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Nearly one-in-five households utilized inadequate iodized salt in Nifas Silk Sub-City, Addis Ababa, Ethiopia

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Abstract

Background There is no country in the developing world where iodine deficiency is not a public health problem including Ethiopia. Therefore, this study aimed to assess inadequate utilization of iodized salt and associated factors at household level in woreda 11 Nifas Silk Sub-city, Addis Ababa, Ethiopia.

Methods A community-based cross-sectional study was conducted with multistage sampling technique on 348 household respondents. The data were collected using interviewer-administered structured questionnaires and an iodine rapid test kit. The data were edited, cleaned, and entered using Epi-data version 4.6.2 and exported to SPSS version 25 for analysis. A multivariable logistic regression model was fitted to identify associated factors for inadequate utilization of iodized salt. The statistical significance was declared at a p-value of less than 0.05 with 95% confidence interval.

Results A total of 348 household respondents were participated. The amount of iodine content in salt 0 ppm, < 15ppm and > 15ppm were 11.8%, 7.2% and 81.0% respectively. Total inadequate utilization of iodized salt was 19%. Using unpacked salt [AOR; 0.50 (95%CI: 0.27, 0.93)], using a container without a lid [AOR; 0.29 (95%CI: 013, 0.63)], and having insufficient knowledge [AOR; 2.10 (95%CI: 1.14, 3.86)] were all significantly connected with using inadequate iodized salt.

Conclusions Iodized salt utilization was inadequate. Using containers without a lid, unpacked salt, and poor knowledge were associated factors. There should be a provision of adequate knowledge about iodized salt, a proper storage and handling.

Keywords Addis Ababa, Ethiopia, Iodine deficiency disorder, Iodized salt utilization

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Introduction

Iodine deficiency disorders (IDD) affect more than 50 nations and are a serious public health issue. WHO estimates that there are around 2 billion people in the world [1]. Worldwide 30% [2] of the world population suffer from insufficient iodine intake below 100 μg/L [3]. Iodine deficiency is a public health problem throughout the world [4, 5]. In Europe (57%), the Eastern Mediterranean (54%), Africa (43%), Southeast Asia (40%), the Western Pacific (24%), and the Americas (10%) are the countries most affected [6]. In Africa, about 260 million people have inadequate iodine intake resulting in iodine deficiency states, which may be related to a 10–15% lowering of average intellectual capacity [7, 8].

Mental retardation, growth retardation, reproductive failure, high childhood mortality, impairments in nervous system development, goiter, physical slowness, and economic stagnation are all connected with IDD [9]. Iodine deficiency can reduce average intellectual quotient (IQ) scores by 13.5 points [10] and a mild iodine deficiency can cause a significant loss of learning ability [11]. In Ethiopia, one out of every 1000 is a cretin and about 50,000 prenatal deaths are occurring annually due to iodine deficiency disorders [12], 26% of the total population have goiter and 62% of the population is at risk of IDD according to the national survey made by the previous Ethiopian Nutrition Institute [13].

Iodine can be found in seafood, dairy products, iodine-rich soils, and minor amounts in the majority of other foods. Topsoil contains iodine naturally, but it has been damaged by deforestation, erosion, and flooding [14]. Iodine shortage in the diet results from this absence of iodine in food crops. Consequently, people need extra sources to consume the required levels [15]. Despite this, the WHO supported the Universal Salt Iodization (USI) programme, a highly cost-effective public health policy [16], and salt iodization campaigns were started in about 120 different nations worldwide. Thanks to USI [17], iodine deficiency diseases have been wiped out in 34 of these countries.

