Knowledge and practice of iodized salt utilization among reproductive women in Addis Ababa City

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Abstract

Objective: The objective of this study was to assess knowledge and practice of iodized salt utilization among reproductive women in Addis Ababa city. A cross-sectional study was carried out on 549 households. A sample district was designated by using the simple random sampling techniques. Data were collected by a face-to-face interview and household salt was tested to check whether its practice was good. p < 0.2 in the bivariate logistic regression was entered into the multivariable logistic regression, and p < 0.05 was considered as significantly associated.

Results: Mothers who had good knowledge and practice of iodized salt were 78% (95% CI 74.9, 81.2) and 76.3% (95% CI 72.7, 79.8), respectively. Monthly household income (AOR = 2.97; 95% CI 1.20, 7.37) was associated with knowledge of iodized salt of respondents. Similarly, educational status (AOR = 2.45; 95% CI 2.10, 6.43) of respondents was significantly associated with the practice of iodized salt. This study indicated that increasing the level of knowledge and practice of iodized salt was good. Monthly household income and educational status were associated with knowledge and practices of iodized salt of respondents. Hence, improving mothers’ education is a highly recommended strategy for addressing public health problems of iodine deficiency.

Keywords: Knowledge, Practice, Iodized salt, Reproductive age, Ethiopia

Introduction

Iodine is an essential dietary nutrient for the thyroid hormones that regulate the growth and development of humans and animals. It plays an important role in controlling body metabolic rate, growth and development of body structures by producing the thyroid hormone [1, 2]. According to the World Health Organization (WHO), adults need about 120 μg of iodine per day to prevent iodine deficiency disorders (IDD) [3].

Poor intake of iodine is the major public health problem of women in the reproductive age pregnant and lactating women are particularly the most susceptible to iodine deficiencies which expose them to getting irreversible mentally impaired babies [2]. It is also documented that it causes abortions, stillbirths, congenital abnormalities, cretinism, goiter and impaired mental function as well as squinting, hypothyroidism, and stunting [4, 5]. Moreover, it impedes learning capacity, women’s health, the quality of life of communities, and the economic productivity of nations [4].

Globally, 38% of the world’s population lives with insufficient iodine [6]. Africa with its 9321.1 million deficient people bears the most burden of the region [7]. In Ethiopia, 35 million people are at risk of iodine deficiency, and the 50,000 annual prenatal deaths are related to this problem [8]. As a result, universal salt iodization (USI) is recommended as the most cost-effective, safe and sustainable strategy to eliminate IDDs [9]. Fortunately, 76% of households are consuming adequate iodized salt globally [10].

Regional coverages of iodized salt vary from 90% in Asia and the Pacific region to 40–60% in Sub-saharan Africa [10]. The level of utilization also varies from 10 to 90% in different countries. For instance, the utilization of iodized salt is less than 10% in Sudan, Mauritania,
Guinea-Bissau, and Gambia, whereas Burundi, Kenya, Nigeria, Tunisia, Uganda, and Zimbabwe have achieved the USI target [7].

In Ethiopia, the practice of adequate iodized salt use showed a marked increase from 15% in 2011 to 89% in 2016 [11, 12]. Inconsistencies of the practice are detected among dwellings and economic status. As an illustration, iodized salt utilization is the highest in Tigray (55.2%) and Somali (49.4%) and the lowest in Gambela (9.5%), SNNPR (13.7%), and Amhara regions (15%) [13]. As a result, 10.8–36% [14, 15] of women aged 15–49 years have been affected by goiter.

The Government of Ethiopia revitalized and launched universal salt iodization initiatives and planned strategies for the achievement of a virtual elimination of iodine deficiency disorders through achieving universal salt iodization [16, 17]. However, still, only 26% of the households are using adequate iodized salt [14]. In fact, IDD stays the major public health problem among all segments of the population [14, 18]. Besides, there is limited information on knowledge and practice of iodized salt use in Addis Ababa. Therefore, this study aimed to assess the knowledge and practice of iodized salt utilization among reproductive women in the city.

