Magnitude and factors associated with Availability of Adequately Iodized Salt at Households of Pregnant Mothers in Wonago district, south Ethiopia

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Research Article

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Abstract

Background

Salt iodization is the most cost-effective, safe and sustainable strategy to eliminate iodine deficiency disorders. It is especially damaging during pregnancy and in early child hood. Adding iodine to salt provides protection from brain damage due to iodine deficiency for whole populations. However, little was known about the availability of adequately iodized salt in South Ethiopia. The aim of this study was to assess prevalence and factors associated with availability of adequately iodized salt at the households of pregnant mothers in Wonago District, South Ethiopia, 2018.

Methods

Community-based cross-sectional study was conducted from May 14-29, 2018 in Wonago district. Using a stratified two stage random sampling technique, a total of 604 pregnant mothers were included in the study. The level of salt iodine content was determined using the rapid field test kit, considering a value of <15 parts per million (PPM) and ≥ 15 PPM with the corresponding color chart on the rapid test kit for classification. Multivariable logistic regression model was fitted to identify factors associated with the availability of adequately iodized salt. Adjusted Odds Ratio (AOR) with the corresponding 95% Confidence Interval (CI) was calculated to show the strength of association.

Result

Availability of adequately iodized salt at households of pregnant mothers was 19.9%. House hold head, husband education, average monthly household income and time of salt addition during cooking were independently associated with adequately iodized salt availability. Accordingly, participatory male headed households [AOR=2.1(95%CI 1.08, 3.96)], women with an average monthly household income of ≥ 817 ETB [AOR=7.3(95%CI 3.03, 17.70)] and those who added salt late or after cooking during food preparation [AOR=2.17(1.08, 4.38)] were more likely to utilize adequately iodized salt. Conversely, women whose husband had no formal education were less likely [AOR=0.33(95%CI 0.11, 0.88)] to utilize iodized salt.

Conclusion

Compared to the recommended standard, use of adequately iodized salt among pregnant women is very low. Paternal conditions and household income level are key predictors of use of adequately iodized salt.

Introduction

Iodine deficiency is the world's single greatest cause of preventable mental retardation. It is especially damaging during the early stages of pregnancy and in early child hood.¹ Iodine deficiency disorders (IDD)

include stillbirths, abortions, and congenital anomalies; endemic cretinism characterized most commonly by mental deficiency, deaf, mutism, and lesser degrees of neurological defect related to fetal iodine deficiency; impaired mental function in children and adults with goiter associated with subnormal concentrations of circulating thyroxine.^{2, 8} Even mild deficiency can cause a significant loss of learning ability – about 13.5 intelligence quotient (IQ) points at population level.³ In addition to infringing on the rights of children, iodine deficiency results in a loss of economic productivity.⁴

Prevention of the detrimental effects of inadequate intake of iodine is of immense importance to global development. It could be the most important achievable international health goal of the decade, exceeding even the impact of global eradication of smallpox in the 1970s.⁵ The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommended universal salt iodization since 1993 to end IDD and its complications.

Globally, close to 2 billion populations (35.2% of world population) is at risk of iodine deficiency, while one-third lives in areas where natural sources of iodine are low. At least 350 million Africans are at risk of iodine deficiency and its complication.⁶

Universal salt iodization (USI) is recommended as the most cost-effective, safe and sustainable strategy to eliminate iodine deficiency disorders (IDDs). However, only 75% of the household's worldwide use iodized salt. This USI coverage is considered as a dramatic increment compared to the 1990 report, 10%.⁷ Yet iodine deficiency remains a considerable challenge worldwide after decades of efforts to address the problem.⁸

In terms of the region, an optimal iodized salt utilization (90%) is reported in East Asia and Pacific countries. In sub-Saharan Africa, 64% of households are using iodized salt, nevertheless the level of utilization widely varies from 10 to 90% in different countries. For instance, utilization of iodized salt is less than 10% in Sudan, Mauritania, Guinea-Bissau, and Gambia, whereas, in Burundi, Kenya, Nigeria, Tunisia, Uganda, and Zimbabwe, it is more than 90%.⁹

