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Iodine status, impact of knowledge, and practice for adequate iodized salt utilization in house hold at North West Ethiopia

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Abstract

Introduction: Iodine is one of the crucial micronutrients required for the normal growth of humans from the fetal stage to adulthood through the synthesis of thyroxin (t3) and triiodothyronine (t4) hormones in the thyroid gland for regulation of metabolism, protein synthesis, and brain development. This study aimed to assess iodine status, the impact of knowledge and practice for adequate iodized salt utilization in household levels in North West Ethiopia.

Method: A population-based cross-sectional study was carried out using multistage sampling among 1398 residents from 28 December 2021 to 30 January 2022. A systematic random sampling technique was used to select the study participants. The collected data were entered into Epi-Data version 3.1 and then exported to STATA/R version 14 for further analysis. An adjusted odds ratio with 95% CI was used to declare statistical significance at $p < 0.05$.

Result: The overall mean (±SD) age of participants was 34.9 (±12.8) years. About 678 (48.5%) had 15–80 ppm, 23 (1.6%) had >80 ppm, 533 (38.13%) had 1.1 ppm to 14.9 ppm, and 147 (10.5) had no iodine in salt (0 ppm) after assessed by Rapid Test Kit. Only 48.5% of the sampled household had used adequate iodized salt with ⩾15 ppm. The overall burden of goiter was estimated at 11.4/1000 population. Adequate iodized salt utilization was significantly associated with having formal education (adjusted odds ratio = 1.89: 95% confidence interval: 1.4, 2.6, $p = 0.001$), monthly income ⩾5000 ETB/month (adjusted odds ratio = 1.99: 95% confidence interval: 1.5, 2.9, $p = 0.001$), and good knowledge score (adjusted odds ratio = 1.6: 95% confidence interval: 1.12, 2.6, $p = 0.03$) were predictors for proper iodized salt utilization.

Conclusion: Coverage of adequately iodized salt was low and respondents' formal education, monthly income ≥5000 Ethiopian Birr/month, and good knowledge score were all significantly associated with proper iodized salt utilization. While the prevalence of goiter was not significantly identified as a public health problem as compared in the regions, however, in light of previous iodine deficiency in this region of Ethiopia, the salt iodization program should be done continually.

Keywords
Ethiopia, goiter, iodine, knowledge, practice, salt

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Introduction

Iodine is an essential micronutrient in human nutrition and a proper amount is needed in the human diet to ensure good physical growth and neural development.[1] When people do not have enough iodine, they cannot make enough thyroxin hormones (T3 and T4),[2,3] which has 65% and 59% respective weight of iodine hormones produced from the thyroid gland.[4] Human beings required iodine to sustain their regular metabolism, physical growth, and cognitive development. However, IDD with endemic goiters as its main clinical

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manifestation, brain damage, dwarfism, spontaneous miscarriages, and stillbirth may occur due to inadequate intake.[3,4] *Globally, nearly 2 billion people suffer from ID with around 50 million having clinical manifestations Children, and pregnant women are more vulnerable to developing ID, and approximately 266 million schoolchildren suffer from ID, with symptoms.*[4] *ID results in goiter, mental retardation, or reduced cognitive function.*[3,5] *Early screening of the iodine status of children is essential to prevent Iodine Deficiency Disorders (IDDs).*[6] *Every year, in under-developing countries, almost 38 million newborns suffered from the enduring impact of neurological associated IDD.*[7] *The mean intellectual Quotient scores are reduced to 13.5 due to iodine deficiency.*[3] *The burden of ID varies from region to zonal levels, and the proportion of the population of school-age children with inadequate iodine (UIC < 100 μg/L) at the national level was found to be 43.4%.*[8]

