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ORIGINAL ARTICLE

Knowledge and utilization of iodized salt among expectant mothers in Harar City's public health facilities: a multicenter study in Eastern Ethiopia

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Background: Insufficient iodine intake during pregnancy can result in abortion, stillbirths, neonatal mortality, cretinism and permanent cognitive impairment. Even although iodized salt is widely accessible in Ethiopia, pregnant women still experience persistent problems related to iodine deficiency disorders.

Methods: A facility-based cross-sectional study was conducted among randomly selected 573 pregnant women who were attending antenatal care services at public health facilities. Bivariate and multivariable logistic regression models were used, and independent predictors were determined based on adjusted ORs with 95% CIs and $p<0.05$.

Results: Knowledge and practice of pregnant women on iodized utilization were 35.6% (95% CI 31.8 to 39.6%) and 37.7% (95% CI 32.1 to 42.9%), respectively. Living in urban areas (adjusted OR [AOR]=1.976, 95% CI 1.136 to 3.435) and having a higher level of education (AOR=2.018, 95% CI 1.037 to 3.930) were associated with having adequate knowledge. Having a diploma or higher education (AOR=2.684, 95% CI 1.137 to 6.340) and adequate knowledge about iodized salt utilization (AOR=2.095, 95% CI 1.273 to 3.447) were significantly associated with good practice.

Conclusions: The current study highlights the level of knowledge and practices of pregnant women on iodized salt. It emphasizes the necessity for targeted programs about the benefits of iodized salt and how to use it correctly, particularly for those with low literacy levels and those living in rural areas.

Keywords: ANC, iodized salt, knowledge, practice, pregnancy.

Introduction

Iodine is an essential micronutrient that our bodies require to produce thyroid hormone, which is crucial for development.[1] It greatly affects different organs and plays a crucial role in the growth of the brain and the central nervous system, starting from the early stages of embryonic and fetal development.[2,3] Insufficient iodine levels result in a lack of production of thyroid hormones, leading to a range of health issues collectively known as iodine deficiency disorders (IDDs).[4]

The WHO suggests that pregnant women should consume 250 μg of iodine daily, a higher amount than recommended for other individuals, to ensure sufficient iodine levels.[5] This is particularly important during pregnancy as iodine's main impact begins during the embryonic stage.[6] Iodine deficiency during pregnancy can lead to abortion, stillbirths, higher neonatal mortality, cretinism, irreversible cognitive impairment, goiter, behavioral problems, increased childhood mortality and economic stagnation.[7] In addition, iodine deficiency not only hampers a nation's progress by decreasing the efficiency of its people, it also diminishes the average intelligence quotient of impacted children by 12 to 13.5 points.[8]

Globally, approximately 38 million babies are born to mothers with iodine deficiency, leading to permanent cognitive impairment in 18 million babies due to IDDs.[9] A systematic review found that the pooled prevalence of iodine deficiency among pregnant women in Ethiopia was 68.79%, and there have been 50 000 reported prenatal deaths associated with iodine deficiency.[10]

The comprehensive legislation passed by Ethiopia's government in 2011 mandates the iodization of salt by all salt producers for human consumption. This legislative action aligns with the overarching objectives of the Ministry of Health in Ethiopia, particularly in the implementation of universal salt iodization. Integral to the national nutrition program, this initiative underscores Ethiopia's concerted efforts to mitigate IDDs and improve overall public health outcomes.[11] According to the Ethiopian Demographic and Health Survey (EDHS), the percentage of iodized salt coverage in Ethiopia has significantly increased in the past 5 y, rising from 15% in 2011 to 89% in 2016.[12] Even although the 2016 EDHS revealed an iodized salt coverage of 89%, a subsequent systematic review conducted in the same year highlighted the persistent presence of iodine deficiency and its related effects.[10] Despite the prevalence of iodized salt, challenges with IDDs persist among pregnant women.[13,14] These problems may be attributed to a lack of knowledge about the benefits of iodized salt and how to use it properly. Iodized salt can lose its iodine content due to various factors, from handling to cooking. Consequently, pregnant women using salt that has lost its iodine content may not provide sufficient iodine for the brain development of the fetus. Therefore, this study was conducted to assess the knowledge, practice and associated factors of iodized salt utilization among pregnant women attending antenatal care (ANC) services at Harar city's public health facilities.

