



Availability of Adequately Iodized Salt at Household Level and Its Associated Factors in Horro Woreda, Horro Guduru Wollega Zone, Oromia, Ethiopia

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Abstract: Iodine Deficiency Disorder (IDD) is one of the biggest worldwide public health problems of today. Even if the coverage of iodized salt in Ethiopia is irregularly increasing, the coverage of households that use adequately iodized salt in different rural communities of Ethiopia was low. A community based cross sectional study was designed to assess availability of adequately iodized salt at household level and its associated factors in Horro woreda, Oromia regional state, Ethiopia from February to March, 2018. Data was collected using a structured and pretested questionnaire. Multistage sampling technique was used to select households and data were analyzed using SPSS v. 20. Variables having $p < 0.25$ in the bivariate logistic regression were entered into multivariate logistic regression analysis and finally, variables having $p < 0.05$ and 95% confidence interval (CI) were considered as significantly associated. The finding of this study revealed that about 23.6% respondents were utilized adequately iodized. The study also found that the knowledge and practice among participants was 63.8% and 60%, respectively. Moreover, access to information AOR (95% CI)=2.5 (1.1-5.55), wealth status AOR (95% CI)=4.7 (2.5-8.83), knowledge about the benefits of iodized salt AOR (95% CI)=1.4 (1.6-2.08) and salt storage place AOR (95% CI)=4.2 (2.33-13.54) were significantly associated with availability of adequately iodized salt during multivariate analysis. This study concluded that the proportion of households covered by adequately iodized salt in rural communities of the study was very low (23.6%) compared to the internationally recommended value to control iodine deficiency disorder (90%). Therefore, nutrition interventions through behavioral change communication (BCC) towards adequately iodized salt utilization and its practice should be strengthened by all concerned bodies to increase its coverage and to eliminate iodine deficiency disorders in rural communities of the study area.

Keywords: Adequately Iodized Salt, Availability, Associated Factors, Horro Woreda

1. Background

Iodine is an essential micronutrient for humans required in a very small amount [8]. The daily recommended amount of iodine for normal function of thyroid gland is 150-200 µg/l for adults, 90-120 µg/l for children and 250 µg/l for pregnant and lactating mothers [19]. World health organization recommends (WHO) that the median iodine urinary level need to be within the range (100-199 µg/l) to ensure adequate iodine content in salt and other sources of iodine in the diet. However, when iodine intake falls below the recommended levels, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormones. This low level of

thyroid hormones in the body is responsible for iodine deficiency disorders (IDD).

The human body does not make iodine, so it is an essential part of diet [5]; found in various foods such as cheese, cow's milk, eggs, frozen yogurt, ice cream, Iodine containing multi vitamins, iodized table salt, saltwater fish seaweeds, shellfish, soymilk and soy sauce.

Failure to have adequate iodine leads to insufficient production of thyroid hormones, which affect many different parts of the body, particularly muscle, heart, liver, kidney, thyroid gland, and the developing brain [22]. Inadequate hormone production adversely affects these tissues resulting in the disease collectively known as IDD. Long term

deficiency in iodine intake is associated with the development of goiter. Iodine deficiency continues to be a significant public health problem in many developing countries [19]. Its deficiency not only causes goiter, it may also result in abortion, mental and growth retardation, irreversible brain damage and retarded psychomotor development in the fetus, infant and child [16].

Iodine Deficiency Disorder (IDD) is one of the biggest worldwide public health problems of today. In Ethiopia, among the four countries included in the review, the highest iodine deficiency (86%) and high goiter prevalence (14% to 59%) was reported [23]. Iodization of salt is first line measure to prevent and control IDD. That was the reason why the Ethiopian Council of Ministers passed salt legislation in February 2011; according to this regulation, every salt for human consumption need to be iodized, and any iodized salt for human consumption shall conform to the standards for iodized salt set by the appropriate authority [12]. However, in Ethiopia about 47.5% of school children had urinary iodine levels less than 100 µg/L and about 51.8% of women had urinary iodine levels less than 100 µg/L and only 23.2% of urban and 13.3% of rural households were reported to have used iodized salt [10].