Global, 35 million people are at risk for IDD, among those 40% have contracted goiter (swelling of the thyroid gland) around the neck.[9] The problem is worsening in African countries specifically in Ethiopia, more than 12 million school children suffered from IDD[1] with 24.3% and 11.5% palpable and visible goiter respective burdens.[1,10] ID-associated goiter is responsible for 24.3% and 11.5% burden of palpable and visible goiter in Ethiopia, respectively.[10] The issue is dreadful and ranged for children ⩽18 years 41.86% in Amhara regions.[11–13] The universal iodized salt initiative recommended daily dose of iodine is based on age class, with 90 μg (RNI) for ⩽15 years, and ⩾250 μg for all pregnant.[9,14] In 2011, Ethiopia was the first among the top ten iodine-deficient countries based on a national median UIC (20–49 μg/L)[12] among 148 countries data the study included in the analysis.[15]

Recently, the practice of adequate iodized salt utilization has increased from 15% in 2011 to 25% in 2016.[16] However, it had a significant variation among regions, as the highest reported was 55.2% in Tigray regions, and as lowest reported in Gambela was 9.5%.[9,14,16] Despite the government of Ethiopia accepting the 90% universal iodized salt initiative strategy of WHO, through the implementation of universal food fortification, and dietary supplementations, however, only 26% of the households achieved using adequate iodized salt utilization.[5,17] The presence of iodine in salt is not enough for preventing IDD. Proper and adequate utilization of iodized salt is necessary as iodine can be lost due to different cooking practices such as pressure cooking, boiling, and shallow frying.[3]

In 2014, Ethiopia was still one of the 25 most iodine-deficient countries, and only 19.9% of the population was reported to consume iodized household salt.[18] Moreover, persistent and significant poverty, poor knowledge, and practice of iodized salt consumption at household levels were responsible for the low coverage at national levels. This study aimed to assess iodine status, and the impact of knowledge and practice for adequate iodized salt utilization at household levels in Debre Markos city, North West Ethiopia.

Objective

1. Assessing population levels' knowledge and practice for adequate iodine salt utilization.
2. Determining levels of iodine concentration among iodine salt utilizer groups.
3. *Assessing the burden of goiter among participants living in selected kebeles.*

Methods

Study design, period, and setting

It was a population-based cross-sectional study conducted from 28 December 2021 to January 30, 2022. The town is located 300 km away from the national capital city of Ethiopia and 265 km away from Bahir Dare regional city of the Amhara region.[19]

Source of population and eligibility criteria

All residents in debre Mark's (Menkorer) city were the source of the population for this study. Participants whose age was ⩾15 years were sampled for an interview as study subjects and included for an interview whereas those who were age ⩾15 years and medically ill, and unable to respond were excluded.

Sample size determination

The sample size was calculated based on the formula of z 2 p(1-p)/d2 to derive the minimum required sample size considering the 95% confidence level, a 4% margin of error (d), Preliminary proportions(P1) iodized salt usage 37% from,[20] *and adding 2.5 design effects for multistage sampling techniques. Eventually, a total sample size of 1398 was derived.*

Sampling technique

A multistage with a three-stage sampling process was used to ensure the representation of all residents in Debre Markos Town. The kebeles were considered uniform in characteristics hence they were considered clusters. Six out of twelve total kebeles, the town has a total of 12 kebeles randomly selected by the lottery method, six out of 12 kebeles. Then, in the final stage, systematic random samplings were used to select the households from each selected Kebele by dividing the total household using the sample size interval ($K = 3$) as shown in Table 1.

Variables

Adequate utilization of iodized salt was the dependent variable for this study. Information on the sociodemographic and economic characteristics, drinking water source, and

Table 1. Selected households and sampled population from six kebeles of Menkorer city.

Data collected site	No of household	Sample interval	Sampled household	Sampled population
Kabel 01	699	K = 3	233	233
Kabel 04	689	K = 3	229	229
Kebel 05	726	K = 3	242	242
Kebele 08	681	K = 3	227	227
Kebel 09	672	K = 3	234	224
Kabel 11	702	K = 3	234	234
Total	4269 HHs	K = 3	1398	1389

information regarding the usage of iodized salt of the selected participants was obtained by a structured interviewer-administered questionnaire and was counted as independent variables of this study.