Methods

Study area, design and duration

An institutional-based cross-sectional study was conducted from 1 April to 30 May 2023. The study was conducted in public health facilities located in Harar, a city situated 521 km from Addis Ababa, the capital city of Ethiopia. Based on the 2007 census conducted by the Central Statistical Agency of Ethiopia, Harar city has a total population of 183 415, of whom 91 099 are female. During the study period, there were 7000 pregnant women residing in the town.

Harar city was equipped with one specialized hospital, one general hospital, two private hospitals, nine health centers and eight private clinics at the time of the study and all those facilities provide an ANC service.

Study population and eligibility criteria

All pregnant mothers who came to selected public health facilities for ANC during the study period were included, while those who were on salt restriction because of chronic illness were excluded.

Sample size determination

The sample size was determined based on a single population formula by considering the following assumption, considering the proportion of knowledge of iodized salt utilization as 65.6% from a study conducted in Ambo, Ethiopia,[15] at a 95% CI and a 5% margin of error (d). Then, after adding a 10% non-response rate and a design effect of 1.5, the final sample size became 573.

Sampling procedure

In the study area, there were a total of nine health centers, one specialized hospital and one general hospital. From these, one specialized hospital and four health centers were selected using a simple random sampling technique. The data from the past 3 mo on client flow were collected then divided by 3 to calculate the average number of clients per month. The study participants were then allocated proportionally to each public health institution based on their average monthly client flow. A systematic random sampling technique was used to select study participants attending ANC follow-ups. By dividing the total monthly client flow by the total sample size, a sampling interval of 4 (k) was determined. The first participant was selected using random selection, then every fourth interval was used to select the subsequent participants.

Operational definitions

Adequate knowledge: respondents who answered $\geq$75% of the knowledge questions correctly.[16]

Inadequate knowledge: respondents who answered $<$75% of the knowledge questions correctly.[16]

Good practice: when the participant answers $\geq$75% of questions about practice correctly.[16]

Poor practice: when the participant answers $<$75% of questions about practice correctly.[16]

Utilization: the action of using iodized salt and making practical and effective use of it.[17]

Iodized salt: table salt mixed with a small amount of various salts of the element iodine.[18]

Data collection tools and procedure

Data were collected using a pretested and semistructured interviewer-administered questionnaire that was developed by reviewing different literature. The questionnaire was initially drafted in English then translated into two local languages, Amharic and Oromifa. It comprised major five parts: (i) sociodemographic characteristics; (ii) reproductive health-related factors; (iii) source(s) of information; (iv) the knowledge of pregnant mothers; and (v) the practice of those pregnant mothers from the perspective of iodized salt consumption. The data were collected by five trained BSc midwives, and they were supervised by two MSc midwives.

Data quality control

The tool's quality was assessed by conducting a pretest on 5% of the sample size at Lege Hare Health Center, which is in the town of Dire Dawa; necessary corrective measures were taken on the tool. Training was provided for data collectors and supervisors regarding the objectives of the study, the data collection method, ethical considerations and the significance of the study.

Data processing and analysis

The respondents' knowledge regarding the use of iodized salt was assessed through 10 knowledge-based questions. Those

who answered correctly and scored ≥75% were categorized as having good knowledge, while those scoring <75% were considered to have poor knowledge. Similarly, iodized salt practices were assessed through nine related questions. Participants who answered correctly and achieved a score of ≥75% were classified as having good practice, whereas those scoring <75% were deemed to have poor practice in utilizing iodized salt.