To ensure the nutritional health of pregnant women with respect to iodine status, a World Health Organization (WHO) Technical Consultation in 2007 proposed increasing the recommendations for iodine intake of pregnant. The iodine content of household salt should be at least 32 and 51 ppm during early and late pregnancy, respectively. These levels are far above the 15 ppm currently considered to be adequate salt iodine content at the household level. Pregnant women may remain iodine insufficient due to the increased demands for iodine during pregnancy even when other members of a household have achieved iodine adequacy.^{8, 10, 18, 19}

In Ethiopia, availability of adequately iodized salt shows a gradual improvement, 4% in 2000 to 15% in 2011, 23% in 2014 and 26% in 2016. Disparities in level of utilization are detected with residence and regions. The rural and urban household availability of adequately iodized salt is 30.6% and 23.8%. South

Nation Nationalities Peoples Region (SNNPR) is the lowest by adequately iodized salt availability in the country only 13.7%.¹¹

Ethiopia is a salt producing state, endorsed mandatory salt iodization program and is working with partners, United Nations Children's Fund (UNICEF), Global Alliance for Improved Nutrition (GAIN) and Micronutrient Initiatives, to reach utilization of iodized salt >90% thereby to mitigate iodine deficiency.¹² But, still only 23.2% of the households use adequately iodized salt. In addition, iodine deficiency remains the major public health problem among pregnant women and school children.¹³

There were no studies regarding availability and factors associated with adequately iodized salt in Wonago District. Therefore, this study aimed to determine magnitude and factors associated with availability of adequately iodized salt at households of pregnant mothers in Wonago district, South Ethiopia.

Material And Methods

Study setting and design

A community-based cross-sectional quantitative study method was applied from May 14-29/2018 in Wonago district. The study was carried out in six randomly selected kebeles of Wonago district which is located 13km from Dilla (administrative city of Gedeo zone) and 377km from Addis Ababa (capital city of Ethiopia). The district has 152,609 (female=76,686 and male=75,923) population and households 31,145. Wonago district has 21 kebeles (the smallest administrative unit in Ethiopia).¹⁴

Study population

Households with pregnant mother who were apparently healthy during the study period were included in the study and severely ill to respond or with difficulty in speech or listening were excluded. The sample size of 604 households of pregnant women was determined by using formula for estimating single population proportion and with the following assumptions to obtain the optimum sample size: P = proportion of households with adequately iodized salt 39%,¹⁵ Z = reliability coefficient = 1.96, d = 5% margin of error and, design effect (DE) = 1.5, non-response rate = 10%

Data collection instruments and procedure

A structured interviewer-administered questionnaire was used to collect survey data. The questionnaire was developed by the investigator after reviewing literatures. They were initially prepared in English then translated into the local language (Amharic and Gedeo-fa) and finally, back translated to English to maintain consistency. A total of six data collectors (six diploma nurses) and one supervisor (BSc nurse) were recruited for the study. Daily supervision and feedback was carried out by the investigator and supervisors during the entire data collection period. A table spoon of salt was taken from each household and iodine Rapid Test Kit (MBI-International) was used to determine the level of salt iodine content. The small cup in the kit was filled with salt, and made the cup surface flat. Two drops of test solution

from white ampoule were added to the surface of the salt by piercing the white ampoule with a pin and gently squeezing the ampoule.

The iodine content in the salt was determined within one minute by comparing the color change on the salt with the color chart. The value parts per million (PPM), <15 PPM and ≥ 15 PPM with the corresponding color chart on the rapid test kit was used to classify the level of iodine in the sampled salt. If no color appears (after 1 min), 5 drops of the recheck solution from red ampoule were added to a fresh salt sample and followed by 2 drops of test solution on the same salt sample. A comparison was done with the color chart indicators for salt iodine content. Finally, Availability of adequately iodized salt was considered when the household sampled salt had ≥ 15 ppm iodized salt. Otherwise, it was classified to inadequately iodized or non-iodized salt.^{12,19}

Data Processing and Analysis

Each questionnaire was checked for completeness and consistency by supervisors. Data was exported from epi-data version 3.1 to SPSS version 20.0 for analysis. It was summarized with tables and figures. To identify factors associated with availability of adequately iodized salt, each variable was assessed independently whether a predictor of availability of adequately iodized salt or not. First, variables were tested using bivariate analysis. Variables which were associated in bivariate analysis were tested in the final multivariate analysis to see their association with availability of adequately iodized salt.

