Journal of Women's Health Care

OPEN ACCESS Freely available online

Research Article

Determinants and Availability of Adequately Iodized Salt at Household Level in Nejo Woreda, Oromia Region, Ethiopia, 2019, Community Based Cross Sectional Study

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ABSTRACT

Background: Iodine Deficiency Disorders refer to a spectrum of health consequences resulting from inadequate intake of iodine. Around 2 billion people in 130 countries worldwide have insufficient intakes of iodine and Ethiopia also one of the countries more than half the population at risk of Iodine Deficiency Disorders (IDD). Recently monitoring of the iodine in Dasse and kombolcha indicated that 68.8% of households used adequately iodized salt which is below the international goal of 90% coverage. Universal salt iodization has been implemented to eliminate Iodine Deficiency Disorders. However, the adequacy of iodine in salts needs close monitoring to meet its intended goal.

Objective: To assess availability of adequately iodized salt and its associated factors at household level in Nejo woreda West Wollega Zone, Oromia, Ethiopia, 2019.

Method: A Community-based cross-sectional study was conducted in Walmara Woreda from February one to 30 in 2020. Multistage sampling technique Data collection was used to study participant. All independent variables with p-value <0.25 in the bivariate analysis were selected for multivariate logistic regression analysis. During multivariate logistic regression analysis the P-value less than 0.05 were considered as statistically significant and degree of association between dependent and independent variables were reported using Adjusted Odds Ratio (AOR) and 95% CI.

Result: This study shows the availability of adequately iodized salt at household level with PPM of > 15 was 355 (65.9%).Households who live in urban areas were 8.74 times more likely to have adequately iodized salt than those rural areas (AOR= 8.74, 95% CI: (2.92, 26.09)). Storage of salt at dry Place was 5.38 times more likely to have adequately iodized salt than that Stored at moister Place (AOR=5.38, 95% CI: (1.46, 19.88). Households who were using packed salt were 11.441 times more likely to have adequately iodized salt compared to those who were using non-packed salt (AOR= 11.44 (95% CI: (3.97, 33.02)).

Conclusions and recommendation: The availability of adequately iodized salt at household level in Nejo wareda was low as compared to the Iodine Deficiency Disorders elimination strategy. Hence zonal and woreda health office should give attention to monitoring and evaluation of iodine salt at production, transportation and consumption levels.

Keywords: Iodized salt, Nejo woreda, Ethiopia, Deficiency, Iodized salt

INTRODUCTION

Iodine is a trace element that is essential for the synthesis of thyroid hormones by the thyroid gland [1]. Globally more than 1.88 billion people are at risk of iodine deficiency and 246 million school-age children are estimated to have insufficient iodine in [2,3], Salt is generally used as the vehicle for providing iodine and iodization of salt is an effective, feasible, economical, safe and broadly accepted by the community [4].

An iodine deficiency disorder is a spectrum of health consequences resulting from inadequate intake of iodine. Iodine deficiency disorders is manifested in multiple adverse health consequences like decreased child survival rates, goiter, abortion, stillbirth,

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Received: 14-Mar-2022, Manuscript No. JWH-22-16264; **Editor assigned:** 16-Mar-2022, PreQC No. JWH-22-16264(PQ); **Reviewed:** 02-Apr-2022, QC No. JWH-22-16264; **Revised:** 09-May-2022, Manuscript No. JWH-22-16264(R); **Published:** 16-May-2022, DOI:10.35248/2167-0420.22.11.581

Citation: Gutema EA (2022) Determinants and Availability of Adequately Iodized Salt at Household Level in Nejo Woreda, Oromia Region, Ethiopia, 2019, Community Based Cross Sectional Study. J Women's Health Care 11(5):581.

malformation and overall impaired growth and development [5]. In Ethiopia, more than 35 million (62%) people are at risk of iodine deficiency and around 28 million people suffer from goiter, and 50,000 prenatal deaths are related to iodine deficiency each year in Ethiopia [6].