After the data were checked, coded and cleaned, they were entered into Epi-data version 3.1 (IBM Corporation, IBM SPSS Statistics, Armonk, New York, United States) and exported to SPSS 23 for further analysis. Descriptive statistics like mean, SD, frequency and percentage were computed to determine the prevalence of women's knowledge and practice of consuming iodized salt. Model fitness was checked using the Hosmer and Lemeshow goodness of fitness test. A multicollinearity test was conducted to assess the correlation between independent variables using variance inflation factors. Both binary and multivariable logistic regression were used to determine the association between dependent and independent variables. In binary logistic regression, the variables with $p<0.25$ were entered into a multivariable logistic regression model to control the possible effect of confounders. Finally, the variables that had an independent association with the outcome variable were identified based on the adjusted OR (AOR) with a 95% CI and $p<0.05$ was considered significant.

Results

Sociodemographic and obstetric characteristics of pregnant women

A total of 573 pregnant women participated in the study with a response rate of 100%. The mean age of the mothers was 27.79 (SD 4.894) y. Most of the participants (457; 79.8%) lived in urban areas, and 306 (53.4%) identified as Muslims. About one-quarter (145; 25.3%) of the women were merchants, and the vast majority (399; 69.6%) had a family size of ≤2.

Of the 573 participants, 332 (57.9%) were in their third trimester, while 50 (8.7%) were gravida ≥6. Most of the participants (458; 79.9%) had ≥4 ANC follow-ups, and 278 (48.5%) began their ANC follow-ups during their first trimester (Table 1).

Knowledge of pregnant women regarding iodized salt utilization

The percentage of pregnant women who had adequate knowledge of iodized salt utilization was 35.6% (95% CI 31.8 to 39.6%) (Figure 1).

Of the 573 participants, 453 (79.1%) were aware of iodized salt, and among those, 279 (61.6%) had learned about it through media such as radio or television; however, 151 (26.4%) of respondents were uncertain whether their salt contained iodine.

Of the 573 participants, 309 (53.9%) recognized the benefits of iodized salt as a way of preventing IDDs, while 64 (11.2%) mentioned it was for improved taste. Also, 334 (58.3%) were aware of the health issues associated with iodine deficiency, with 308 (92.2%) of those specifically identifying goiter as a

Table 1. Sgraphic and obstetric characteristics of pregnant women attending antenatal care services at public health facilities of Harar City, 2023

Characteristic	Frequency	%
Age, y		
15–25	194	33.9
26–35	338	59
≥36	41	7.2
Religion		
Orthodox	184	32.1
Muslim	306	53.4
Protestant	73	12.7
Other	10	1.7
Residence of pregnant women		
Urban	457	79.8
Rural	116	20.2
Educational status of the pregnant women		
Unable to read and write	95	16.6
Primary school	138	24.1
Secondary school	173	30.2
Diploma or higher education	167	29.1
Occupational status of the pregnant women		
Housewife	208	36.3
Merchant	145	25.3
Private employee	113	19.7
Government employee	107	18.7
Marital status		
Single	71	12.4
Married	502	87.6
Educational status of the husband		
Unable to read and write	16	3.0
Primary school	123	22.7
Secondary school	192	35.4
Diploma or higher education	211	38.9
Occupational status of the husband		
Farmer	58	10.7
Daily laborer	86	15.9
Private employee	220	40.6
Governmental employee	178	32.8
Average monthly income of the household in Ethiopian birr		
<2000	29	5.1
2001–4000	176	30.7
≥4001	368	64.2
Family size		
<2	399	69.6
3–5	161	28.1
≥6	13	2.3
Gestational age, wk		
<13	14	2.4
14–27	227	39.6
≥28	332	58
Number of pregnancies		
<2	209	36.5
3–5	314	54.8
≥6	50	8.7

Table 1. Continued

Characteristic	Frequency	%
Number of babies given birth to		
<2	388	67.7
3–5	168	29.3
≥6	17	3.0
History of stillbirth		
Yes	60	10.5
No	513	89.5
Number of stillbirths		
≤2	59	98.3
≥3	1	1.7
History of abortion		
Yes	99	17.3
No	474	82.7
Number of abortions		
≤2	97	98.0
≥3	2	2.0
Number of ANC follow-ups		
≤3	115	20.1
≥4	458	79.9
Gestational age ANC started, week		
≤13	278	48.5
14–27	267	46.6
≥28	28	4.9

related health problem. Most of the respondents (459; 80.1%) indicated that they were unaware of the potential health risks to an unborn baby due to a lack of iodine in the diet of pregnant women, with only 67 (11.7%) mentioning the risk of mental impairment. Additionally, only 104 participants (18.2%) recognized the benefit of iodized salt during pregnancy. Of those, 81 (77.9%) knew its importance for maintaining good health. Furthermore, 86 respondents (15.0%) believed that the taste of iodized salt differs from that of regular salt (Table 2).