Despite the fact that worldwide iodine nutrition has vastly improved, 20 to 30% of pregnancies and hence babies continue to be disadvantaged by the usage of iodized salt [18]. Iodized salt coverage varies by region, ranging from 90% in Asia and the Pacific to 40–60% in Sub-Saharan Africa [19]. Furthermore, use varies significantly between countries, ranging from 10 to 90%. Sudan, Mauritania, Guinea-Bissau, and the Gambia, for example, use less than 10% of iodized salt, whereas Burundi, Kenya, Nigeria, Tunisia, Uganda, and Zimbabwe have met the USI objective [20]. In Ethiopia, the use of adequate iodized salt increased from 15% to 2011 to 89% in 2016 [21, 22]. According to research conducted in Ethiopia, iodized salt usage ranges from 55.2% in Tigray [23] to 8.7% in the Lalo Asabi District in west Ethiopia [24–26].

The Ethiopian government revitalized and launched universal salt iodization activities, as well as strategies for the virtual elimination of IDD. The Ethiopian quality and standards authority has set the iodine level as potassium iodate at 60–80 parts per million (PPM), after allowing for iodine losses during storage and distribution, and salt fortification with iodine has been a long-term and effective preventive measure against IDD [27, 28]. However, still, only 26% of the households are using adequate iodized salt [29] and 10.8 −36% of women aged 15–49 years have been affected by goiter [29, 30].

In fact, IDD continues to be a major public health concern for people of all ages [29, 31]. There is little data on the iodine amount of salt at the retail and consumer levels, and studies have found that households in Ethiopian regions frequently utilize iodized salt insufficiently. Although they did not show how knowledge and practice influence the use of salt with an acceptable iodine level in the research area, the parameters that predicted coverage, adequacy, and consumption were also investigated. In order to evaluate iodized salt intake and related factors among families in woreda 11 Nifas Silk Sub-City, Addis Abeba, Ethiopia, the current study was conducted.

Methods and materials

Study area

Woreda 11 Nifas Silk sub-city is where the study was carried out. Woreda 11 contained 8 settlements. The woreda record states that the current estimated total population was 65,512, with 30,398 men and 33,114 women living in 5845 homes.

Study design and period

A community-based cross-sectional study was conducted from September 1 to October 1, 2020.

Source population and study population

The source population consisted of all houses in Addis Ababa's woreda 11 Nifas Silk Sub-city. The study population consisted of households from randomly selected villages in Addis Ababa's woreda 11 Nifas Silk sub-city. The houses that provided the actual response during data collecting time were chosen by systematic sampling as the study unit. Respondents who were suffering from a serious illness at the time of the visit were omitted from the study.

Sample size determination

The sample size was calculated using the Epi info software version 7.08 by using double population proportion formula considering the assumptions of 95% confidence

interval, ($Z_{\alpha/2}$=1.96), 80% power and factors that had association with iodized salt utilization in respondents educational status among no formal education and formal education 21.3% and 35.7% respectively; a study done Arsi zone, South East Ethiopia [32]. Based on the assumption, the total sample size became 334. Since the total households of the district were 5845 (which was less than <10,000), therefore reduction formula was used (nf=n/(1+n/N)). Where nf was the desired sample size and after adding (10% non-response), the final minimum required sample size became 348 households.

Sampling technique and procedure

To guarantee the representation of all residents in Addis Abeba's Nifas Silk Sub-City, a multistage sampling the technique was adopted. The villages were regarded as clusters since their traits were thought to be uniform. Three out of eight villages, or a total of eight villages, were randomly selected by the lottery system to make up the sub-city. Then, using the sample size interval (K=5), the total household was divided to select the households from each of the selected villages in the last stage of the process.

Study variables

Inadequate iodized salt utilization was the outcome variable. Socio-demographic variables (age, sex, marital status, educational status, occupation, family size, monthly income), knowledge about iodized salt utilization, attitude about iodized salt utilization, availability, accessibility and taste of iodized salt, iodized salt utilization (type of salt, expose salt to sunlight, place of salt storage, type of container used to store, the time when did they add the salt while cooking) were the independent variables.

Operational definitions

Adequately iodized salt was defined as a salt that was fortified with iodine and has an iodine concentration of greater than or equal to 15 PPM [24, 32, 33], and when the salt contains an iodine concentration less than 15 PPM was classified as inadequate iodized salt [24, 32–34].