**Main text**

**Methods**

Community based cross-sectional study design was conducted to assess Knowledge and Practice on iodized salt among reproductive age group women in Yeka Sub City Addis Ababa. Addis Ababa is a Capital City of Ethiopia. The City has 10 boroughs named sub-Cities and 99 districts. Yeka is one of the 10 sub cities of Addis Ababa, with the total population of a 413, 175. The sub-City has 13 districts [19].

All the women in the reproductive age in Addis Ababa were used as the source of the population this study. The sample size was calculated by using a single proportion formula through by judging the following assumptions: 29.6% as prevalence of salt practice [11], 95% confidence level, and 4% degree of precision. Finally, the sample size of 550 was obtained by considering 10% non-response rate. A multistage stratified sampling technique followed by systematic sampling technique was employed to select study participants. Four districts were selected by lottery method among 13 districts in Yeka sub-city. Then, the total sample size was allocated proportionally to each selected district. Finally, Households were selected using systematic random sampling technique.

Structured interviewed and observation technique was used to collect data. The questionnaire was first prepared in English and then translated into Amharic. The questionnaire was developed by through by different literature review, other similar studies and EDHS [11, 20–22]. Two day training was given for data collectors and supervisors who have extensive experience in data collection about the methods of interview and observation. A total of 6 clinical nurses as data collector and 2 public health experts as supervisor were recruited for the study. During the data collection, close supervision was done by the principal investigator and supervisors.

The knowledge of the respondents towards iodized salt use were computed by using eight knowledge item questions accordingly, participants who respond correctly to knowledge questions and score median and above the median value considered as good knowledge whereas, respondents respond below median value were supposed as poor knowledge. Practice of iodized salt was summarized by applying four practice questions, as a result, participants who respond correctly answered practice question score median and above the median value considered as good practice whereas, respondents respond below median value were supposed as poor practice of iodized salt. Concerning media exposure women who read a newspaper or magazine or listen to the radio, or watched television at least once per month were considered having satisfactory media exposure and salt iodine content estimation was done by using a rapid test kit (RTK). The colour of the test sample is compared with the standard colour chart for calculating the salt iodine content. Finally, salt with ≥ 15 PPM was categorized as adequately iodized salt, whereas < 15 PPM was considered non-iodized salt.

All returned questionnaire were checked for completeness and consistency of responses manually. The data were entered using Epi-info version 3.5.4. Analysis associations between dependent and independent variables was assessed by using binary logistic regression and variables with p value < 0.2 entered into multiple logistic regression with 95% Confidence Intervals. Corresponding p value of < 0.05 was considered as statistically significant at 95% of confidence interval.

**Result**

Nearly half (45.5%) of the respondents were in the age group of 36–49 years; two-thirds (62.7%) were married and 25.5% of the respondents had university degrees. About 35.8% were employed, while 25.3% of the households earned a monthly income of less than ETB 1500. The majority (69.9%) of the husbands were employed of whom 10.2% were unable to read and write. A huge proportion (88.3%) of the respondents indicated that they had heard about iodized salt. Radio and television were the major media for 73.3% of the information about the importance of iodized salt and iodine-deficiency diseases. They said that a legal frame which prohibits the
production, trade, and sales of non-iodized salt is in place in Ethiopia. Nearly two-thirds (60.8%) of the respondents added salt at the end of cooking. The majority (88.9%) of the respondents stored their salt in closed containers. Some (33.5%) participants consumed salt with an iodine level of $\geq 15$ ppm (Table 1).

The overall prevalence of knowledge and practice of iodized salt use among women in reproductive age in Addis Ababa was 78% (95% CI 74.9, 81.2) and 76.3% (95% CI 72.7, 79.8), respectively.