Table 2. Knowledge of iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023

Variable	Frequency	%
Have you heard about iodized salt?		
Yes	453	79.1
No	120	21.9
Do you think all salts contain iodine?		
Yes	269	46.9
No	304	53.1
Do you know about health problems caused by iodine deficiency?		
Yes	334	58.3
No	239	41.7
Have you heard about the importance of iodized salt during pregnancy?		
Yes	104	18.2
No	469	81.8
Is the taste of iodized salt different from common salt?		
Yes	86	15.0
No	304	53.1
I don't know	183	31.9

Practices of pregnant women regarding iodized salt utilization

Out of all the participants, 324 (56.5%) purchased packaged salt, 266 (82%) stored it in a sealed container and 220 (67.9%) kept it

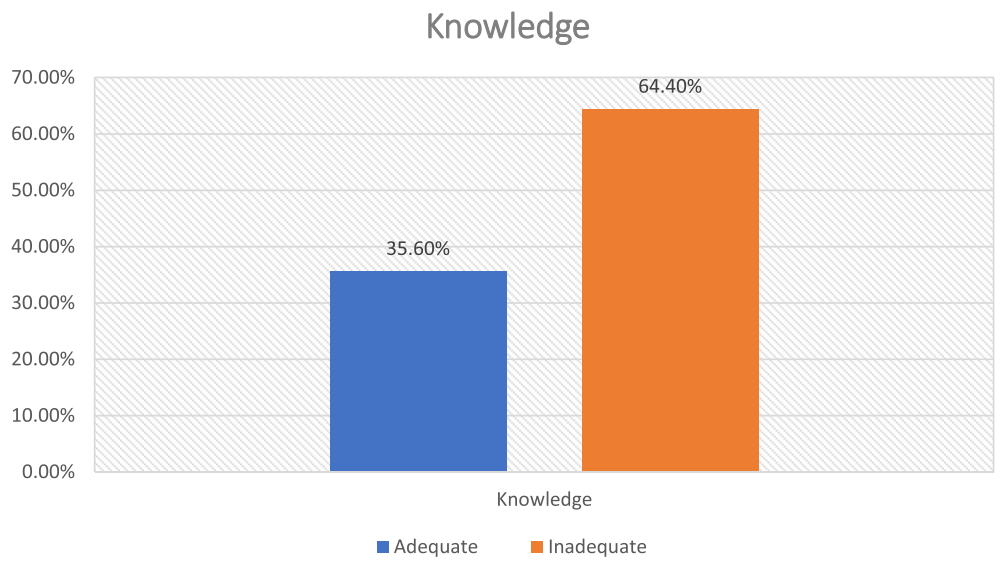

Figure 1. Knowledge of iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023 (N=573).

Table 3. Practice of iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023

Variable	Frequency	%
Practice		
Good	216	37.7
Poor	357	62.3
The kind of salt you buy		
Packed	324	56.5
Unpacked	249	43.5
Storage of iodized salt		
In open package	29	9.0
In open container	29	9.0
In a container closed with a lid	266	82
Where do you put your iodized salt?		
In a dry place	220	67.9
In a moist area	8	2.5
Near a fire	37	11.4
It doesn't need a special place	59	18.2
Is your salt exposed to sunlight?		
Yes	28	8.6
No	296	91.4
Get additional iodine during pregnancy?		
Yes	55	17
No	269	83
Do you know the right time to add iodized salt to your meal?		
Yes	187	57.7
No	137	42.3

in a dry area. Only 55 (17%) of participants paid special attention to obtaining additional iodine during pregnancy; 187 (57.7%) of women claimed to know the correct time to add iodine, with 143 (76.5%) stating it should be added at the end of cooking. Additionally, 146 (45.1%) of them bought their salt from the market (Table 3).