Results

Socio-economic and demographic characteristics

Majority of the respondents 310(52.7%) were in the age group of 25-34 years and their mean (SD $\pm$ 5.40) age was 26.7 years. 514(87.4%) were from rural area .More than three-fourth (77.7%) households were headed by men (husbands). Majority of the respondents (54.4%) had family size greater than five. Slightly less than half or 286 (48.6%) had not formal education, but three-fourth (74.5%) of husbands of these women had at least some form of formal education. More than ninety five in hundred (96.30%) respondents were housewife (**Table 1**).

Knowledge of respondents towards iodized salt

237 (40.3%) had good knowledge. Slightly less than half 275 (46.8%) of the respondents reported that they had heard about iodized salt. The main source of information being health worker 105(38.2%) followed by TV/radio 81(29.5%) and family member 55(20%). Even if they had had information, 166 (60.4%) of the respondents reported that they didn't use iodized salt because it is expensive 155 (93.4%). (**Table 2**)

Source and type of iodized salt

510(86.7%) households used unpacked salt during the study in the district. Majority 436(74.1%) of the respondents purchased salt from market for consumption. **(Table 3)**

Handling and utilization practices

Out of the respondents, only 60 (10.2%) had proper practice. Majority 300(51.0%) of the respondents reported that they can't identify iodized salt. Slightly more than one-fourth 155(26.4%) of the respondents said iodized salt is more white than else. Only slightly more than one-fifth 133(22.6%) of the respondents can identify iodized salt by reading the logo. Out of the respondents, 248(42.2%) added salt early/at the middle of cooking during food preparation **(table 4)**.

Availability of adequately iodized salt at households of pregnant women

117(19.9%) had adequately iodized salt (salt iodine content ≥ 15 PPM) but 471(80.1%) sampled households had inadequately iodized salt (salt iodine content < 15 PPM). According to residence, adequately iodized salt availability was 33.8% (25 households out of 74 sampled households) in Urban and 17.9% (92 households out of 514 sampled households) in rural areas of Wonago district during the study period. **(Figure 1)**

Factors associated with availability of adequately iodized salt

Predictor variables of socio-demographic, maternal knowledge, source and type of salt, and handling and utilization practices were assessed independently.

Both women and husband (participatory) headed households were twice more likely to utilize adequately iodized salt compared with husband only headed households [AOR=2.10 95% CI (1.08, 3.96)]. Similarly, Pregnant women whose average monthly household income was between 816 and 1634 ETB were 7.32 times [AOR=7.32 95% CI (3.03, 17.70)] more likely to utilize adequately iodized salt compared with whose average monthly household income was 816 ETB or less.

However, pregnant women who had husbands with no formal education (no formal schooling) were less likely to use adequately iodized salt by 67% [AOR=0.33 95%CI (0.11, 0.88)] compared with counter parts.

Respondents who added salt late or after cooking during food preparation were twice [AOR=2.17(1.08, 4.38)] more likely to utilize adequately iodized salt compared with who added salt early or at the middle of cooking. **(Table 5)** and **(Table 6)**

Discussion

The study aimed to assess the availability and predictors of using adequately iodized salt among pregnant women in one of the rural cash crop (coffee) producing areas of Ethiopia. Accordingly, results showed that utilization of adequately iodized salt among pregnant women was very low. There were

several maternal, paternal and household factors identified as key predictors of use or non-use of products.

The availability of adequately iodized salt (≥ 15 ppm) was found to be only 19.9% [95% CI (16.70%, 23.13%)] which was far lower than the WHO recommendation according to which greater than 90% of households should utilize adequately iodized salt to eliminate IDD.²⁰ However, the present study finding was higher than the regional (SNNPR) 13.7%,²⁰ a study conducted in Niger 6.2%,²¹ Homoe, Ghana 16.5%,²⁴ Northern Ethiopia 6%,²² and Lalo Assabi, West Ethiopia 8.7%.²³ This might be due to different socio-economic characteristics and time sequence of the study area and referenced area.