For knowledge-related items, the questions contained the category of ("Yes"/"No"). A correct answer was assigned "1" point and an incorrect answer was assigned a "0" point. The total item ranged from 1 to 9. "Good knowledge score" was when the scoring was 5.5 (50% and above) out of 9 items and a score below it indicated a "poor knowledge score" on iodized salt-related beneficiaries and IDDs. This is similar to practice-related items ($N=6$). "Good practice score" was when the scoring was 5.5 (50% and above) out of 9 items and a score below it indicated a "poor practice score" on the iodized salt beneficiary and IDDs. The respondents who answered greater than or equal to the mean score listed items have individually experienced knowledge and good practice for iodized salt utilization.

The internal consistency reliability of knowledge and attitude items were checked on 16 pre-tested questionnaires giving a result of Cronbach's alpha ($\alpha = 0.81$) and ($\alpha = 0.72$), respectively.

Operational words

Adequately iodized salt: When we tested the sample salt with the rapid iodine test kit if the iodine content of the household salt sample was ⩾15 parts per million (ppm), a deep blue color change was seen and it is called an adequately iodized salt.[1]

Levels of iodine content determination

To obtain the dietary iodine intake, the 24-h dietary recall method was used with the help of a semi-quantitative Food Frequency Questionnaire as described elsewhere.[4,18] The questionnaire was first prepared in English, then translated into the local language (Amharic), and finally, back-translated to English to maintain consistency. Quality assurance mechanisms included training the data collectors and supervisors about the objectives of the project and the data collection processes. Approximately 75–100 g of a salt sample was collected from the participants' homes and kept in air-tight plastic containers. The samples were stored at room temperature, away from sunlight, until analysis was carried out. Samplings were done from the top, middle, and bottom of the pack bag/containers to ensure the representativeness of the sample by using a moisture-free, clean plastic container.[2,21] Briefly, about 15 g of salt was dissolved in distilled water and made up to 50 mL solution. 1 mL of 2 N sulfuric acid and 5 mL 10% potassium iodide were added, which in the presence of iodine was turned yellow. The liberated iodine was titrated against 0.005 M sodium thiosulfate solution using 1 mL of 1% starch indicator near the end of the titration using the formula mg/kg (ppm) iodine = titration volume in mL × 21.15 × Normality of sodium thiosulfate × 1000/salt sample weighting.[9,21]

Clinical assessment

Two BSC health officer supervisors performed a clinical examination of the neck for goiter for all respondents after being ruled out by graduated BSc nurse data collectors. Goiter classification was done based on the WHO-recommended method.[4] Based on that, 0 was graded for no palpable or visible goiter; 1 was graded for palpable, but not visible goiter when the neck is in the normal position; and 2 was graded if swelling in the neck, which is visible when the neck is in a normal position.

Data collection tools and quality controls

Data were collected by using a structured questionnaire interview. The questionnaire was adapted from previous studies in the area,[16,21–23] and a 5%($N=79$) pretest was done in Emanuel woreda. The quality of the test kit was assured by internal and external quality control. Two-day data collection training was given to three BSC graduated nurses and two-health officers for the objectives of the study, variables of interest, and maintaining data confidentiality.

Statistical analysis

Questionnaires were checked and coded manually for completeness before being entered into Epi-Date Version 4.2, and then exported to STATA 14.0 for final analysis. Descriptive analysis results were presented in the form of tables, figures, and pie charts. Text using frequencies, and summery and summery statics such as mean (±SD), and

percentages were used for final reports. The assumption of the logistic regression model was checked before fitting it to the model. A multivariable logistic regression model was used to assess determinants for proper iodized salt utilization at the household level. An adjusted odds ratio with 95% CI was used to declare statistical significance at $p < 0.05$.

Result

Sociodemographic characteristics of participants

In this study, 1389 respondents were included for the final analysis and made the overall response rate 99.4%. The majority of 968 (79.61%) of the respondents were female in gender, and 719 (59.13%) of them were married. The overall mean (±SD) age of the participants was found to be 35 (±15.5) years with 471 (33.6%) being found in age groups 26–36 years. During the interview, the majority of 991 (81.50%) respondents were orthodox followers, and ⩾451 (37.1%) of them lived with ⩾8 family members in a house as shown in Table 2.