Among respondents who buy packed salt, approximately 37.7% (95% CI 32.1 to 42.9%) displayed good practice in iodized salt utilization (Figure 2).

Factors associated with knowledge of iodized salt among pregnant women

Factors such as residence, educational status of the mother, the number of pregnancies and the number of ANC follow-ups were significantly associated with the knowledge of pregnant women regarding iodized salt utilization in the bivariate analysis. In the multivariable logistic regression, residence and educational status were significantly associated with knowledge of iodized salt utilization.

Pregnant women residing in urban areas were 1.976 times more likely to have adequate knowledge compared with mothers residing in rural areas (AOR 1.976, 95% CI 1.136 to 3.435). Respondents who had obtained a diploma or a higher level of education were 2.018 times more likely to have an adequate knowledge than those who had not received any formal education (AOR 2.018, 95% CI 1.037 to 3.930) (Table 4).

Figure 2. Practice of iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023 (N=324).

Factors associated with the practice of iodized salt utilization among pregnant women

During bivariate analysis, gravidity, educational status, occupational status and knowledge about iodized salt showed significant associations with good practice of iodized salt utilization. Consequently, these variables were selected as candidates for the multivariable logistic regression analysis.

Factors associated with the practice of iodized salt utilization among pregnant women

In the multivariable logistic regression analysis, residence, educational status and knowledge about iodized salt were found to be significantly associated. Participants who had an educational status of a diploma or higher education were 2.684 times more likely to have good practice than those who were unable to read and write (AOR 2.684, 95% CI 1.137 to 6.340). Mothers who had adequate knowledge about iodized salt utilization were 3.187 times more likely to display good practice than their counterparts (AOR 2.095, 95% CI 1.273 to 3.447) (Table 5).

Discussion

In this study, 35.6% (95% CI 31.8 to 39.6%) of pregnant women had adequate knowledge about iodized salt utilization. This is higher than in the studies conducted in Norway (25.5%), Tehran (26%) and Ethiopia (28.7%).[19–21] However, the percentage is lower compared with the studies carried out in Debrebrihan (51.4%), Gondor (50.1%) and Ghana (72%).[22–24] This discrepancy can be explained by the difference in the study setting, sociodemographic characteristics, sample size and the

Table 4. Factors associated with knowledge about iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023

Variable	Pregnant women's knowledge of iodized salt (N=573)		Bivariate logistic regression COR (with 95% CI)	Multivariate logistic regression AOR (with 95% CI)
	Adequate	Inadequate		
Residence of pregnant women				
Urban	182	275	2.828 (1.714 to 4.665)	1.976 (1.136 to 3.435)*
Rural	22	94	1	1
Educational status of pregnant women				
Primary school	29	109	0.833 (0.447 to 1.553)	0.648 (0.329 to 1.278)
Secondary school	50	123	1.273 (0.717 to 2.257)	0.671 (0.351 to 1.283)
Diploma or higher education	102	65	4.912 (2.797 to 8.627)	2.018 (1.037 to 3.930)*
Unable to read and write	23	72	1	1
Number of pregnancies of pregnant women				
≤2	106	208	1.807 (0.889 to 3.671)	0.703 (0.306 to 1.613)
3–5	87	122	2.528 (1.226 to 5.212)	0.807 (0.539 to 1.207)
≥6	11	39	1	1
Number of ANC follow-ups of pregnant women				
≥4	151	307	0.575 (0.380 to 0.872)	0.843 (0.526 to 1.351)
≤3	53	62	1	1

*p<0.05,
Abbreviations: AOR, adjusted OR; COR, crude OR.