Another survey done by Ethiopian Public Health Institute (EPHI) also showed that only 26% of the total households were getting > 15 ppm iodine in salt and about 66 million persons were unprotected from IDD and only 15% of households had access to iodized salt [13]. To ensure adequate availability and use of iodized salt, the government of Ethiopia has set a goal to virtually eliminate IDD by the year 2015 through universal salt iodization by increasing the proportion of households using iodized salt from 15.4% to 95% [18]. But the coverage of adequately iodized salt at household level is different from local to local due to different factors associated to it [11].

Moreover, a study done in Jigjiga showed that the rate of adequate iodized salt use at household level was 26.6% [4]; household food cookers who had non corrugated iron sheet house, good knowledge were also predictors to adequately iodized salt. Similarly, a study done in Gondor town also reported that using packed salt, not exposing salt to sunlight, shorter storage of salt at household and good knowledge of participants about iodized salt were factors associated with availability of adequately iodized salt at household level [14]; the availability of adequately iodized salt (≥ 15 ppm) was 28.9%.

Additionally, a study done in northwest Ethiopia reported that about 57.4% salt samples had iodine content in the range 15 ppm to 59.42 ppm [6]. This result indicates that salt stored in closed containers, salt samples stored in dry places and salt samples stored for less than two months were significantly associated with adequate iodine level.

According to a study done in Goba town, Ethiopia, only 30% of the households were covered by adequately iodized salt [1]; the associated factors that were found to be statistically significant with it were salt not exposing to sunlight, salt purchasing from supermarkets or big shops & perceived cheap. In addition, a study done in north Ethiopia

reported that the coverage of adequately iodized salt among the households was 17.5% [21], and family size, residence, the availability of iodized salt and affordability to iodized salt were strong predictors to proper iodized salt utilization.

Furthermore, a study done in Debre Tabor, Ethiopia revealed that the magnitude of poor knowledge and practice regarding iodized salt consumption was 53.8% and 55.6%, respectively [20]. Studies conducted in Ethiopia also showed that occupational status, packaging, educational status, residence and knowledge were factors associated to the use of iodized salt utilization [20, 24].

The Ethiopian rural communities have low levels of adequately iodized salt use compared to those who live in urban areas. Studies done in SNNPR [17] and in northwest Ethiopia [2] reported that urban households were used more adequately iodized salt (≥ 15 ppm) compared to those households lived in rural areas.

However, little information is known regarding the availability of adequately iodized salt at the household level in the rural Horro woreda and factors associated to it. Therefore, this study was designed to assess the availability and utilization of adequately iodized salt at household level and its associated factors in rural communities of the study area.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted in Horro Woreda, Horro Guduru Wollega zone, Ethiopia. The study area Horro woreda is located at about 314 km west of Addis Ababa. With geographical coordinates of 09°29'N and 37°26'E, and at an altitude of approximately 2,296 m. a. sl. Mixed crop-livestock agriculture is the main stay in the area. The area has one long rainy season extending from March to mid October with annual rainfall ranging from 1000-2400mm. The monthly mean temperature varies from 14.9°C to 27°C. The area is favorable for multi-disciplinary agricultural activities and livestock and fishery production.

2.2. Study Design and Period

A community based cross sectional study was done in Horro Woreda, Horro Guduru Wollega Zone, Ethiopia between February and March 2018.

2.3. Source and Study Population

All households in Horro Woreda, Horro Guduru Wollega Zone, Ethiopia were the source population while all households in Horro Woreda which were randomly selected from the four kebeles (Gitilo, Doyo Barso, Akeji Chabir and Sombo Dede) constituted the study population.

2.4. Inclusion and Exclusion Criteria

Participants in Horro Woreda who are the residents of the study area at least for six months were included in the study.

Participants in Horro Woreda who are chronically sick at the time of study and not found at home during three visits were excluded from the study.

2.5. Sample Size Determination

The sample size was calculated using formula for a single population proportion by considering the following assumptions like 95% CI ($Z=1.96$), expected prevalence of Household inadequate iodized salt use ($p=19\%$) and a margin of error 5% [10]. The formula was yielded $n=236$, 10% of non-response rate and design effect of 1.5 to maximize sample size, lastly the required total sample size is 390 households.

2.6. Sampling Procedures

Multistage stages sampling methods were used to draw samples for the study. Firstly, from the 11 kebeles of the woreda, four rural kebeles (Gitilo, Doyo Barso, Akeji Chabir and Sombo Dede) were randomly selected. Then, all the households in the four kebeles were listed based on the data available in the woreda.