Table 2. Sociodemographic characteristics of respondents' knowledge, the practice of iodized salt determination in Menkorer city, in North West Ethiopia.

Characteristics	Categories	Frequency	Percent
Sex	Male	302	21.6
	Female	1096	78.4
Age	⩽25 years	322	23.03
	26–35	471	33.69
	36–45	382	27.3
	⩾46 years	223	15.9
Marital status	Married	816	58.1
	Never in union	498	35.2
	Divorced	84	6.83
Educational status	Unable to read and write	150	10.3
	Complete primary	40	3.13
	Complete high school	211	15.2
	Complete preparatory	378	27.6
	Diploma and above	617	44.4
Religion	Orthodox	971	79.8
	Muslim	128	10.5
	Others	117	9.6
Occupation	Merchant	461	33.22
	Farmer	370	26.4
	Employer	346	24.59
	Student	221	15.7
Family size	⩽4	404	29.3
	5–8	453	33.5
	⩾8	451	37.1
TV watching	Yes	310	25.5
	No	906	74.5
Radio listening	Yes	591	57.6
	No	807	57.39
Economic status	⩽1000 ETB/M	617 44.17	44.2
	1000–5000 ETB/M	375 26.84	26.8
	⩾5000 ETB/M	405 28.99	

Knowledge of iodized salt utilization

Majority of 1182 (45.4%) participants heard about the importance of iodized salt but not 216 (15.4 %). Nearly two in every five, 522 (37.7%) participants were informed about adequate iodized salt utilization from mass media. More than 1076 (76.97%) respondents know more risk segment population for IDD when did not use adequate iodized salt as shown in Table 3.

The overall good level of knowledge of participants about the usefulness of iodized salt and the health consequences of IDD was estimated at 879 (62.88%). Furthermore, nearly two in every five of the respondent had information about iodized salt from mass media, but 136 (9.7%) did not have any information about it as shown in Figure 1.

Practice-related questions

Nearly half of the participants 629 (44.99%) mentioned that the salt they were consuming in their homes was usually purchased from mini-shops (grocers) surrounding their homes, while about 380 (27.18%) and 389 (27.83%) of the participants were purchased from Bazar and market, respectively. Majority of 840 (60.1%) participants used iodized salt at the end of cooking dish. The largest proportion of 742 (53.08%) respondents stored their salt in closed containers. The mean practice of iodized salt utilization was found 775 (55.5%) as shown in Table 4.

Levels of iodine concentration from collected salts

About 678 (48.5%) had 15 –80 ppm, 23 (1.6%) had >80 ppm, 533 (38.13%) had 1.1 ppm to 14.9 ppm, and 147 (10.5) had no iodine in salt (0 ppm) after rapid test kit titrations salt sample (RTK). However, of the total, there were no 17 (1.22%) salt samples were not tested (less than 10 g) salt available in a house. The mean (±SD) iodine content of salt from collected Households was found to be 31.9 (±12.8) ppm as shown in Figure 2.

The health burden of a goiter on selected variables

Of the total respondents, 11.4 %(N=160) (95% CI: 9.87, 13.22) participants had visible goiters. The majority, 118 (73.7%) of these cases were female in gender, and 50 (32.02%) were within ⩽25 years of age group. Regarding poor-scored knowledge participants; nearly 8% of 105 (7.5%) had goiter, but doubled reduced this burden among good knowledge-scored participants. The overall grading of goiter was determined as grade 1 was 8.5% and that of grade

Table 3. Frequency distribution of knowledge status of respondents on iodized salt from 28 December 2021 to 30 January 30 2022.