Around 2 billion people in 130 countries worldwide have insufficient intakes of iodine [7]. Nearly 38 million newborns in developing countries every year remain unprotected from the lifelong effect of brain damage due to Iodine Deficiency Disorders (IDD). In Africa about 260 million people have inadequate iodine intake resulting in iodine deficiency states, which are 10–15% lowering of average intellectual capacity [8]. The consequences of iodine deficiency disorders affect all stages of life from fetus to adult hood as well as old age.

Ethiopia is one of the countries more than half the population at risk of IDD. Recent monitoring of the iodine indicated that 68.8% of households used adequately iodized salt containing at least 15 ppm iodine Dasse and kombolcha, considerably below the international goal of 90% coverage. Hence the need to undertake this study was to provide current information regarding the availability of adequately iodized salt and its associated factor at household level in Nejo woreda,West Wollega Zone, Oromia, Ethiopia.

Monitoring Salt at the Household provides important information about the successful delivery of iodized salt to the consumer [9]. This study contributed information to monitor percentage of population remains at risk of inadequate intake of iodine. It gives baseline information for the next intervention plan based on the finding to promote Universal Salt Iodization (USI) for the Nejo woreda and stakeholders. The baseline information can also be used to forward recommendations for policy makers and implementers to enhance appropriate planning and implementation of intervention relevant to utilization of adequately iodized salt. This study finding can be used as starting point for other researchers who are interested to conduct further investigations [10].

MATERIALS AND METHODS

Study area

This study was conducted in Nejo woreda, West Wollega Zone, in Oromia Region, Ethiopia.

Study design and period

Community based cross-sectional study was conducted from February 1 to 30/2019.

Source of population

All households who live in Nejo woreda

Study population

All households who selected in the selected kebeles

Inclusion and exclusion criteria

Inclusion criteria

All household selected and adult member of the household who were involved in the food preparation at household level were included. In the household where two or more household members were involved in food preparation, the representative of mother or wife was purposely selected for interview.

Exclusion criteria

- Household who lived less than six month in the study area were excluded from the study.
- Household member who were < 18 years old and participated in food preparation was excluded from the study.

Sample size

The study sample size was determined by using a single population proportion formula considering following assumption.

P =Presently monitoring of availability of adequately iodized salt at household level in Dessie and Kombolcha Towns =68.8%(27), the standard normal value at 95% confidence level (1.96), d=margin of error (0.05) ,Non-responserate10% and design effect of the study: 1.5, fitting in to the formula the final sample size was calculated as:

$$n = (Z\alpha/_2)^2 pq$$

$$d^2$$

$$n = ((1.96)^2 * 0.688(1-0.688))/0.05^2 = 0.826/.0.0025 = 330$$

Then adding 10% for non-response rate the Sample size (N) =330+33=363, however, since the study utilized multi-stage sampling, this sample size was multiplied by 1.5 for the design effect. The final sample sizes for this study is 1.5*363 = 545.

Data collection method

Data was collected using interviewer administered structured questionnaire and rapid iodine test kit. Four diploma and two BSC heaths professionals were participated in data collection and supervision respectively. During the data collection sample of salt used for cooking was obtained to test for the iodine content using MBI KITS (international salt test kits). The test kit contains a small white cup, 2 test solution ampoules of 10 ml, a recheck solution ampoule of 10ml and color chart indicators for iodine content ranges of 0 ppm, less than 15 ppm and more than 15 ppm.

The Procedure to test iodine content of salt are:-

1. Fill small cup with salt, then spread the salt surface flat.
2. Add two drops of the test solution on the surface of the salt by piercing the white ampoule with a pin and gently squeezing the ampoule.
3. Compare the color on the salt with the color chart, within one minute and determine the iodine content.
4. If no color appears on the salt (after one minute) on a fresh sample add up to five drops of the recheck solution in red ampoule and then add two drops of test solution on the same spot. The color of the test sample is compared with the standard color 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.