Women living on a monthly household income greater than ETB 5000 had 2.97 times better knowledge on iodized salt use [AOR: 2.97; 95% CI (1.20, 7.37)] compared to those who lived on a monthly income of less than ETB5000 (Table 2). Women who had college and above educational status were 2.45 (2.10, 6.43) times more likely to use iodized salt compared to mothers unable to read and write. Similarly, the odds of having earning a monthly household income greater than ETB 5000 were 3.66 times [AOR: 3.66; 95% CI (1.78, 8.03)] higher among respondents who had good practice of iodized salt use compared to their counterparts (Table 3).

**Discussion**

It is apparent that the use of iodized salt by individuals and households is the major approach in the control of IDDs globally [23–25]. Thus, strengthening salt iodization programs and improving monitoring is a crucial step to eradicate the problem [22, 26, 27]. This study found that 78% of the respondents had good knowledge of iodized salt use. The finding was higher than the 26% reported from Tehran [22]. The variation might be due to the nature of study settings in that woman from slum areas and poor communities were included in the Tehran study. Clearly, slum areas are characterized by poor infrastructure and inadequate communication channels compared to Addis Ababa, the setting of our study, where the respondents had ample opportunities to increase their knowledge through promotions of iodized salt on the media. In fact, promotions on the media increase public awareness and alert that all salt producers and traders duly iodize their salt which is essential for achieving the USI goal [18, 28]. Our finding was slightly lower than 90.4% reported in Ghana [5]. This might be due to the accessibility of different media nearby for the target group in the study area.

Regarding the practice of iodized salt use of reproductive women, this finding is also higher than the 14% noted in Tehran [22]. The difference could be due to the fact that our study was used to ascertain the outcome by using two cut-off points, whereas the Tehran study considered three classifications as to determine outcome variable.

| Variable                          | Frequency | Percent (%) |
|----------------------------------|-----------|-------------|
| Age of the respondents           |           |             |
| 15–25                            | 76        | 13.8        |
| 26–35                            | 223       | 40.7        |
| 36–49                            | 250       | 45.5        |
| Religious of the respondents     |           |             |
| Orthodox                         | 372       | 67.8        |
| Protestant                       | 86        | 15.7        |
| Muslim                           | 79        | 14.4        |
| Catholic                         | 11        | 2.0         |
| Other                            | 1         | 0.2         |
| Ethnicity of the respondents     |           |             |
| Amhara                           | 240       | 43.7        |
| Oromo                            | 151       | 27.5        |
| Gurage                           | 85        | 15.5        |
| Tigre                            | 56        | 10.2        |
| Other                            | 17        | 3.1         |
| Marital status                   |           |             |
| Married                          | 344       | 62.7        |
| Unmarried                        | 205       | 37.3        |
| Educational status of the mother |           |             |
| Unable to read and write         | 49        | 8.9         |
| Read and write                   | 23        | 4.2         |
| Primary education                | 137       | 25.5        |
| Secondary education              | 156       | 28.4        |
| Vocational Diploma               | 44        | 8.0         |
| Degree and above                 | 140       | 25.5        |
| Respondents occupational        |           |             |
| Own business                     | 138       | 25.1        |
| House wife                       | 128       | 23.3        |
| Private employee                 | 101       | 18.4        |
| Government employee              | 79        | 14.4        |
| Unemployed                       | 40        | 7.3         |
| Daily laborer                    | 38        | 6.9         |
| Other                            | 25        | 4.6         |
| Household monthly income (ETB)   |           |             |
| $<$ 1500                         | 239       | 25.3        |
| 1501–2800                        | 139       | 25.3        |
| 2801–5000                        | 164       | 29.9        |
| $>$ 5000                         | 107       | 19.5        |
| Age of the husband (n = 352)     |           |             |
| 23–35                            | 104       | 29.5        |
| 36–50                            | 176       | 50.0        |
| $>$ 50                           | 72        | 20.5        |
| Religion of the husband (n = 352)|           |             |
| Orthodox                         | 229       | 65.1        |
| Muslim                           | 57        | 16.2        |
| Protestant                       | 49        | 13.9        |
| Catholic                         | 14        | 4.0         |