Characteristics	Categories	Frequency	Percent
Do you hear about iodized salt here before the importance of it	Yes	1182	84.5
	No	216	15.9
Is there any problem exposing iodized salt to sunlight	Yes	291	20.8
	No	1,107	79.2
Does exposure of iodized salt to moisture have a problem	Yes	724	51.8
	No	674	48.2
Is there any problem might have the washing of iodized salt before cooking	Yes	917	66.5
	No	463	33.5
Do you know goiter is one of the main causes of deficiency of iodine	No	917	65.5
	Yes	481	34.4
Do you know purchasing site for iodized salts	Yes	1020	72.8
	No	378	27.1
Do know animal foods and vegetables are the main sources of iodine	Yes	1178	84.26
	No	220	15.74
Do you know the risk population segment for IDD	Children	1076	76.97
	Adult	422	23.1
Where did you get source information for iodized salt?	I don't know	136	9.79
	School	315	22.5
	Health institution	145	10.4
	Mass media	522	37.4
	Friend	256	18.3
	Other	23	1.65
Do you know the long-term complication of iodine deficiency	I don't know	410	29.33
	Abortion	350	25.04
	Cretinism	309	22.1
	Goiters	279	19.9
	Mental illness	50	3.58
Knowledge score	Good knowledge	879	62.88
	Poor Knowledge	519	37.12

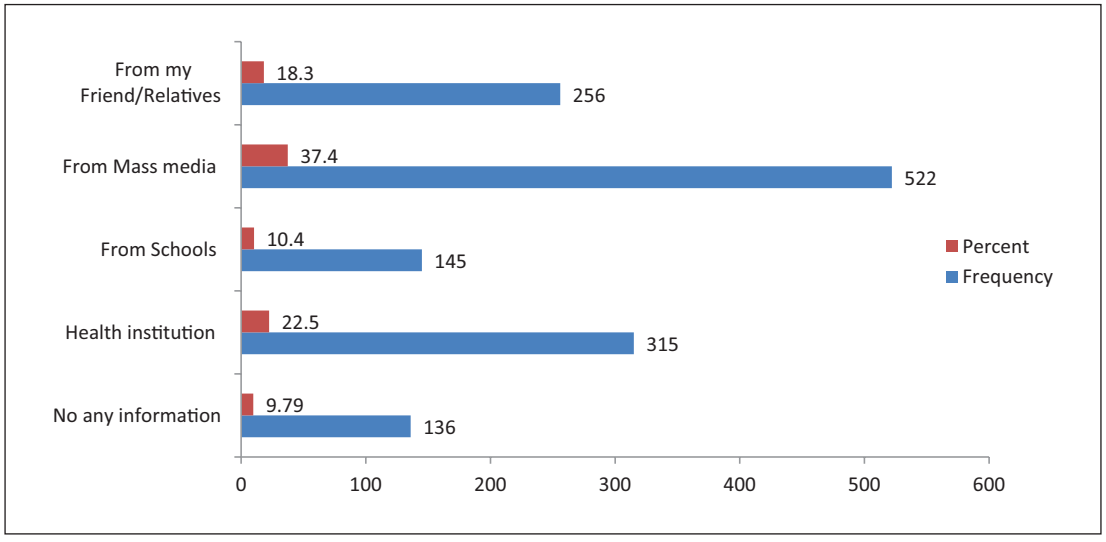

Figure 1. Source of information about the importance of iodized salt consumption among respondents.

Table 4. Frequency distribution of practicing iodized salt utilization among respondents in Menkorer city.

Characteristics	Categories	Frequency	Percent
How much-iodized salt is used daily	Always	920	65.8
	Sometimes	348	24.89
	Never	130	9.3
What types of salt did you use daily for your cooking dish?	Iodized salt	858	61.8
	Common salt	299	21.89
	I don't know	241	17.3
Where do you buy iodized salt if you are a user?	Market	629	49.9
	Bazar	380	27.18
	Mini-shop	389	28.01
Where do you put your iodized salt	Packed items	742	53.9
	Dry place	314	22.5
	In pastel	24	23.5
When do you use iodized salt during cooking dish	At beginning	558	39.89
	Last of cooking	840	60.11
How much it is the perceived cost the iodized salt	Expensive	611	43.7
	Cheap	787	56.29
How long can you store the salt and possibly re-used	<2 month	609	43.5
	>2 month	789	56.4
Practice-related score	Good practice	775	55.44
	Poor practice	623	44.5
Iodine test through titrations of rapid test kits	Deep blue	740	52.9
	Not colored	658	47.1