Data quality management

The questionnaire was developed in English and then translated in to Afan Oromo and retranslated into English to check consistency. To assure data quality of the study one day training was given for four data collectors and two supervisors on the data collection tool and the data collection procedure by preparing training material. The questionnaires were pretested before the actual data collection on 5% of the sample size out of the study area to ensure its validity. The data collectors and supervisors checked the accuracy and

completeness of filled questionnaires on daily basis. Any error in data collection was rechecked before proceeding with the next day's data collection activity.

Variables of the study

Dependent Variable

- Availability of adequately iodized salt at household level.

Independent variable

- Socio-demographic characteristics of study population (Age, Residence, Sex, Marital status, Ethnicity, family size, Education status, Occupation, Monthly income of the family, and role of respondent).
- Knowledge about iodized salt And Iodine Deficiency disorder.
- Duration of storage salt.
- Place of storage salt.
- Type of iodine salt (packed or not)
- Types of container storage.
- Time salt added during food cooking.

Operational Definitions

Availability of adequately iodized salt: Salt tested by rapid test kit had ≥ 15 ppm called adequately iodized salt [11].

Knowledge: Study participants who scored ≥50% regarding iodized salt and IDD questions were considered as having good knowledge, whereas, participants who scored below 50% were considered as having poor knowledge [12].

Duration of storage iodized salt: House hold those store the purchased salt more than two months were considered as having longer storage time, and those who store for less than two months were considered as having shorter storage time [13].

Storage of salt: storage of iodized salt at household level without exposing to environmental factors such as heat, moisture and light [14].

Type of salt: type of salt means based on whether the salt was packed or not. Packed salt means when the salt is packed by any plastic or with tin and not packed when the salt was not packed with anything [15].

Place of storage of salt: place store iodized salt at household level without exposing to moisture or not. Storage at dry place when the storage place not exposed to moisture and if storage place of salt is exposed to moisture called storage at moisture [16].

Salt exposed to sun light/ heat: storage of iodized salt at household level without exposing to environmental factors light/ Heat or not. Not Salt exposed to sun light/ heat when the storage place of salt not exposed to sun light/ heat and if storage place of salt is exposed to sun light/ heat called exposed to sun light/ heat [17].

Container of storage: container used to store salt at house hold level, store with cover container when respondents use to store salt any type of container which has cover and without cover if not use with cover container [18].

Role of Respondent in food preparation: preparation only when respondents participate only in food preparation , buy salt if respondents only participate in buy salt and participate both preparation and buy salt if the respondents participate both [19].

Data processing and data Analysis

After data collection, each questionnaire was checked for completeness and consistency manually [20]. The data was entered into Epi data 3.1 and exported to SPSS statistical software Version 20.0 for analysis. The descriptive statistics was presented by using frequencies, percentages, tables and graphs. A binary logistic regression analysis was performed to determine the association. All the independent variables with p-value <0.25 in the bivariate analysis were the candidates for multivariate logistic regression analysis [21]. The P-value less than 0.05 were considered as statistically significant. The degree of association between dependent and independent variables was reported using Odds Ratio (OR) and 95% CI [22].

Ethical Considerations

The necessary explanation about the purpose, potential risk and procedure of study was explained and verbal consent was obtained from each respondent to ensure the right of participant [23]. Participants were informed that participation was on voluntary basis and they can withdraw at any time if they are not comfortable about the questionnaire. In order to protect the confidentiality of information name and other identification was not be included in questioners and maximum effort was made to maintain privacy of the respondent during the interview [24]. The collected data was stored and kept safe place where any the investigator is acceptable and the computer was protected by private pass word [25,26].

RESULT

Socio demographic Characteristics of the Study Participants

Out of the 545 samples 539 of participant involved in the study, with a response rate of 98.8%. Out of study subject, 400(74.2%) were rural residence area, 365(67.7%) Oromo in ethnicity, 115(21.3%) unable to read and write, 370(68.4%) were married and 279(51.8%) were farmers. Three hundred fifty seven (66.2%) study house hold had family size ≤ five and 312 (57.9%) had an average monthly income of <5000 Ethiopian Birr (ETB).