Good knowledge when the participant scores more than or equal to the average for knowledge question scores and knowledge scores less than the average (50%) was labeled as poor knowledge [35].

Favorable attitude for positive statements, those who responded including strongly agree and agree in a Likert scale with five possible responses, and unfavorable for negative statements those who responded disagree, strongly disagree and uncertain. Marking the total attitude score out of a hundred, those with a score of greater than 50% were rated to have a favorable attitude and those with a score below 50% an unfavorable attitude [35].

Data collection tools and processes

The data were collected using a structured questionnaire adapted from iodized salt program assessment tool [25] and from similar related kinds of literatures [23, 24, 35, 36]. The questionnaire was first prepared in English and translated to the local language Amharic and then back-translated to English to check for its consistency. The socio-demographic characteristics, knowledge, attitude, and practice of iodized salt questions were contextualized with the study area. The questionnaires contained both open and close-ended questions. The questionnaires included a section for observing the type of container used to store the salt and the place of salt storage. Iodine rapid test kit was used to assess the use of iodized salt at the household level by trained nurses and midwives using an interviewer based structured questionnaire and the iodine levels in sampled salt were measured by the rapid test kits.

To assess the iodine content of the salt at the household level, interviewers asked households to provide a teaspoon of salt used for cooking. The salt was tested for iodine by using the iodine rapid test kit (MBI Kits International). MBI KITS was an improved iodized salt field test kit for salt fortified with potassium iodide. The test kit was contained 2 test solution ampoules of 10 ml; 1 recheck solution ampoules of 10 ml, 1 color chart, and 1 white cup.

Procedure to test iodine content of the salt

Primarily a small cup was filled with salt and then it was spread on a flat surface. Two drops of the test solution were added to the surface of the salt by piercing the white ampoule with a pin and then the ampoule was gently squeezed. Then after within one minute, the color of the salt was compared with the color chart and the iodine content was determined. When it had no color that appeared on the salt (after one minute), on a fresh sample five drops of the recheck solution in a red ampoule and then added two drops of test solution on the same spot was added. Finally, it was compared the color with the color chart and determined the iodine content.

Data quality control

A pre-test of 10% of the minimum calculated sample size was performed, as well as data collecting and monitoring. The questionnaire was thoroughly reviewed before entering data. To determine the iodine content of salt at the home level, trained data collectors followed standard techniques. The data collectors and supervisors were trained for three days.

Table 1 Socio-demographic characteristics among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia, 2020

Variables		Frequency	Percent
Age in years	18–24	100	28.7
	25–29	78	22.4
	30–34	52	14.9
	35–39	43	12.4
	≥40	75	21.6
Sex	Male	63	18.1
	Female	285	81.9
Marital status	Married	217	62.4
	Single	112	32.2
	Divorced	12	3.4
	Widowed	7	2.0
Educational status	Unable to read and write	26	7.5
	Read and write only	18	5.2
	Primary school (Grade 1–8)	62	17.8
	Secondary school (Grade 9–10)	78	22.4
	Preparatory school (Grade 11–12)	28	8
	College and above	136	39.1
Occupation	Government employ	37	10.6
	Private employ	171	49.1
	Student	31	8.9
	House wife	109	31.3
Family size	Less than 3	126	36.2
	3–5	172	49.4
	Above 5	50	14.4
Average monthly income per USD	< 30	25	7.2
	30–60	111	31.9
	60–90	58	16.7
	> 90	154	44.3

Table 2 Knowledge among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia, 2020

Variables		Frequency	Percent
Knows effects of iodine deficiency at least one	Yes	249	71.6
	No	99	28.4
Knows effects of iodine deficiency Two or more	Yes	99	28.4
	No	249	71.6
Heard about iodized salt	Yes	322	92.5
	No	26	7.5
Knows that iodized salt prevents IDD	Yes	216	62.1
	No	132	37.9
Source of information on utilizing iodized salt n (338)	From social media	114	32.8
	Health professional	147	42.2
	Other	77	22.1
Attitude status	Unfavorable	132	37.9
	Favorable	216	62.1