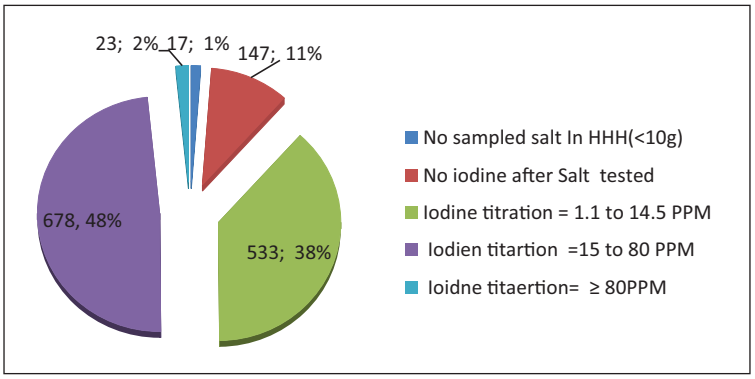

Figure 2. Levels of iodine concentration after sample d salt tested through RTK.

2 was 2.4%. The majority 128/160 (80.1%) of the cases did not use iodized salt as shown in Table 5.

Factors associated with adequate iodized salt utilization

Bivariate and multivariable logistic regression analysis was conducted. Finally the model of multivariable logistic regression, three variables were found significantly associated with adequate iodized salt utilization. Accordingly, formal education (AOR = 1.89; 95% CI: 1.4, 2.6, $p = 0.001$), Monthly income ⩾5000 ETB/month (AOR = 1.99; 95% CI: 1.5, 2.9, $p = 0.001$), and good knowledge score (AOR = 1.6: 95% CI: 1.12, 2.6, $p = 0.03$) were significantly associated with adequate iodized salt utilization shown as in Table 6.

Model goodness of test

The overall goodness-of-fit test for final models of a multivariable logistic regressions model analysis was assessed using the area under the Roc-curve with the following given parameters as shown in the and it is fitted with Hosmer and Lemeshow test as shown in the Figure 3.

Discussion

At the end of the study periods, 905 (64.74%) participants self-reported as they used always-adequate iodized salt at cooking. However, only 48.5% were confirmed with ⩾15 ppm iodine content in their daily salt which self-reported as they always used adequate iodized salt utilization. Which

Table 5. Health-related IDD of goiter among residents in Menkorer city in North West Ethiopia.

Variables	Categories	Burden of Goitre		χ^2	*p* Value
		Yes (*N* = 160) (%)	No (*N* = 1229)		
Sex	Male	42 (3.01)	1001 (71.6)	1.47	0.94
	Female	118 (8.5)	237 (16.9)		
Educational status	Formal education	105 (7.5)	908 (64.9)	14.2	0.001
	No formal education	57 (4.1)	330 (23.6)		
Knowledge score	Good Knowledge	55 (3.8)	890 (63.6)	91.1	0.01
	Poor Knowledge	105 (7.5)	348 (24.8)		
Practice score	Good practice	75 (5.3)	665 (47.56)	83.2	0.01
	Poor practice	85 (6.1)	573 (40.9)		
Iodized salt status	Adequate user group (⩾15 ppm)	32 (2.2)	692 (49.4)	73.4	0.02
	Inadequate user groups (⩽14 ppm)	128 (9.1)	546 (39.1)		

Table 6. Bi-variable and multivariable logistic regression for adequate iodized salt utilization in Menkorer city, North West Ethiopia.