This finding was lower than the national 26%,¹¹ a study conducted in Jalisco, Mexico 24%,²⁴ Kolkata, India 34%,²⁵ Bareilly, India 42%,²⁶ Volta, Ghana 24.6%,¹⁰ Coastal province, Kenya 26.2%,⁶ Dabat, North West Ethiopia 33.2%,²⁷ Gondar, North West Ethiopia 28.9%,¹⁷ Laelay Machew 33%,²⁸ and Gobba town, South East Ethiopia 30%.²⁹ This might be due to different socio-demographic characteristics, sources and type of salt used. Another possible explanation is the difference in practices and knowledge level of the study and referred areas. For example, using packed salt, dry area salt storage place, salt container with cover and unexposed to sunlight in Laelay Maychew was 27.3%, 91.8%, 92.3% and 97.3% but in the study area, it was 13.3%, 85.5%, 83.2%, and 83.8% respectively.

In this study, Households whose head were both husband and wife (participatory) was significantly associated with adequately iodized salt utilization. The possible explanation could be free flow of ideas between the partners exposed to information and commonness. Besides, husband education was significantly associated with adequately iodized salt utilization. This might be due to education and household discussion influences nutritional knowledge. This finding was similar with a study conducted in Dara district, North West Ethiopia.³⁰

In this study, average monthly household income was significantly associated with adequately iodized salt utilization. Pregnant mothers whose average monthly household income was between 816 and 1634 ETB were 7.3 times [AOR=7.32 95% CI (3.03, 17.70)] more likely to utilize adequately iodized salt compared with whose average monthly household income was 816 ETB or less. The possible explanation could be those who have better income can access and buy what they prefer-recent batch iodized salt. Another possible reason could be those with lower income may source their salt from market which lost its iodine content through exposure to light. This finding was in line with a study conducted in Wolayta Sodo zuriya district,³¹ and Ghana.³²

The study showed that time of iodized salt addition during cooking was significantly associated with adequately iodized salt utilization. Respondents who added salt late or after cooking during food preparation were twice [AOR=2.17(1.08, 4.38)] more likely to utilize adequately iodized salt compared with who added salt early or at the middle of cooking. Iodized salt should be added to meal late or after cooking in order not to lose the iodine content of the salt through heating. This finding was consistent

with a study done in Ada district, Oromia.¹⁵ The possible explanation for this could be due to similarity in household practices.

Compared to the recommended standard, use of adequately iodized salt among pregnant women is very low. Household head (participatory), husband education and household income level are key predictors of use of adequately iodized salt.

Limitation of the study

This study used rapid field test kit to measure salt iodine level from salt samples which didn't include titration and urinary iodine concentration of pregnant mothers.

Conclusion

The findings showed that only 19.9% households of pregnant mothers had adequately iodized salt which was very low compared to the recommended value (90% & above) to control iodine deficiency disorders. Adequately iodized salt availability at household level was influenced by factors like household head, educational level, average monthly household income and time of salt addition during cooking in Wonago district.

Based on finding of the study, the following recommendations were made:

The SNNPR Health bureau, Gedeo Zone Health Department and Wonago District Health Office should Strengthen, cooperate and monitor supply chain, educational program to influence utilization of adequately iodized salt at household level in the study area. Health care professionals should teach the community towards good handling and practice of iodized salt through behavior change communication in Wonago district and further study should be conducted considering titration and urinary iodine concentration.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of Dilla University, College of Health Science and Medicine. Letters of permission were gained from Gedio Zone Health Department and Wonago District Health Office. The local authorities were informed about the study objectives. Informed consent was obtained from participants involved in the study.

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Authors' contributions

MA involved in the design, selection of articles, statistical analysis and manuscript writing. TAZ and ATA also involved in analysis and manuscript preparing and editing. All authors read and approved the final draft of the manuscript.

Disclosure

The author reports no conflicts of interest in this work.