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| Read and write | 23 | 4.2 |
| Primary education | 137 | 25.5 |
| Secondary education | 156 | 28.4 |
| Vocational Diploma | 44 | 8.0 |
| Degree and above | 140 | 25.5 |
| Respondents occupational |           |             |
| Own business | 138 | 25.1 |
| House wife | 128 | 23.3 |
| Private employee | 101 | 18.4 |
| Government employee | 79 | 14.4 |
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Table 1 (continued)

| Variable                                      | Frequency | Percent (%) |
|-----------------------------------------------|-----------|-------------|
| Other                                         | 1         | 0.4         |
| Husband educational status (n = 352)          |           |             |
| Unable to read and write                      | 32        | 9.1         |
| Read and write                                | 4         | 1.1         |
| Primary education                             | 37        | 10.5        |
| Secondary education                           | 100       | 28.4        |
| Vocational diploma                            | 27        | 7.7         |
| University degree                              | 152       | 43.2        |
| Husband occupation                            |           |             |
| Private employee                              | 136       | 38.6        |
| Government employee                           | 90        | 25.6        |
| Own business                                   | 76        | 21.6        |
| Non-governmental organization                 | 20        | 5.7         |
| Daily laborer                                  | 18        | 5.1         |
| Other                                         | 12        | 3.4         |
| Have you heard about iodized salt?             |           |             |
| Yes                                           | 485       | 88.3        |
| No                                            | 64        | 11.7        |
| The source of information about iodized salt  |           |             |
| Radio, television                             | 402       | 73.2        |
| Printed material                              | 68        | 12.4        |
| Friends/neighbors                             | 26        | 4.7         |
| Health workers                                | 20        | 3.7         |
| Others                                        | 2         | 0.4         |
| Have you heard the effects of iodine deficiency on human |           |             |
| Yes                                           | 436       | 79.4        |
| No                                            | 113       | 20.6        |
| Iodized salt should be handled in the store and household with great care than non-iodized | |             |
| Yes                                           | 86        | 15.7        |
| No                                            | 463       | 84.3        |
| What are the advantage of using iodized salt? |           |             |
| Better test                                   | 24        | 4.4         |
| Better digestion                              | 3         | 0.5         |
| Makeup for iodine in the human body (prevent IDD such as goiter, abortion) | 401 | 73 |
| I don’t know                                  | 99        | 18          |
| Other                                         | 22        | 4           |
| What is the consequence of iodine deficiency? |           |             |
| Goiter                                        | 420       | 76.5        |
| Cretinism/mental retardation in children       | 118       | 21.5        |
| Abortion/still birth/miscarriage              | 96        | 17.5        |
| Regular consumption of iodized salt can remove iodine deficiency in the body? | |             |
| Yes                                           | 408       | 74.3        |
| No                                            | 141       | 25.7        |
| Health risk of unborn baby if there is lack of iodine in the diet of pregnant women? | |             |
| Risk of being physically impaired              | 68        | 12.4        |
| I don’t know                                  | 270       | 49.5        |
| Other                                         | 39        | 7.1         |

Is there legal frame exist in Ethiopia which prohibit production, trade and sales of non-iodized salt?

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| Yes                                                     | 70        | 12.8        |
| No                                                      | 246       | 44.8        |
| I don’t know                                            | 233       | 42.4        |

Does iodine in the salt affect its test?

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| Yes                                                     | 75        | 13.7        |
| No                                                      | 329       | 59.9        |
| I don’t know                                            | 145       | 26.4        |

Timing of adding salt during food cooking process

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| At the beginning                                         | 45        | 8.4         |
| In the middle                                            | 168       | 30.8        |
| At the end                                               | 334       | 60.8        |

Where do you usually store your salt?