Variable	Categories	Utilization of iodized salt		COR	AOR	*p* Value
		User	Non-user			
Sex	Male	157 (11.2)	122 (8.7)	Ref	Ref	
	Female	594 (42.4)	525 (37.1)	1.14 (0.76, 1.3)	1.2 (0.79, 1.38)	0.07
Age	⩽25 years	240 (17.6)	196 (14.1)	1.1 (0.75, 1.4)	1.17 (0.62, 1.34)	0.14
	26–35	175 (12.5)	191 (13.6)	1.2 (0.73, 1.8)	1.4 (0.94, 1.7)	0.25
	36–45	197 (14.1)	139 (9.9)	1.03 (0.87, 1.6)	1.3 (0.82, 1.58)	0.41
	⩾46 year	240 (17.5)	121 (8.6)	Ref	Ref	
Family size	⩽5	471 (33.6)	412 (29.5)	1.18 (0.75, 1.28)	1.18 (0.75, 1.28)	0.12
	>5	253 (18.1)	262 (18.7)	Ref	Ref	
Mass media attended	Yes	535 (38.3)	189 (13.5)	1.2 (0.9, 1.5)	1.16 (0.9,1.4)	0.08
	No	478 (34.2)	196 (14.2)	Ref	Ref	
Economic status	⩽1000 ETB	378 (27.1)	340 (24.3)	Ref	Ref	
	1000–5000 ETB	238 (17.1)	178 (12.7)	1.19 (0.92, 1.54)	1.29 (0.99, 1.6)	0.05
	⩾5000 ETB	134 (9.5)	129 (9.2)	1.3 (0.9, 1.6)	1.99 (1.5, 2.9)	0.01*
Education status	No formal education	231 (16.5)	173 (12.3)	Ref	Ref	
	Had formal education	520 (37.2)	474 (33.9)	1.56 (1.2, 1.9)	1.8 (1.41, 2.32)	0.01*
Knowledge score	Good Knowledge	487 (34.8)	392 (28.04)	1.5 (1.3, 2.7)	1.6 (1.12, 2.6	0.03*
	Poor knowledge	264 (18.8)	255 (18.2)	Ref	Ref	
Practice score	Good practice	428 (30.6)	347 (24.3)	1.4 (1.2, 1.8)	1.02 (0.55, 1.6)	0.41
	Poor practice	323 (23.1)	300 (21.4)	Ref	Ref	

is considerably lower than the WHO recommendation levels to be 90%,[24] Pradesh Indian 48%,[25] Mayhew district (59.7%),[26] Dessie town 68.8%,[20] Asella town 76.8% in 2016,[27] Goba town 57.2%,[28] Dega Damot 88.8%[29] but higher than previous finding in 33.2% in Gondar,[30] 33.5% in Addis Ababa,[16] and 25.7% in Ziway.[26] This might be due to the difference in whether there was a problem in the identification of iodized salt during purchasing from the whole sellers, shops, and others where iodized salt was sold and the lower global and regional levels.[10] In fact, in this report, more than 945 (67.6%) participants scored good knowledge about iodine-related beneficiaries but this was divergent from the study where 386 (27.61%) lacked iodized salt in their homes during the interview.

Concerning to health-related burden of goiter in the population was estimated as 11.4/1000. However, which is lower than the previous reported 50.7% North Shewa Zone,[9] *and 13.6% Hawassa Town.*[11] *This difference might be due to the current improvement in the utilization of iodized salt compared to previously reported studies*. On the other hand, the political and logistic problems in the production and distribution of iodized salt could be the main reason for poor regulatory agencies have attributed to inadequate iodized salt utilization and low attributable risk difference on iodized salt utilization.

Regarding the factors associated with adequate iodized salt utilization, the level of education is one factor that facilitates iodized salt utilization.[31] Accordingly, participants who