Abbreviations

ANC: Ante Natal Care

CIDA: the Canadian International Development Agency

CIF: Central Iodization Facility

GAIN: Global Alliance for Improved Nutrition

EDHS: Ethiopia Demographic and Health survey

ETB: Ethiopian Birr

FAO: Food Aid Organization

FGD: Focus Group Discussion

HEWs: Health Extension Workers

ICCIDD: International Council for Control of Iodine Deficiency Disorders

IQ: Intelligence Quotient

IDD: Iodine Deficiency Disorder

IRB: Institutional Review Board

NNP: National Nutrition Program

PPM: parts per million

PPS: Proportional to Population Size

SNNPR: South Nation Nationalities People Region

UNICEF: United Nation International Children's Fund

USD: United States Dollar

USI: Universal Salt Iodization

WHO: World Health Organization

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Additional Files

- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Tables

Table 1: Socio-demographic characteristics of respondents on availability of adequately iodized salt at households of pregnant women in Wonago district, South Ethiopia, 2018

variable	Frequency	percent
Age in years		
15-24	221	37.6
25-34	310	52.7
35-45	57	9.7
Total	588	100
Residence		
Rural	514	87.4
Urban	74	12.6
Total	588	100
Religion		
Protestant	521	88.6
Orthodox	53	9
Islam	14	2.4
total	588	100
Ethnicity		
Gedeo	499	84.9
Oromo	53	9
Gurage	15	2.6
Amhara	12	2
Other	9	1.5
Total	588	100
Head of household		
Husband	457	77.7
Both	131	22.3
Total	588	100
Family size		
≤5	268	45.6
>5	320	54.4

Total	588	100
Educational status of mothers		
Not educated	286	48.6
Educated	302	51.4
Total	588	100
Educational status of husband		
Not educated	150	25.5
Educated	438	74.5
Total	588	100
Occupational status of mother		
Housewife	566	96.3
Employee	22	3.7
Total	588	100
Average monthly HH income		
<817 ETB	308	52.4
817-1634 ETB	195	33.2
≥1635 ETB	85	14.4
Total	588	100

HH=Household, ETB=Ethiopia Birr

Table 2: Knowledge of respondents on availability of adequately iodized salt at households of pregnant women in Wonago district, South Ethiopia, 2018

variable	Frequency	percent
Respondents knowledge		
Good knowledge	237	40.3
Poor knowledge	351	59.7
Total	588	100
Ever heard about iodized salt		
Yes	275	46.8
No	313	53.2
Total	588	100
Main source of information		
TV /radio	81	13.8
Health worker	105	17.9
Family member	55	9.4
School	21	3.6
Printed material	13	2.2
No information	313	53.2
Total	588	100
Use of iodized salt right now		
Yes	109	39.6
No	166	60.4
Total	275	100
Reason for not using iodized salt		
Expensive	155	93.4
Not accessible	11	5.4
Total	166	100
Cause of goiter		
Iodine deficiency	169	28.7
Hereditary	164	27.9
Water(rain)	136	23.1

Other(hen excreta)	69	11.7
Don't know	50	8.5
Total	588	100
Disorders of lack of iodine		
Mental retardation	25	4.3
Goiter	169	28.7
Cretinism	12	2.0
Abortion/other	12	2.0
Don't know	370	62.9
Total	588	100
Goiter is preventable		
Yes	322	54.8
No	266	45.2
Total	588	100

Table 3: Source and type of salt of respondents on availability of adequately iodized salt at household of pregnant women in Wonago district, South Ethiopia, 2018.

Variable	Frequency	Percent
Source		
Market	436	74.1
Shop/pharmacy	152	25.9
Total	588	100
Type		
Unpacked	510	86.7
Packed	78	13.3
Total	588	100

Table 4: Practices of respondents on availability of adequately iodized salt at pregnant women households in Wonago district, South Ethiopia, 2018

Variable	Frequency	Percent
practice		
Proper practice	60	10.2
Improper practice	528	89.8
Total	588	100
Method of identifying iodized salt		
More white	155	26.4
Reading the logo	133	22.6
Don't know	300	51.0
Total	588	100
Distance on foot to buy salt		
≤ 1 hour	519	88.3
>1 hour	69	11.7
Total	588	100
Salt added during food preparation		
Late/after cooking	340	57.8
Early/middle of cooking	248	42.2
Total	588	100
Salt exposed to light		
Yes	95	16.2
No	493	83.8
Total	588	100
Place of salt in household		
Fire/moist area	85	14.5
Dry area	503	85.5
Total	588	100
Salt container cover		
With cover	489	83.2
No cover	99	16.8