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| In an open package                                       | 25        | 4.6         |
| In container without lid                                 | 36        | 6.5         |
| In container with closed lid                             | 488       | 88.9        |

Iodine test result

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| Not iodized (< 0 ppm)                                    | 160       | 29.1        |
| Inadequate iodine in the salt (< 15 ppm)                 | 200       | 36.4        |
| Adequate iodine in the salt (> 15 ppm)                   | 184       | 33.5        |
| No salt at home                                          | 5         | 0.9         |

Place where salt is store

| Item                                                    | Frequency | Percent (%) |
|---------------------------------------------------------|-----------|-------------|
| Exposed to sun light                                     | 4         | 0.7         |
| Near to fire in the kitchen                              | 7         | 1.3         |
| Far from sun light and fire                              | 536       | 97.6        |
| Other                                                    | 2         | 0.4         |

* Indicate One US Dollar = 27.00 Ethiopian Birr (ETB)
Household monthly income of the respondents was one of the factors associated with knowledge of iodized salt use of reproductive women. Accordingly, women belonging to greater than ETB 5000 monthly income were about three times more likely to have good knowledge of iodized salt compared to women belonging to less than ETB 1500 monthly household income group. This might be because women who lived on higher socioeconomic status had chances to purchase and use different electronic equipment which is important for enhancing nutrition education. In addition, house-to-house health visits by urban health workers improves knowledge of iodized salt utilization [29]. Besides, household income can be strongly associated with the type of salt used. That is, poorer households are much more likely to consume coarser salt owing to their low purchasing power [30].

The odds of practicing iodized salt were 2.45 times higher among reproductive age women who were university degree and above graduates compared to those who were unable to read and write. This finding is supported by those of studies done in Wolaita [31] and Arsi [28] zones. This might be due to the fact that higher levels of education provided better nutritional awareness about the benefits of iodine, increased awareness on the health benefits of iodine in diets, and raised the use of iodized salt. In addition, women who had the highest educational status had good employment opportunities which might be indicative of better socioeconomic status. This could relate to women who were better educated and had the ability of purchasing good quality food appropriate for salt iodization practice [30]. Moreover, mothers who were less educated and had less resources, had the least knowledge about the importance of iodized salt [20].

Finally, the probabilities of practicing iodized salt use were high among reproductive women who had higher monthly income compared to those who had low income.

| Variables                        | Knowledge                   | Crude Odds Ratio with 95% CI | Adjusted Odds Ratio with 95% CI |
|----------------------------------|-----------------------------|------------------------------|---------------------------------|
|                                  | Good | Poor | Good | Poor | Good | Poor | Good | Poor |
| Respondents educational status   |      |      |      |      |      |      |      |      |
| Unable to read and write         | 33 (67.3) | 16 (32.7) | 1 | 1 |
| Read and write                   | 19 (82.6) | 4 (17.4) | 2.30 (0.67,7.90) | 2.44 (0.68,8.68) |
| Primary education                | 84 (61.3) | 53 (38.7) | 0.77 (0.39,1.53) | 0.76 (0.37,1.55) |
| Secondary education              | 128 (82.1) | 28 (17.9) | 2.22 (1.08,4.57) | 2.02 (0.92,4.44) |
| Degree and above                 | 164 (89.1) | 20 (10.9) | 3.98 (1.87,8.47) | 2.72 (1.05,7.03) |
| Occupations of the respondents   |      |      |      |      |      |      |      |      |
| Government employee              | 69 (87.3) | 10 (12.7) | 1.08 (0.34,3.41) | 1.21 (0.35,4.13) |
| Private employee                 | 87 (86.1) | 14 (13.9) | 0.97 (0.32,2.91) | 1.64 (0.51,5.27) |
| Own business                     | 101 (73.2) | 37 (26.8) | 0.43 (0.16,1.18) | 1.02 (0.33,3.14) |
| House wife                       | 88 (68.8) | 40 (31.2) | 0.34 (0.13,0.95) | 0.97 (0.30,3.06) |
| Unemployed                       | 27 (77.1) | 8 (22.9) | 0.53 (0.15,1.80) | 1.01 (0.47,2.10) |
| Daily laborer                    | 24 (77.4) | 7 (22.6) | 0.54 (0.15,1.90) | 1.19 (0.32,4.51) |
| Others                           | 32 (86.5) | 5 (13.5) | 1      | 1 |
| Household monthly income         |      |      |      |      |      |      |      |      |
| < 1500                           | 98 (70.5) | 41 (29.5) | 1  | 1 |
| 1500–2800                        | 100 (71.9) | 39 (28.1) | 1.07 (0.64,1.80) | 0.85 (0.48,1.49) |
| 2801–5000                        | 131 (79.9) | 33 (20.1) | 1.67 (0.98,2.82) | 0.97 (0.54,1.83) |
| > 5000                           | 99 (92.5) | 8 (7.5) | 5.18 (2.31,11.61) | 2.97 (1.20,7.37)*|
| Marital status                   |      |      |      |      |      |      |      |      |
| Not married                      | 164 (80) | 41 (20) | 1  | 1 |
| Married                          | 264 (76.7) | 80 (23.3) | 2.59 (0.81,8.32) | 0.86 (0.53,1.40) |
| Media exposure                   |      |      |      |      |      |      |      |      |
| Poor                             | 7 (58.3) | 5 (41.7) | 1 | 1 |
| Good                             | 421 (78.4) | 116 (21.6) | 1.21 (0.79,1.85) | 1.15 (0.33,3.94) |