Table 5. Factors associated with the practice of iodized salt utilization among pregnant women attending antenatal care services at public health facilities of Harar City, 2023

Variable	The practice of pregnant women on iodized salt (N=324)		Bivariate logistic regression COR (with 95% CI)	Multivariate logistic regression AOR (with 95% CI)
	Good	Poor		
Educational status of pregnant women				
Primary school	12	39	0.855 (0.315 to 2.322)	0.895 (0.318 to 2.515)
Secondary school	27	70	1.071 (0.444 to 2.588)	1.125 (0.449 to 2.818)
Diploma or higher education	74	68	3.023 (1.318 to 6.932)	2.684 (1.137 to 6.340)*
Unable to read and write	9	25	1	1
Occupational status of pregnant women				
Merchant	28	61	1.005 (0.508 to 1.991)	0.701 (0.334 to 1.472)
Private employee	22	53	0.909 (0.444 to 1.862)	0.490 (0.219 to 1.094)
Government employee	51	42	2.660 (1.377 to 5.137)	1.010 (0.453 to 2.251)
Housewife	21	46	1	1
Knowledge of pregnant women on iodized salt				
Knowledgeable	82	91	2.501 (1.565 to 3.996)	2.095 (1.273 to 3.447)*
Not knowledgeable	40	111	1	1

*p<0.05.
Abbreviations: AOR, adjusted OR; COR, crude OR.

assessment instruments employed. Furthermore, the study conducted in Tehran focused on women residing in poor and slum areas.

Pregnant women who had an educational status of a diploma or higher education were 2.018 times more likely to have adequate knowledge than those who were unable to read and write. This is in line with the studies carried out in Wolaita, Addis Ababa and Norway.[19,23,25] This could be because women with higher levels of education have access to a variety of sources and possess better reading and comprehension skills compared with those who are illiterate. In addition, they may also receive information through their schooling.[26]

Pregnant women who live in urban areas were 1.976 times more likely to have adequate knowledge than those who live in rural areas. This result is consistent with the studies performed in Wolaita and Mecha district.[17,25] This could be due to the fact that pregnant women residing in urban areas are more likely to have greater access to various sources of information, healthcare facilities and educational resources compared with those living in rural areas.[27,28]

This study revealed that only 37.7% (95% CI 32.1 to 42.9%) of pregnant women had good practices of iodized salt utilization. This percentage is higher than the findings in Mecha, Ethiopia (25.7%) and Tehran (16%), but lower than the results from Debrebrihan (53%) and West Shewa (45.4%).[17,20,24,29] The variation in these percentages can be attributed to differences in study settings, sociodemographic characteristics, sample sizes and the assessment methods used.

Pregnant women with a diploma or higher education were 2.684 times more likely to demonstrate good practices compared with those who were illiterate. This finding aligns with similar studies conducted in Debrebrihan and Addis Ababa.[16,24] This could be attributed to the fact that women with higher education levels have access to various sources of information and possess better reading and comprehension skills, enabling them to understand and implement health practices more effectively than those who are unable to read and write.[26,30,31]

Pregnant women who had adequate knowledge were twice as likely to engage in good practices compared with those who did not. This finding was consistent across studies conducted in Debrebrihan, Mecha district and Addis Ababa.[21,23,24] This might be due to their improved understanding and awareness of the benefits associated with proper practice.[32,33]

Conclusion

The current study highlights the level of knowledge and practices of pregnant women regarding iodized salt. It emphasizes the necessity for targeted programs about the benefits of iodized salt and how to use it correctly, particularly for those with low literacy levels and those living in rural areas.

Authors' contributions: All authors made equal contributions to generating the idea for this study, creating the proposal, overseeing the fieldwork, analyzing and interpreting the data, as well as drafting, writing and preparing the manuscript. Also, all authors agreed on the journal to which the article has been submitted.

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Ethical approval: Ethical clearance was obtained from the University of Gondar Institutional Review Board, with reference number 1735/06/2021. Informed consent was obtained from the study participants to confirm their willingness to participate after explaining the objective of the study. The respondents were notified that they had the full right to refuse or terminate the interview at any point. Information from any respondent was kept confidential and the study subjects were interviewed individually to maintain privacy.

Data availability: The datasets used and/or analyzed during the current study can be obtained from the corresponding author on reasonable request.

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