Data processing and analysis

The acquired data were reviewed, cleaned, and input into Epi-data software version 4.6.2 before being exported to SPSS version 25.0 for analysis. Frequency tables, graphs, and summary statistics were used to present the descriptive analysis. Bivariable analysis was used to examine the relationship between outcome and independent factors. All variables with a p-value < 0.25 in the bivariable analysis were deemed candidate variables for the multivariable logistic regression model. A multivariable logistic regression model was used to discover factors influencing insufficient iodine salt utilisation. A p-value of less than 0.05 was considered statistically significant. The degrees of connection between outcome and independent variables were calculated using an adjusted odds ratio with a 95% confidence interval.

Results

Socio-demographic characteristics

A total of 348(100% response rate) participants were interviewed in the study period. The mean (±SD) age of the respondents were 31.7(±10.4) years and 100(28.7%) of the mother were in the age range of 18–24 years. Among the total respondents, 217(62.4%) were married and 136(39.1%) attended college and above. The majority of 285(81.9) were female and 171(49.1%) were private employees. Almost half 172(49.4%) of family sizes were 3–5. In the present study, almost 45% of respondents earn > 90 USD per month (Table 1).

Participant's knowledge about iodized salt

The majority 249(71.6%) of the respondent knew at least one effect of iodine deficiency and while 99(28.4%) knew of two or more effects of iodine deficiency. In the current study 322(92.5%) respondents had heard about iodized salt and the majority of mother 216(62.1%) knew that iodized salt prevents IDD. The majority of 147(42.2%) source of information is health professionals. In the present study 216(62.1%) participants had a favorable attitude toward iodized salt utilization (Table 2).

The practice of participants about iodized salt

The majority of 238(68.4%) participants used packed salt. Of some mothers 46(13.2%) were exposed salt to sunlight. Almost all of 333(95.7%) participants stored salt dry places. The majority of 314(90.2%) participants used containers with lids. More than half 193(55.5%) added salt after cooking (Table 3).

Availability, accessibility, and taste of iodized salt

Almost all 332(92.5%) respondents got iodized salt easily when needed. The price of iodized salt for the majority of 256(73.6%) of the respondents was affordable and the test of the iodized salt for the majority of 248(71.3%) respondents was no different from to the normal salt (Table 4).

Table 3 Handling of iodized salt among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia, 2020

Variables		Frequency	Percent
Type of salt	Packed	238	68.4
	Non-packed	110	31.6
Expose salt to sun light	Yes	46	13.2
	No	302	86.8
Place of salt storage	Dry place	333	95.7
	Moisture area	15	4.3
Type of container	Container with a lid	314	90.2
	Container without a lid	34	9.8
Time of adding salt during cooking	While cooking	155	44.5
	After cooking	193	55.5

Table 4 Availability, accessibility, and taste of iodized salt among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia, 2020

Variable		Frequency	Percent
Availability iodized salt when needed	Yes	332	92.5
	No	26	7.5
The price of iodized salt	Expensive	92	26.4
	Affordable	256	73.6
Iodized salt taste change	Yes	98	28.2
	No	248	71.3

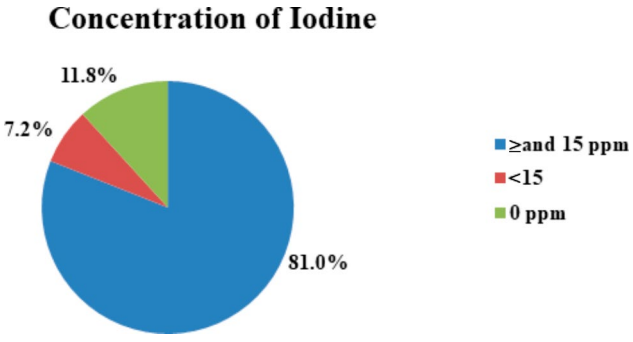

Fig. 1 Percentage of iodine concentration in the salt among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia, 2020

The iodine content of household salt

The prevalence of iodine content on salt 0 ppm, <15ppm and ≥15ppm were 11.8%, 7.2% and 81.0% respectively (Fig. 1).