Next, the number of households in each kebele were determined by proportional allocation on the bases of total number of households in the respective kebeles. Finally, the households were randomly selected from each kebele.

2.7. Data Collection Procedures

The quantitative data were collected using a structured questionnaire adapted from different relevant studies. The questionnaire was first developed in English and then translated into Afan Oromo with some modification from the relevant sources. It was translated back to English by different language experts to check for consistency and then back to Afan Oromo to make interview with local respondents. The questionnaire was pre-tested on 5% of the sample in a kebele not included in the sample to check for its understandability and time required to complete the questionnaire before the actual data collection began. Based on feedback from the pretest, necessary corrections and editions were made in terminologies and formatting of the questionnaire.

To assess the use of iodized salt at the household level, interviewers were asked households to provide a teaspoon of table salt used for cooking. The salt samples about 20-50 gm were tested for iodine content using the iodine Rapid Test Kit.

After a training was given for two days, the data were collected by six diploma nurses and supervised by two public health professionals and the researcher. At the end of each day, the completeness of questionnaires were checked by the principal investigator.

2.8. Variables of the Study

The dependent variables were the use of iodized salt (inadequate use of iodized salt and adequate of use iodized salt) whereas independent variable were knowledge and practices of households about iodized salt, socio-

demographic and economic characteristics of the respondents.

2.9. Data Analysis

Data were entered in to SPSS software v. 20.0. Before the analysis, data were checked for completeness and then cleaned. Descriptive statistics was run using tables, graphs, and percentages. Binary and multivariate logistic regression was used to identify factors associated to availability and utilization of adequately iodized salt. All independent variables that had a p -value <0.25 in the bivariate analysis were the candidates for multivariable logistic regression. A P -value less than 0.05 was considered statistically significant. The degree of association between dependent and independent variables was reported using adjusted odds ratio (AOR) and 95% CI.

2.10. Ethical Considerations

Ethical clearance was obtained from Institutional Review Board (IRB) of the Wollega University, College of Health Sciences. A formal letter of permission was written to Regional Health Office, Horro Guduru Wollega Zonal Health Department, Horro Woreda Health Office, and to each selected kebele administration. After explaining the purpose of the study, verbal consent was obtained from each study participant. Participants were also be informed that participation is on voluntary basis and that they can withdraw at any time if they are not comfortable. Personal identifiers were not included in the questionnaires to ensure participants' confidentiality. Nutrition education on the importance, source of iodized salt and practice of it at household level were given by the data collectors for households with low iodized salt during the survey.

3. Results

3.1. Socio-demographic Characteristics

A total of 390 households were included in this study with a response rate of 100%. Of 390 rural participants, 380 (97.43%) were Oromo by ethnicity and the left 10% (2.56%) participants were Amhra. Three hundred twenty (82%) and seventy (18%) participants in the study were Protestant and Orthodox in religion, respectively. This study also reported that about 345 (88.46%) participants were married, 30 (7.69%) were single and 15 (3.85%) were divorced. Regarding the educational status, about 180 (46.2%) participants had attended formal education while 210 (53.8%) had not.

Table 1. Socio-demographic and economic characteristics of the study participants, Horro Woreda, Oromia region, Ethiopia, 2018.

Variables	Frequency	Percentage (%)
Age (year)		
18-31	68	17.43
32-45	165	42.3
>45	157	40.25

Variables	Frequency	Percentage (%)
Marital status		
Single	30	7.69
Married	345	88.46
Divorced	15	3.846
Education status		
Attend formal education	180	46.2
Not attend formal education	210	53.8
Income		
>500 ETB	146	37.43
< 500 ETB	244	62.56
Occupational status		
Civil servant (salary)	68	17.43
Daily labor	42	10.769
Farmer	240	61.53
Merchant	40	10.25

ETB=Ethiopian Birr.

3.2. Availability and Adequacy of Iodine in Household Salts

This study showed that 210 (53.8%) participants used iodized salts at their home. However, out of 390 households who used iodized salts, only 92 (23.6%) of households used adequately iodized salt (≥ 15 ppm) while 220 (56.4%) households used iodized salts (< 15 ppm) during the survey. No iodine was found in salts used by 78 (20%) households (Figure 1).