Total	588	100
Duration of salt storage		
≤ 2 months	518	88.1
>2 months	70	11.9
Total	588	100
RTK salt iodine level		
Inadequate iodine level	471	80.1
Adequate iodine level	117	19.9
Total	588	100

HH=Household, RTK=Rapid Test Kit

Table 5: Associated factors of availability of adequately iodized salt at households of pregnant women in Wonago district, South Ethiopia, 2018

	Salt iodine content			
variable	≥15 ppm N (%)	<15 ppm N (%)	COR(95% CI)	AOR(95% CI)
Household head				
Husband	55(12%)	402(88%)	1	1
Both	62(47.3%)	69(52.7%)	6.57[4.21,10.24]***	2.10[1.08, 3.96]*
Mother education				
Not educated	27(9.4%)	259(90.6%)	1	1
Primary(1-8)	44(18.7%	191(81.3%)	2.21[1.32, 3.69]**	1.16[0.56, 2.38]
Secondary& above	46(68.7%)	21(31.3%)	21.01[10.96, 40.28]***	1.53[0.54, 4.38]
Husband education				
Not educated	5(3.3%)	145(96.7%)	0.1[0.04, 0.25]***	0.33[0.11, 0.98]*
Educated	112(25.6%)	326(74.4%)		1
Mother occupation				
employee	16(72.75)	6(27.3%)	12.28(4.69,32.15)***	0.75(0.17,3.42)
Not employee	101(17.8%)	465(82.2)		1
Husband occupation				
farmer	37(11.81%)	277(88.2%)		1
merchant	35(30.70%)	79(69.30%)	3.32(1.96,5.61)***	0.73(0.35,1.53)
employee	40(58.8%)	28(41.20%)	10.7(5.9,19.3)***	0.43(0.16,1.16)
Daily labor	5(5.4%)	87(94.60%)	0.43(0.16,1.13)	0.38(0.12,1.16)
Monthly HH income				
<817 ETB	7(2.3%)	301(97.7%)		1
817-1634 ETB	44(22.6%)	151(77.4%)	12.53[5.51, 28.48]***	7.33[3.03, 17.70]***
>1634 ETB	66(77.6%)	19(22.4%)	149.36[60.33, 369.82]***	51.81[16.92,158.63]***
Type of salt				

Unpacked	64(12.5%)	446(87.5%)		1
Packed	53(67.9%)	25(32.1%)	14.77[8.58, 25.43]***	1.47[0.57, 3.75]
Source of salt				
Market	43(9.9%)	393(90.1%)		1
Shop/pharmacy	74(48.7%)	78(51.3%)	8.67[5.54, 13.56]***	1.33[0.63, 2.86]
Distance on foot to buy				
≤1 hour	115(22.2%)	404(77.8%)		1
>1 hour	2(2.9%)	67(97.1%)	0.11[0.03, 0.44]**	2.78[0.59, 13.02]
Salt added				
Early/middle of cooking	31(9.1%)	309(90.9%)		1
Late/after cooking	86(34.7%)	162(65.3%)	5.29[3.37, 8.32]***	2.17[1.08, 4.38]*
Place of storage				
Fire/moist area	1(1.2%)	84(98.8%)	0.04[0.005, 0.29]**	0.22[0.02, 2.18]
Dry area	116(23.1%)	387(76.9%)		1
Salt container				
No cover	1(1%)	98(99%)	0.03[0.005, 0.024]**	0.13[0.01, 1.59]
With cover	116(23.7%)	373(76.3%)		1
HH storing time				
≤2 months	112(21.6%)	406(78.4%)		1
>2 months	5(7.1%)	65(92.9%)	0.28[0.11, 0.71]**	0.49[0.13, 1.92]

HH=household, RTK=Rapid Test Kit, *=p<0.05, **=p<0.01, ***=p<0.001

Figures

Conceptual frame work extracted from different literatures

Figure 1

Schematic presentation of conceptual framework showing factors associated with availability of adequately iodized salt at households of pregnant women, extracted from different literatures, Wonago district, 2018.