Availability of adequately iodized salt at the household level

Using rapid test kit adequately iodized salt (>15) was found in 355 (65.9%) of the 539 tested salt sample at house hold level and rest 184(34.1%) had inadequate (<15 ppm) iodine salt. Regarding the type of salt tested 84.1% of packed salt had adequate iodine and only 24.4% of those non packed salt had adequately iodized at house hold level.

Respondent's information regarding iodine salt and Iodine Deficiency Disorders

In this study, 100 (18.55%) of the participants had not heard about iodine. Among study subjects who heard about iodine 437 (51.9%) obtained information from friend and relatives only. From the total respondent 318 (59%) believed that all salt are iodized salt. One over two respondents those who do not use packed salt was believed that packed salt was not available and 52.1% respondents knew iodine important for health. Among study participant only 191(35.4%) knew cause of goiter is iodine deficiency and one over two of respondents knew IDD preventable by universal salt iodization.

Practice of respondents regarding the use of iodized salt

Among study subject 370(68.8%) of household use packed salt, nearly three forth of respondents buy the salt from market and only 232 (43%) check iodine content by reading the label on the pack. Regarding the practice of iodine salt, 491(91.1%) households stored salt in a dry place, 434 (80.5%) store salt with cover, 152(28.2%) of the respondents exposed salt for sunlight/heat at house hold level, all most all 99.1% household use salt without washing and 347(64.4%) add salt to food at the end of food preparation.

Factors associated with the availability of adequately iodized salt at household level

The investigation on the presence of association between suspected factors and availability of adequately iodized salt revealed the following results. Residence of respondent, family size, respondents knew IDD preventable, method used to check salt iodine content, storage place, container used to store salt, salt exposure to sun/heat, duration salt storage and type of salt respondents use were significantly associated with availability of adequately iodized salt during multivariate analysis. Households who live in urban areas were 8.74 times more likely to have adequately iodized salt than those who were from rural areas (AOR= 8.74, 95% CI: (2.92, 26.09)).

Family size less than five 3.51 times more likely to have adequately iodized salt than those whose family sizes greater than five member (AOR= 3.51, 95% (CI: 1.45, 8.26)). Storage salt in dry Place was 5.38 times more likely to have adequately iodized salt than that stored at moister Place in home (AOR=5.38, 95% CI: (1.46, 19.88). Use of container with a cover to store was 4.69 times more likely to have adequately iodized salt than that use a container without cover to store (AOR=4.69, 95% CI: (1.64, 13.39)).In relation to duration of salt storage those household who store salt for short time were 3.75 times more likely to have adequately iodized salt than those who store for longer period of time (AOR=3.75, 95% CI: (1.12, 11.32)). House hold those who use packed salt was 11.44 times more likely to have adequately iodized salt compared to respondents those who use non packed salt(AOR= 11.441 (95% CI:(3.97, 33.02)

DISCUSSION

The study finding indicates that the overall percentage of households who use adequately iodized salt (>15 ppm) was 355 (65.9%). This study result is nearly in line with the study conducted in Debra Tabor Town 66.4%, Assela town 62.9%, South Africa 62.4%, and Dasse and kombolcha 68.8% [27-29].The finding was much higher than the study reports in Ethiopia from rural community of Maychew33%, Gondar town, 28.8% and Lalo Assabi (8.7%) [30]. In contrast to the above finding, adequacy of iodized salt in the study was lower than findings from Sri Lanka, 88.7%, in Bia district Ghana 75.6%, the Iodized salt Coverage of EDHS 2016 89% [31]. This study also less than the WHO, UNICEF and ICCIDD recommendation for the elimination of IDD is possible when the proportion of households using iodized salt reaches 90%, and in Ethiopia USI target should be 90% at house hold level [32].

The reason for these variations may be due to relatively wide time elapsed between the current study and others. Additionally, controlling of iodine deficiency disorders has been given universal attention with strong monitoring and evaluation of iodine at every level (at production, transportation and consumption levels). The differences in agro-ecological situations, socio-economic status and practices among households may bring the above discrepancies in different areas [33].