* Indicate significant at p value less than 0.05 in multivariable logistic analysis
This finding was supported by researches elsewhere [24, 28]. Confirming the fact that better practices of iodized salt by women in the reproductive age has a relationship to the price of the salt. Women who earned better monthly household income have the ability of purchasing and utilizing iodized salts for high prices [32]. Similarly, household income might be strongly associated with the types of salt preference in that poorer households were much more likely to purchase coarser salts [30]. Furthermore, excess cost of iodized salt might be a barrier to preventing iodine deficiency because it forces people with low incomes not to buy and use the salt [29, 33]. Thus, most women may not able to use it due to its high cost [21].

In conclusion, this study showed that women had good levels of knowledge and practice of iodized salt use. Monthly household income and educational status are associated with the knowledge and practices of iodized salt of respondents. Hence, improving mothers’ education is an important strategy to address the public health problems of IDDs.

### Limitation of the study

Rapid test kit show only color change which cannot tell the exact amount of iodine concentration in the salt but due to resource constraint gold standard iodine test couldn’t be use which show the exact concentration. This study didn’t triangulate with qualitative study.
Abbreviations
ACIPH: Addis Continental Institute of Public Health; AOR: Adjusted Odd Ratio; CI: confidence interval; COR: Crude Odd Ratio; IDD: iodine deficiency disorder; UNICEF: United Nations International Children's Education Fund; USI: universal salt iodization; PPM: part per million; SPSS: Statically Package for Social Science; WHO: World Health Organization.

Authors' contributions
MS conceived the study, developed the tool, coordinated the data collection activity, and carried out the statistical analysis. WW participated in the design of the study, tool development, and drafting the manuscript. AK participated in the design of the study and tool development, performed statistical analysis, and reviewed the manuscript. All authors read and approved the final manuscript.

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

Availability of data and materials
Data will be available upon request from the corresponding authors.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Ethical approval was obtained from the ACIPH and University of Gondar Institutional Review Board. The purpose of the study was clearly explained to all concerned bodies. Informed verbal consent was obtained from parent/guardians before the interview for each participant after briefly explaining the purpose, risk, and benefit of the study subject less than 18 years old and oral assent obtained from study subjects. Confidentiality was maintained and assured by excluding their names from identification of the study subjects. The instruments and procedures were not cause any harm to the study subjects, the community, the data collectors and supervisor. Health education about the use of iodized salt and handling practices in the household were given to each participant after data collection.

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