95% CI) = 2.2 (1.08, 4.29)) times more likely to have adequately iodized salt than those who have no information about iodized salt. Those who have goiter problem in the family were 2.7(AOR (95% CI) = 2.7 (1.48, 5.23)) times more likely to have adequately iodized salt than those who have no such problem in their family. Long time iodized salt utilization of at home was identified as one of the associated factors for

having adequately iodized salt. Those who utilize salt for greater than five years at household level were 3.18 (AOR (95% CI) = 3.18 (1.7, 5.9) times more likely to use adequately iodized salt than those who were using more than five years others were depleted in (Table5).

Table 5: Factors Associated with iodine concentration level in salt at household level Arsi Zone 2016

Variables	Iodine concentration of salt at household level		Crude OR (95% CI)	Adjusted OR (95% CI)
	<15ppm	>15ppm		
<b>Sex of HH</b>				
Female	195	21	1.8(1.04, 3.07)*	1.3(0.73, 2.43)
Male	388	77	1	1
<b>Residence</b>				
Urban	250	51	0.69(0.45, 1.06)	0.73(0.35,1.49)
Rural	333	47	1	1
<b>Ever heard About Iodine salt</b>				
Yes	315	19	4.9(2.9, 8.3)*	2.2(1.08,4.29)**
No	266	79	1	1
<b>Goiter common problem</b>				
Yes	315	67	2.2(1.3, 3.7)*	2.7(1.48,5.23)**
No	63	30	1	1
<b>Year started to use iodine salt</b>				
>=5year	203	23	1.74(1.05,2.86)*	3.18(1.7,5.9)**
<5year	380	75	1	1
<b>Family Income</b>				
<1000	323	36	12.14(1.37, 3.39)*	.696(.41, 1.17)
>=1000	260	62	1	1



**Discussion**

This community-based study tried to expose the overall iodized salt utilization rate in study area. Even if the proportion of households consuming iodized salt is increasing after the start of a national program, the present study result showed that 14.4% of households have utilized adequately iodized salt which was very far lower than WHO's recommendation according to which 90% of the households should have to utilize adequately iodized salt to eliminate iodine deficiency disorder (Jooste PL et al, 2001).

Nevertheless, the observed percentage was a little bit higher from EDHS 2011 report and the national coverage of iodized salt in rural households (13.3%), Tigray region (22.3%). Somalia (7.7%) (Gidey B et al; WHO 2008). This improved rate of availability of adequately iodized salt in our study may be due to implementation of more effective strategies in the production and distribution of iodized salt at the retailer level to enhance universal salt iodization program by the Ethiopian Ministry of Health in the last few years. However, still the household use of iodine salt in our study is lower than study conducted in south Africa (62.4%), and Belgaum (50%) (Jooste PL et al, 2001; Ebrahim S, 2012). Therefore, collaborative effort should be strengthened further to access and utilize households adequately iodized salt in this study area.

Utilizing packed salt at the household level was significantly associated with availability of adequately iodized salt. A study conducted in Canada showed that iodine content of the salt remained constant and its distribution remained uniform for many months when the salt is packed and kept dry, preferably in cool place and away from strong light (Davidson W, 2005). A different study conducted in Iraq showed that packed salt was mostly adequately iodized compared with non-packed salt (Ebrahim S, 2012). This might be due to

good transportation system, storage, and keeping in a suitable environmental condition. Most (74%) of salt containers had cover at household and the majority of food caterers (68.7%) stored their salt in dry place. These good practices may not be due to care of iodized salt but to prevent the salt contamination and to keep them from moisture for a long time.

The most frequently mentioned source of information on iodized salt in this study was health workers (36%) which is not consistent with other studies (Buxton C et al, 2012; Ebrahim S, 2012). This may be due to the current house to house educational strategy through health extension worker more deployed in the rural communities of Ethiopia.

This study also disclosed that having radio and TV accounted as a source of information in 29%. About 43.5% of the study participants replied that the taste of iodized salt is different from that of common salt which is in accordance with the study done in Ghana (Buxton C et al, 2012). The reason for this might be due to the psychological perception that the iodized salt is different from that of common salt.

As evidenced, by one study conducted in Mongolia respondents could not be distinguish the taste difference between iodized and non-iodized salt. Therefore, misconceptions among rural communities on the utilization of adequately iodized salt should be clarified through public media campaign and using the existing communication channels in the community.

In this study showed that 32.7% of HHs add salt to cooking at the end or right after cooking, that is proper utilization of iodized salt. In contrast to this a study at Michew district, North Ethiopia 2014 show that 40.3% HH add salt at the beginning of their cooking (Buxton C et al, 2012, Gidey B).

Having good Knowledge about iodized salt was significantly associated with availability and utilization of adequately iodized salt at household level. This

is similar with many studies which had been conducted in Africa (Imdad S, 2008; Ebrahim S, 2012).

This is due to the fact that an information education and communication should be conducted in village about importance of consuming iodized salt and hence it may increase the demand for it. Households should have to instructed about importance of iodized salt and proper handling at household level.

In this study in bivariate analysis being female sex headed was significantly associated with availability of iodine concentration of salt at household level compared to males. This may be due to the fact that mostly females are engaged with food preparation and are more exposed to different local or cultural practices than males.

In another way in this study ever heard about iodine 2.291.08,4.29) timer more iodine concertation is available at household level than their counter parts. This is because lack of knowledge about advantage of iodine iodine salt may contribute to its availability and utilization of iodine salt at household level.

In our finding having goiter as common problem in the family is 2.7(1.48,5.2) times more iodine salt is available at their house hold than their counter parts this is similar to most study in th world (Imdad S, 2008; Ebrahim S, 2012). This is due to those individuals who are exposed to the problem may practice prevention action when we compared with un exposed individuals.

This study has the following limitation; iodine level was determined by taking sample only from the salt which did not include titration level of iodine in the salt and urinary testing of iodine determine body iodine level.

**Conclusion**

In this study, the availability and utilization of adequately iodized salt at household level was very low as compared to the WHO recommendation to prevent Iodine deficiency disorder. The availability and utilization of adequately iodized salt was found to be associated with having goiter problem, having good knowledge about iodized salt and long-term utilization of iodized salt at house hold level.

**Recommendation**

Nutrition education program regarding availability of iodized salt and proper utilization of salt at household level should be incorporated in the package during any health information communication intervention to increase knowledge of the public about iodized salt utilization.

Educational campaigns through different communication media should target those vulnerable to acquire goiter disease.

Educational campaigns through different communication media should encourage long time utilization of iodine at household level

Finally, Educational campaigns through different communication media should target the less educated females who are the most responsible in cooking food and utilizing iodized salt in the family.

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