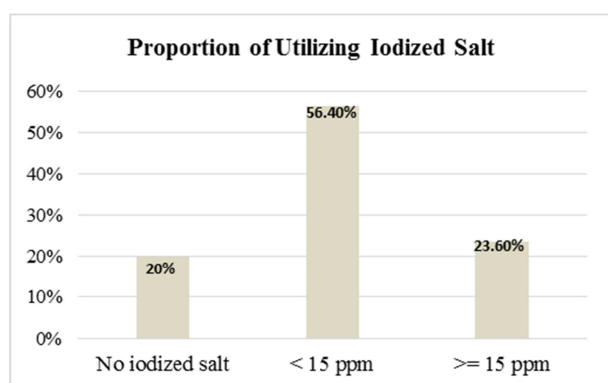


Figure 1. Proportion of utilizing iodized salt, Horro Woreda, Oromia region, Ethiopia, 2018.

3.3. Knowledge of Participants Regarding the Importance of Iodized Salt

This study reported that one hundred forty three (36.7%) participants said iodized salt prevents from IDD and knew about iodine deficiency disorders and their effects on human beings. When asked if they have ever heard about iodized salt, 150 (38.46%) respondents said that they have heard about iodized salt. About 150 (38.46%) participants have got the information from mass media, health extension workers. The remaining 240 (61.5%) participants had not heard about iodized salt (Table 2).

Table 2. Knowledge of participants regarding iodized salt, Horro Woreda, Oromia, Ethiopia, 2018.

Variables	Frequency	Percentage (%)
Heard about iodized salt		
Yes	150	38.46

Variables	Frequency	Percentage (%)
No	240	61.5
Food Sources of iodine		
Meat	31	7.95
Bread	43	11
Fish, dairy products, eggs	67	17.2
Fruits, vegetables	18	4.6
I don't know	231	59.2
Importance of using iodized salt		
It prevents from IDDs	112	28.7
I don't know	278	71.3
Knew effects of iodine deficiency		
Yes	143	36.7
No	247	63.3
Knowledge		
Good	141	36.2
Poor	249	63.8

3.4. Utilization Pattern/Practices/of Iodized Salt

About 180 (46.2%) participants did not have iodized salt while 210 (53.8%) participants had adequately iodized salt during the survey. The majority 280 (71.8%) of participants have got iodized salts from nearby shops.

Two hundred one (51.5%) households used non-packed salt while the remaining 189 (48.5%) households used packed salt. In addition, 197 (50.5%) of participants used cover for their salt containers whereas 193 (49.5%) participants did not. Majority 256 (65.5%) of participants, stored salt in a fire area. Moreover, about 246 (63.1%) participants stored salt for less than two months while 144 (36.9%) used for more than two months (Table 3).

Table 3. Utilization pattern/practices/ of iodized salt, Horro Woreda, Oromia, Ethiopia, 2018.

Variables	Frequency	Percentage (%)
Access to iodized salt		
Yes	210	53.8
No	180	46.2
Source of iodized salt		
Market	280	71.8
Nearby shops	65	16.7
Pharmacy	45	15.54
Salt container		
With cover	197	50.5
Without cover	193	49.5
Salt storage place		
Dry and cool place	80	20.5
Moisture area	54	13.85
Fire area	256	65.5
Washing salt before use		
Yes	48	12.3
No	342	87.7
Duration of salt storage at HH level		
<2 months	246	63.1
≥2 months	144	36.9
Type of salt used		
Packed	201	51.5
Not packed	189	48.5
Time salt was added during cooking		
Late at the end of cooking or after cooking	108	27.69
Early or at the middle of cooking	282	72.31
Iodized salt utilization practices		
Good	156	40

Variables	Frequency	Percentage (%)
Poor	234	60

3.5. Factors Associated with Availability of Adequately Iodized Salt

The bivariate analysis of this study showed access to information, wealth index, sources of iodine, knowledge about the benefit of iodized salt, salt, using cover for salt

container, type of salt and salt storage place were significantly associated with availability to adequately iodized salt.

However, in the multivariate analysis, only access to information, wealth index, salt storage place and knowledge about the benefit of iodized salt were significantly associated with availability to adequately iodized salt.

Table 4. Factors associated with availability of adequately iodized salt, Horro Woreda Horro Guduru Wollega Zone, Oromia, Ethiopia, 2018 (n=390).