Among study participant 402 (74.6%) of respondents have good knowledge about iodine salt and iodine deficiency disorder. This study result was higher than the study conducted in Arba Minch 52.8% and in Ghana 59.3% respondent have good knowledge about iodine salt [34]. However, the result in this study was less than finding of study conducted in Addis Ababa with prevalence of knowledge among women in reproductive age was 78% [35]. The variation might be due to the nature of study settings, in Addis Ababa women in reproductive age group and who have opportunities to increase their knowledge through promotions of iodized salt on different media. It may also be due to variation on awareness creation and educational activities so that most of the communities become aware of iodized salt and its importance to improve the health status of the people [36].

Among respondents who have good knowledge, 3/4th of household use adequately iodized salt. Similarly the study conducted in Ghana respondents those who have good knowledge 73.3% use adequately iodized salt and the study conducted in Gondar shows respondents those who have good knowledge were 1.94 times more likely have adequate iodized salt than those have poor knowledge [37].

Residence of study participants was one of the associated factors with availability of adequately iodized salt at household level. The study participants who were from Urban areas were8.74 (AOR= 8.74, 95% CI: (2.92, 26.09)) times more likely to have adequately iodized salt than those who were from rural areas. Similarly a study conducted in Lalo Assabi and Dasse and Kombolcha town indicates that in the urban areas respondents were 1.26 and 2.53 times more likely to have adequately iodized salt than those who were from rural areas respectively [38]. Households whose family size less than five were 3.51(AOR= 3.51, 95% CI: 1.45, 8.26) times more likely to have adequately iodized salt than those households whose family size was greater than five.

Respondents who knew iodine deficiency disorder is **preventable were 8.20(AOR= 8.20, 95% CI 3.33, 20.16)** times more likely to have adequately iodized salt than those who didn't know.

Respondents who check the iodine content by reading the label on salt was 3.70(AOR = 3.70, 95% CI: (1.28, 10.68) times more likely to have adequately iodized salt than those did not use any method to check the iodine content during salt buy. This difference might be due to educational back ground of respondents, it also might be due to economic level, knowledge and practice of respondents.

Salt that stored in dry Place was 5.38 (AOR=5.38, 95% CI: (1.46, 19.88) times more likely to have adequately iodized salt than that stored at moister place in home. This result is almost similar with a study conducted in Jigjiga which indicates that salt stored at dry place at household level had 5.15 times adequately iodized salt than that stored at moisture place. But this study result was higher than study conducted in Lalo Assabi which shows that salt stored in dry place was 2.15 times more likely to have adequately iodized salt than the counterpart [36,37]. The probable reason for this difference might be period of the investigation, geographical location of study areas and educational background of study participants. Moreover, a study conducted in Canada showed that iodine content of the salt remained constant and its distribution remained uniform for many months when the salt is packed and kept dry [33].

On the other hand those household who use container with a cover to store salt was 4.69(AOR=4.69, 95% CI: (1.64, 13.39)) times more likely to have adequately iodized salt than those who store salt in a container with no cover. This study result is greater

than a study conducted in lalo Assabi which shows those who use container with a lid to store their salt at home were 1.45 times more likely to have adequately iodized salt than those who use container other than a lid [37] and it is also greater than a study conducted in Lay may chew which shows those who use container with a cover to store their salt at home were 2.15 times more likely to have adequately iodized salt than those use container without Cover [26]. Those households who were not exposing salt to sunlight or heat were 3.04 (AOR=3.04 95% CI: 1.38, 6.71) times more likely to have adequately iodized salt than those were exposing salt to sunlight or heat. This study finding was less than study conducted in Dire Dawa , Gonder and Dase Aand Combolcha which shows 7.26, 7.25 times more likely to have adequately iodized salt than those who expose salt to sun respectively [25,34]. The reason behind this difference might be due to educational background of study participants.