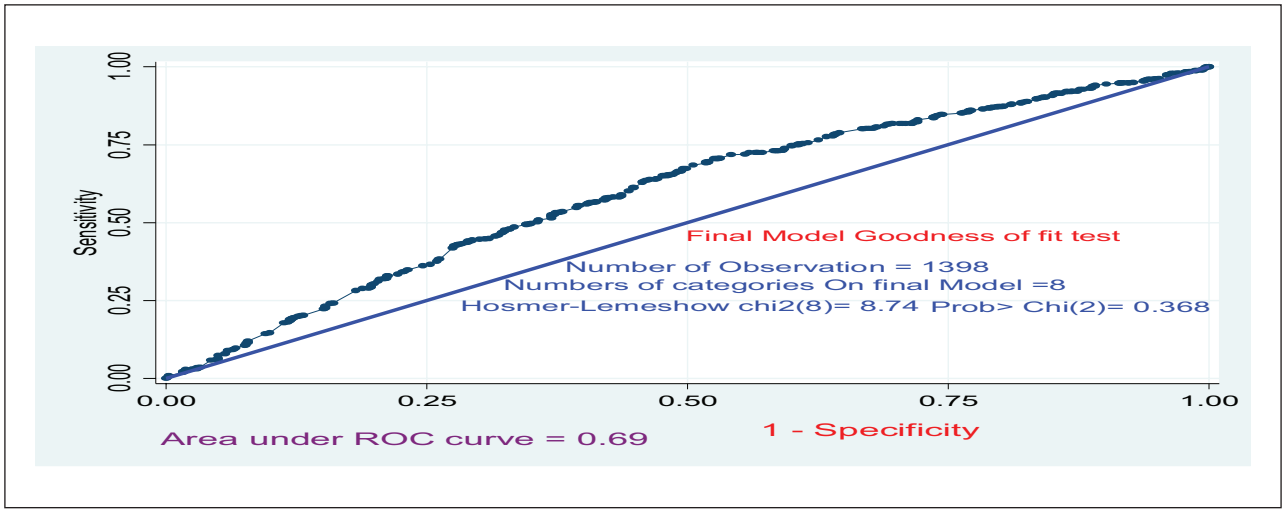

Figure 3. Final model goodness-of-fit test.

have formal education were 1.6 times more likely to use iodized salt as compared to those who did not attend formal education. This is consistent with the previous report on Hote district,[32] Laelay Maychew in 2015, Woilata in 2018, Asella in 2016, Sudan in 2017, and Iraq in 2012.[16,22,23,31,33,34] Public awareness is necessary for the demand of iodized salt utilization.

Likewise, respondents having a Monthly income ⩾5000 ETB/month were nearly two times more likely to use adequate iodized salt as compared with respondents with a monthly income ⩽1000 ETB/M. *Previously reported studies to reveal that the unavailability (52.2%) of iodized salt is due to the high cost (32%) as the primary reason for not using iodized salt.*

In some occasions, the frequent practice of cooking of food can motivate purchasing of iodized salt from shops or markets. This makes directly increased the availability of iodine in cooked food if the daily income did not matter it.

Consistent with previous studies' reports[3,32,35] respondents with good knowledge score had two times more likely to use iodized salt as compared with the counter group. This could be because educated respondents have learned and could read about the importance of iodized salt. In addition, the educated respondent might have the power to better access to mass media that motivates them to utilize iodized salt properly. A significant proportion of the population not used still iodized salt was doing so because of concerns about using it. The most reason for not using iodized salt in every household is the issue of inaccessibility and cost. Each of these barriers could be tacked if and only if edible salts were used in every household.

Limitations of the study

This study ignored knowledge of the whole household members' iodine status and only interviewed one among them. This effect was ignored during the sample size calculation, and the cross-sectional study design restricts the factors to establish a causal relationship.

Conclusion

In this study, the overall coverage of iodized salt utilization among households was better; however, the proportion of proper utilization remains low, which was 48.5% as compared with universal salt initiative declarations of 90%. Respondents with formal educational status, monthly income ⩾5000 ETB/month, and good knowledge score were significantly associated with proper iodized salt utilization. For effective USI and IDD risk reduction, regular inspection and monitoring must be taken barrier on the production and distribution of iodized salt in retailers and purchasers.

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Authors' contributions

FK, MG, and AM conceived the study, supervised the data collection, did the analysis and interpretation, and wrote the full manuscript from the initial to the end. Finally, each author commented, edited the final draft, and approved the final version for submission.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The Ethical Review Board of Debre Markose University ethically cleared this research to conduct with the protocol (119/011).

Written informed consent was taken from the participants and legally authorized representatives of minor participants before the study initiation. The purpose of the study was explained to all study participants, and study was carried out in accordance with relevant guidelines and regulations.

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Informed consent

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Consent for publication

Not applicable

Trial registration

Not applicable

Data sharing statement

The data set for this research is up on corresponding author with reasonable request.

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Supplemental material

Supplemental material for this article is available online.

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