Variables	Frequency		COR (95% CI)	AOR (95% CI)
	≥15ppm	<15ppm		
Access to information about iodized salt				
Yes	135	88	3.1 (1.52, 6.32)*	2.5 (1.1, 5.55)**
No	73	94	1	1
Source of iodized salt				
Market	129	54	1	1
Nearby shops	60	72	2.63 (1.65, 4.2)*	.746 (.31, 1.797)
Pharmacy	35	40	2.44 (1.52, 3.93)*	1.16 (.65, 2.08)
Wealth index				
High	78	42	5.69 (3.3, 9.94)*	4.7 (2.5, 8.83)**
Medium	60	63	1.696 (.924, 3.11)*	1.399 (.71, 2.757)
Low	34	113	1	1
Time salt was added during food cooking				
Early or at the middle of cooking	141	28	1	
Late at the middle of cooking or after cooking	108	113	1.88 (.923, 3.2)	-
Knowledge about benefit of iodized salt				
Yes	201	65	1.96 (1.6, 3.9)*	1.4 (1.6, 2.08)**
No	81	43	1	1
Using cover for salt container				
Yes	38	122	1	1
No	63	167	1.887 (.92, 3.86)*	1.13 (.456, 2.78)
Educational Status				
Attended formal education	96	75	1.72 (0.26, 2.9)	-
Not attended formal education	85	134	1	
Salt storage place				
Dry and cool place	90	87	6.5 (1.72, 24.6)*	4.2 (2.33, 13.54)**
Moisture area	22	18	1.22 (.69, 2.15)*	1.44 (.62, 3.35)
Fire area	120	53	1	1
Type of salt				
Packed	98	95	2.44 (1.52, 3.93)*	1.16 (.65, 2.08)
Not packed	32	165	1	1

* P- value <0.25 in the bivariate analysis, ** P-value< 0.05 in the multivariate analysis, 1=References.

4. Discussion

At household level, the recommended iodine concentration in salt should be 20-40 ppm to provide iodine [19]. However, iodine level in the salt examined in this study was clearly not iodized in accordance with this recommendation. The iodine concentration of salt varied from 0-156ppm, which indicates the need to further improve the quality of iodized salt at the point of production. This might be due to traditional salt production process and manual iodization, manual mixing does not achieve the required uniformity throughout the salt pile. In addition to this raw salt with high level of impurities, high moisture, large crystal agglomerates may not be able to maintain the quantity and homogeneity of iodine [9]. According to this study, iodized salt was found in 210 households (53.8%). However, adequately iodized salt (≥15 ppm) was found in 92 (23.6%) households only. This iodized salt coverage result was less compared to studies done in

Mecha district, 25.7% [24], Jigjiga, 26.6%) [4], Gondor, 28.9% [14] and in Sothorn Nation, Nationalities and People Representative (SNNPR), 65.5% in urban & 45.2% in rural [17] and at national, 26%) [13]. This differences could be due to the present survey was done in rural communities where information about iodized salt is low.

On the other hand, this finding of this study is higher compared to a study done in north Ethiopia, 17.5% [21], and a national survey conducted in Ethiopia, 15.4%. [10]. This difference might be due to the number of reasons such as study area differences, sample size, current house to house educational strategy through health extension workers organized both in the urban and rural communities.

According to this study, households who had information were 2.5 times more used adequately iodized salt than those who had no information (AOR (95% CI)=2.5 (1.1, 6.55)). This result is similar with a study done in SNNPR [17], which reported that those households who had access to

information were 3.99 times more likely to use adequately iodized salt than those who had no access to information (AOR (95% CI)=3.99 (2.54, 6.27)). This finding is consistent with the study done in Northwest Ethiopia [20], which showed that participants who had information from school, AOR (95% CI)=0.42 (0.242, 0.711) and television, AOR (95% CI)=0.463 (0.276, 0.777) were less likely to practice wrongly in iodized salt consumption compared to those who had no information.

Studies done in Tigray, Ethiopia [15] and Ghana [3] also showed that media's role, where access to formal education opportunities were not available, access to information through media served as an important instrument to educate the public and increase the community's knowledge on the nutritional value of consuming adequately iodized salt. This better availability and utilization of iodized salt in the study area might be due to access to information and proximity to nearby shops to buy iodized salt for consumption than those who had no information.