Factors associated with inadequate utilization of iodized salt

Bivariable analysis was done to assess the association between individual independent variables and utilization of inadequately iodized salts. Age, family size, type of salt, type of container, time of adding salt during cooking, knowledge status, and attitude status became candidate variables for multivariable logistic regression model.

Finally keeping the other variables constant, the odds of utilization of inadequately iodized salt among the packed types of salt were 50% [AOR; 0.50 (95% CI= (0.27, 0.93)] lower than non-packed type users. The odds of inadequately iodized salt in a salt container with a lid were 71% [AOR; 0.29 (95%CI= (0.13, 0.63)] lower than a container with no lid. The odds of the utilization of inadequately iodized salt among respondents with poor knowledge were 2.29 times [AOR; 2.1 (95% CI=1.14, 3.86] higher than respondents with good knowledge (Table 5).

Discussion

The prevalence of iodine content on salt 0 ppm, <15ppm and ≥15ppm were 11.8%, 7.2% and 81.0% respectively. In this study prevalence of inadequately iodized salt utilization was higher when compared to a study in Arsi at 8.2% [32]. This study was lower when compared to Tigray northern and western Ethiopia 44.6-82.5% [23, 37–39], Gambela 47.2% [40], Lalo Assabi district in West Ethiopia 92.3% [24], Jimma 73.8% [25], and Amhara regions 85% [26]. This might be due to the fact that a study area Addis Ababa was better socioeconomic status and also this might be due to the availability & accessibility of iodized salt in the market, legislation & policies to fortify salt with iodine, regular follow up & monitoring regarding utilization of iodized salt in this study area.

The current finding revealed that about 56.9% of participants had good knowledge about iodized salt & iodine deficiency disorders. The result was slightly higher when compared to a study done in Gobe town revealed about 51.7% of the respondents had sufficient knowledge about iodized salt and IDD [41]. It was also slightly higher than 56% in Sudan [42]. This finding was also lower when compared to a study done in Dire Dawa indicated that 62.4% of the households had good knowledge of the importance of using iodized salt [43]. It was also lower than in Yeka sub city Addis Ababa 78% [44]. This might be due to the different levels of social structure, regular follow up and monitoring regarding the utilization of iodized salt.

In this study about 62.1% of the respondents had a favorable attitude towards iodized salt which is higher than the study revealed from in Shebelle town 50.6% of respondents had a favorable attitude [35].

The study revealed that the odds of utilization of inadequately iodized salts among the packed types of salt were 50% lower than non-packed type users. This finding was also consistent with other studies like a study done in the Arsi zone, South East Ethiopia [34], Lalo Assabi District West Ethiopia [24], and Dire Dawa [43]. This might be due to the fact that exposing iodized salt to households or using unpacked salt gradually reduces iodine concentration in salt in addition to that of its volatile nature [45, 46]. However, iodine content will remain relatively constant if the salt is packed dry with an impermeable lining such as polyethylene bags [32] and the production might be contained inadequate iodine [47].

Table 5 Bivariable and multivariable logistic regression model predicting factors associated with inadequate iodine salt utilization among households in Woreda 11, Nifas silk Sub-city, Addis Ababa, Ethiopia 2020