Similarly, duration storage of salt at home was significantly associated with availability of adequately iodized salt. Respondents who store salt for shorter time were 3.75(AOR=3.75, 95% CI: (1.12, 11.32)) times more likely to have adequately iodized salt than those who store for longer period of time. This study result is similar with a study conducted in Dire Dawa which indicates that store salt for less than two month were 3.6 times more likely to have adequately iodized salt than that stored for more than two months; while it was more than a study result conducted in Maychaw which shows 2.1 time more likely to have adequate iodine salt than those store more than two month respectively [25]. A study conducted in London showed that duration of salt storage had an impact on the level of iodine [37].

Using packed salt at was significantly associated with availability of adequately iodized salt. A respondents those use packed salt was 11.441 (AOR= 11.441 (95% CI: 3.965, 33.014) times more likely to have adequately iodized salt compared to respondents those use non packed salt. A study conducted in Gonder those who use packed salt were 9.7 times more likely to have adequately iodized salt than those who use non packed salt [36]. A study conducted in Lalo Assabi those used packed salt were 1.38 times more likely to have adequately iodized salt than those who use non packed salt [37,38]. This might be due to good transportation system, storage, and keeping it in a suitable environmental condition.

CONCLUSIONS

Based on finding of this study, availability of adequately iodized salt was 65.9% at house hold which is very low compared to IDD elimination strategy. Residence of respondent, family size, Knowledge of respondents about IDD preventable, method use to check salt iodine content, storage place of salt, container used to store salt, exposure of salt to sun/ heat, duration salt store and type of salt respondents use were found to be significantly associated with adequacy iodine in edible salt. This shows that working at grass root level is vital to achieve the desired target of universal salt iodization. Educating the households regarding proper practices of iodized salt, intervention of factors that affect the salt iodine content and proper use of salt in house hold level. We can conclude that it is important to develop regular and strict monitoring schedule on salt supply.

Recommendation

- Health workers and community-based voluntary health workers should conduct regular community awareness creation and promotion activities to improve universal salt-iodization coverage and practice of iodized salt at house hold level.
- Zonal health Department and Woreda health office should give attention to monitoring and evaluation of iodine salt at production, transportation and consumption levels.
- The regulatory authority should appropriately implement legislation of national salt iodization program to ensure sufficient supply of adequately iodized salt throughout the country from the salt dietary production to consumption.
- Further researches need to be done to identify factors that affect the adequacy of iodized salt at sale level (market, shop, super market).

Abbreviations or Acronyms

AOR: Adjusted Odd Ratio

CI: Confidence Interval

EFMHACA: Ethiopian Food, Medicine and Health care Administration and control Agency

EDHS: Ethiopian Demographic and Health Survey

FSF: West Wollega Zone

HHIS: House Hold Iodine Salt

ICCIDD: International Center for the Control of Iodine Deficiency Disorders

IDD: Iodine Deficiency Disorders

MoH: Ministry of Health

NGO: Non -Governmental Organization

PPM: Parts-Per-Million

RTK: Rapid Test Kit

TGR: Total Goiter Rate

UI: Urinary Iodine

UNICEF: United Nations Children Emergency Fund

UNAIDS: United States Agency for International Development

USI: Universal Salt Iodization

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from Ethiopian Public Health Institute institutional review committee and letter of approval was granted. Then individual participants' written consent for participation was obtained.

Consent to publish

Not Applicable

Data Availability and Materials

The dataset analyzed during the current study available from the corresponding author on reasonable request. The questionnaire that we developed for the collection of data is provided as a supplementary file.

Competing interests

The authors declare that they have no competing interests.

Funding

The financial support for this research project was by us and no any financial support from anyone.

Authors' contributions

EA conceived the study, wrote the proposal, facilitated data collection, analysis, data interpretation, drafted the final report write up, and prepared manuscript. MM, and JB participated in developing the tools and data collection process, data analysis and involved in report write up. All authors read and approved the final manuscript.

Acknowledgements

Heartfelt gratitude to Nejo Woreda Health Office, Supervisors, Data collectors and Study participants for their cooperation and support during the study period.

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