Regarding participants' knowledge, this study reported that households who had knowledge about the benefit of iodized salt were 1.4 times more likely to use adequately iodized salt than those who did not know (AOR (95% CI)=1.4 (1.6, 2.08)). This result is supported by a study done in SNNPR [17] which showed that those households who did know the benefit of iodized salt were 4.466 times more likely to use adequately iodized salt than those who did not know (AOR (95% CI)=4.66 (3.01, 7.22)). A study done in northern Ethiopia [15] also reported that those household who did know the benefit of iodized salt were 2.11 times more likely to use adequately iodized salt than their counterparts (AOR (95% CI)=2.11 (1.37, 3.25)). In addition, a study done in Northwest Ethiopia showed that those participants who were unable to read and write, AOR (95% CI)=2.18 (1.043, 4.566) were two times more likely to have poor practice compared to those having university and above educational status [20]. Similarly, a study done in Gondar town, Ethiopia [14] reported that knowledge of participants about the iodized salt was significantly associated with availability of adequately iodized salt (AOR (95% CI)=1.94 (1.23, 3.05)).

Furthermore, a study conducted in Ghana showed the result of increased knowledge regarding the importance of using iodized salt and the effects of its deficiency in the diet of an individual; there has also been an increase in the consumption rate of iodized salt [7]. Another a study done in Mecha district, Ethiopia [24] also reported that participants who had good knowledge were three times more likely to utilize adequately iodized salt compared those who had poor knowledge (AOR (95% CI)=3.8 (2.1, 6.8.)).

Concerning wealth index, the current study showed that households lived in high wealth index were 4.7 times more likely to get adequately iodized salt than those households in medium and low wealth index (AOR (95% CI)=4.7 (2.5, 8.88)). In addition, a study done in SNNPR [17] also reported that having monthly income >500 ETB was significantly associated with availability of adequately iodized salt (AOR (95% CI)=7.16 (4.55, 11.29)).

Another study done in Ethiopia among school children [2] also showed that medium household wealth status were 1.78 times more likely to get adequately iodized salt compared to those household in low wealth status (AOR 95% CI=1.78 (1.18, 2.92)). Similar study conducted in Ghana revealed that compared to the highest wealth index households, those who in lower levels of wealth index were more likely to use non-iodized salt [3]. This could be due to the fact that those who have high income may buy iodized salt easily and provide it for household family compared to those households who live in low income.

According to this study households who store their salt at dry and cool place were 4.2 times likely to get adequately iodized salt than those who store at moisture and fire area (AOR (95% CI)=4.2 (2.33, 13.54)). A study done in Jigjiga [4] reported results that food cookers who were using dry place to store their salt were found to use adequate iodized salt significantly more than those who had moist place and fire area (AOR, 95% CI=5.15 (1.32, 20.06)).

Furthermore, a study in Dera District, North Shewa zone, Oromia region, Ethiopia [6] showed that salt samples stored in dry places were 1.5 times more likely to retain iodine compared to samples stored near to heat/fire or in a moist area (AOR (95% CI)=1.5 (1.03, 2.14)). This could be due to the fact that salt stored in humid condition and stay for longer period attracts moisture and becomes wet and may loss edible iodine. At hot condition, salt can release surface moisture, and this may cause an iodine loss by its volatility if the container of edible iodine salt is not packed.

5. Conclusions

This study concluded that the proportion of households covered by adequately iodized salt in rural communities of Horro Woreda, Oromia region, Ethiopia was low (23.6%) compared to the internationally recommended value to control iodine deficiency disorder (IDD) (>=90%). In addition, this study also revealed that participants' had inadequate knowledge and practice regarding adequately iodized salt was 63.8% and 60%, respectively. This indicates that the survey was done in rural communities where access to information is low. Efforts need to be intensified through better educational programmes on the benefits, its practice and increased use of adequately iodized salt at household level in the study area. Moreover, the findings of this study suggested that access to information, wealth status, knowledge regarding the benefits of iodized salt and its storage place were factors significantly associated with coverage of adequately iodized salt at household level. Therefore, nutrition education intervention through behavioral change communication (BCC) towards adequately iodized salt utilization and its practice should be strengthen by health extension workers and nutritionists to increase its coverage and to eliminate iodine deficiency disorders (IDD). Furthermore, researches are recommended to look at the possible factors to use adequately iodized salt at manufacturers, whole, sellers and retailers to prevent the

production and distribution of under iodized salt in the market. The findings are of interest to local public sectors and non-governmental organizations for informed decisions in addition to provide baseline information and updated evidence for future researches in the study area.

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