Variable		PPM		COR (95% CI)	P-value	AOR (95% CI)	P-value
		<15ppm No (%)	≥15ppm No (%)				
Age	18–24	22(33.3)	78(27.7)	1.23(0.58,2.59)	0.590	1.63(0.73,3.62)	0.231
	25–29	19(28.8)	59(20.9)	1.41(0.65,3.05)	0.393	1.57(0.68,3.62)	0.293
	30–34	8(12.1)	44(15.6)	0.79(0.31,205)	0.631	0.68(0.25,1.88)	0.455
	35–39	3(4.5)	40(14.2)	0.33(0.09,1.21)	0.094	0.28(0.07,1.77)	0.064
	≥40	14(21.2)	61(21.6)	1		1	
Family size	<3	30(45.5)	96(34)	2.29(0.89,5.91)	0.086	1.93(0.71,5.29)	0.201
	3–5	30(45.5)	142(50.3)	1.55(0.61,3.96)	0.361	1.49(0.55,4.06)	0.434
	>5	6(9.1)	44(15.6)	1		1	
Type of salt	Packed	34(51.5)	204(72.3)	0.41(0.23,0.70)	0.001	0.50(0.27,0.93)	0.028*
	Not packed	32(48.5)	78(27.7)	1		1	
Type of container	Container with a lid	50(75.8)	264(93.6)	0.21(0.10,0.41)	0.001	0.29(0.13,0.63)	0.002*
	Container without a lid	16(24.2)	18(6.4)	1		1	
Time of adding salt during cooking	While cooking	34(51.5)	121(42.9)	1.41(0.83,2.42)	0.207	1.35(0.75,2.43)	0.313
	After cooking	32(48.5)	161(57.1)	1		1	
Knowledge status	Poor	40(60.6)	110(39)	2.41(1.39,4.16)	0.002	2.29(1.26,4.17)	0.007*
	Good	26(39.4)	172(61)			1	
Attitude status	Unfavorable	33(50)	99(35.1)	1.85(1.08,3.18)	0.026	1.28(0.69,2.40)	0.434
	Favorable	33(50)	183(64.8)			1	

*Significant at P-value < 0.05, AOR = adjusted odds ratio, COR: Crude Odds Ratio

The odds of inadequate iodized salt in a salt container with a lid were 71% lower than a container with no lid. This study was also consistent with a study done in Lalo Assabi District, West Ethiopia [18], India [36], and Tigray [17]. This might be as iodine can be lost due to its volatile property [46].

The odds of the utilization of inadequately iodized salt among respondents with poor knowledge were 2.29 times higher than respondents with good knowledge. This finding was supported by another study done in Dire Dawa city and North west Ethiopia [39, 43, 46]. It was also supported by a study conducted in Bangladesh [48]. This might be due to the fact that unless households get access to information about how to store iodized salt, know the importance of it and the consequences of not using an ionized salt to reduce IDD. This was confirmed by the demographic analysis of findings from Ethiopian demographic and health survey [49]. The study limitation was on using only rapid field-testing kits to determine the availability of adequately iodized salt samples which did not include titration levels of iodine and urinary iodine.

Conclusion

About 19% of households have inadequate iodine. Salt consumption, lack of knowledge, and unpackaged salt are all connected factors. Instructions and proper storage are also required. Future research can be conducted to assess the appropriateness of iodine concentrations at the manufacturing level.

Abbreviations/acronyms

CSA	Central Statistical Agency
EDHS	Ethiopian Demographic & Health Survey
HH	Head of Household
ICCIDD	International Council for the Control of IDD
IDD	Iodine Deficiency Disorder
MOH	Ministry of Health
PPM	Parts Per Million
SPSS	Statistical Package for Social Sciences
TSH	Thyroid Stimulating Hormone
UNICEF	United Nations Children's Fund
USI	Universal Salt Iodization
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1

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Authors' contributions

GSM, EAE, BZT, and FWF designed the questionnaire and conducted the data collection process. GSM, EAE, BZT, and FWF contributed to data acquisition, analysis, and interpretation. All the authors critically reviewed, edited the manuscript. Finally, read and approved the final manuscript.

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Data Availability
The data sets analysed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by both Institutional Review Board (IRB) of Jimma University and Addis Ababa health research and emergency management directorate with a reference number of IRB/01289/08/2020 and A/A/H/1832/324. Written informed consent was obtained from the study participants and the parent/guardian of each participant for those 18 years of age after a detailed explanation of the purpose and benefit of the study right before data collection. Thumb printed consent was also obtained after informing their legal guardian(s) of all subjects who were unable to read and write in their educational status for those of who were at 18 years of age to make them to feel more confident about the study. The authors also confirm that all methods were performed in accordance.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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