Utilization of Iodized salt and Associated Factor in Zuway Dugda District, Arsi Zone, Oromia Regional State, South East Ethiopia

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Abstract: Iodine deficiency is a major cause of preventable mental retardation, deafness, autism, short stature, and various other defects in humans around the globe. These problems can be prevented with simple slat iodization. Ethiopia has implemented slat iodization as a strategy to prevent iodine deficiency disorders (IDD). However, little is known about households' use of iodized salt and associated factors. A community based cross-sectional study was conducted from August 1, 2017 to August 30, 2017 in rural Zuway Dugda, Arsi Zone, Oromia Regional state, South East Ethiopia. A total of 402 households were selected using a systematic random sampling technique. Data were collected using structured questionnaires and household salt use was tested using the Rapid Test Kit from the salts used during the previous night. Bivariate and multivariate analyses were performed to determine household uses of salt iodization. P-value of 0.05 was employed to declare statistical significance in multivariate analysis. This study indicated that 30.7% of the households had adequate iodine level (> 15ppm) in their salts while 60.1%, and 8.2% of the households had inadequate iodine level (< 15ppm and no iodine at all (0 ppm) respectively. Using packed type of salt (AOR=2.89, 95%CI (1.54, 5.44)), having information about iodized salt (AOR= 4.11 95%CI 2.42, 7.01) and storing salt in dry place (AOR=3.41 95% CI (1.01, 11.51) were positively associated with utilizations of adequately iodized salts. This study revealed that the availability of adequate iodized salt in the household salt was very low. Health information dissemination to every household about the storage and the importance of utilizing iodized salt is critically important and needs to be done across the study area.

Keywords: Iodized salt; rural; Arsi Zone; Ethiopia

1. Introduction

Iodine deficiency is a major public health problem facing mankind. Iodine deficiency causes goiter and brain damage in all ages beginning with the fetus during pregnancy (Basil and Emeritus, 2004), physical sluggishness, growth retardation, reproductive failure, increased childhood mortality, and economic stagnation. Healthy humans require iodine, an essential component of the thyroid hormones, thyroxin and tri iodothyronine. Failure to have adequate iodine leads to insufficient production of these hormones, which affect many parts of the body, particularly muscle, heart, liver, kidney, and the developing brain. Inadequate hormone production adversely affects these tissues and causes Iodine Deficiency Disorders (IDD). (De Benoist, Andersson et al. 2004). Correction of the deficiency dramatically improves school performance, agricultural output and per capita income as it typically results in educable and economically productive population (Yifru et al. 2007).

There is no country in the developing world where iodine deficiency is not a public health problem. About 38 million newborns in developing countries every year remain unprotected from the lifelong consequences of brain damage associated with iodine deficiency disorders (Unicef 2008). The primary cause of iodine deficiency is a low dietary supply of iodine, typically in environments where the soil lacks iodine due to past glaciation, often compounded by the leaching effects of precipitation or flooding. These remove iodine from the soil, and plants and livestock become iodine deficit (Zimmermann et al., 2007). The estimated productivity loss due to IDD in Ethiopia was Birr 64 billion between 2006 and 2015 (FMOH, 2009). People living in areas affected by severe iodine deficiency may have an intelligence quotient (IQ) of up to 13.5 points below that of those from comparable communities in areas where there is no iodine deficiency (WHO,2007; Zimmermann 2007). Health planners and international agencies are increasingly recognizing that the elimination of iodine deficiency is an attainable goal with important benefits for many people (Mannar and John, 1995). One of the possible ways to eliminate deficiency of iodine is fortification of the nutrient in salt.

Salt iodization programs, like any other health interventions, require an effective system for monitoring and evaluation. Salt iodization is currently the most widely used strategy to control and eliminate IDD. However, to be fully effective in correcting iodine deficiency, salt must not only reach the entire affected population – in particular those groups that are the most susceptible(pregnant women and young children) – but it also needs to be adequately iodized (WHO 2007). Treatment of IDD prevents further complication of the disease and its impact on socioeconomic effects.

The World Health Organization (WHO) and the Micronutrient Initiative state that in order to achieve sustainable elimination of iodine deficiency at least 90% of households must be using salt and that the salt must have an iodine content of 15 parts per million (ppm) or

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more (Worldvision 2011). The Ethiopian Standards Board requires that the iodine content in salt should not be less than 50 ppm at the production point; and it is expected to be at 25 ppm at the retail level (Teklit, 2015).

A review of the prevalence of iodine deficiency among vulnerable population in Ethiopia indicates that severe iodine deficiency in women leads to 50,000 still births annually and the country's goiter rate had ranged from14% to 59% in 2009 to 2011 respectively (Tesema et al. 2009). Moreover, to the knowledge of the principal investigator, there is no a documented community based study done on household's salt iodine level and associated factors in the households of Zuway Dugda district as these community are living in lowland area. Many studies have been conducted to assess household's salt iodine level and associated factors, however, studies on the household's salt iodine level and associated factors have not be conducted in this area. Therefore, this study was undertaken to assess household's salt iodine level and associated factors in rural Zuway dugda district, Arsi zone, and Oromia regional state.

2. Methods

2.1. Study Area and Period

This study was done in Zuway Dugda District, which is located in Arsi administrative Zone of Oromia regional state, South East Ethiopia, about 212 km distance to the south from Addis Ababa, the Capital city of Ethiopia. Based on the 2007(1999E.C) census, the district has a total population of 137, 227 of whom 67,927 are males and 69,300 are females. This area with lowland area and the population growth rate was 2.1%. There are 30 kebeles in the district (2 urban and 28 rural).Governmental health facilities are six health centers (2 in town and 4 in rural areas) and 32 health posts (2 in town and 30 in rural areas); this makes the district a hundred percent health coverage (Woreda Expert and primary Health Care Unit Directore 2016). This study was conducted from August 1st to 30 August, 2017 in rural Zuway Dugda district.

2.2. Design and Population

A community based cross-sectional study design was used to select 402 households living in different kebeles of Zuway Dugda District who lived the area for more than 6 months were included. The targeted study populations were household's access to iodized salt and the study participants were household members mostly (women) participated in food cooking were interviewed. Households that with seriously sick head of household (particularly women) that made communication difficult to get the necessary data was excluded from the study.

2.3. Sample Size Determination and Sampling Procedures

The sample size was determined by using the formula to estimate a single population proportion. The sample size was calculated using population proportion (PP), that is, 48.3% taken from previous study (Tsegaye, H, et al. 2016), 95% confidence level, and 5% margin of error. Adding 5% for the non-response rate the final samples size was 402.

Data were collected from rural kebles. Among 28 rural kebles five kebeles: namely Hula Arba, Beshira, Hallo, Kiyansho and Ogolcho were selected using simple random sampling. The sampled population were selected from the selected kebele using systematic random sampling from registry of health extension workers (HEW) and proportionally allocated to size of women found in each kebele. Based on this sampling 84, 83, 62 93, and 80 data were collected from Hula Arba, Beshira, Hallo, Kiyansho and Ogolcho kebeles, respectively.

2.4. Data Collection

Data were collected using interviewer administered structured questionnaire. The questionnaire was developed through literature review and comprised of questions based on socio demographic characteristics, knowledge, associated factors, availability and accessibility of iodized salt. Data were collected by six diploma clinical nurses and supervised by one BSc nurse and one public health officer. Each team was given a standard scope of work, encompassing data collection (collecting salt sample, interview of the respondent and recorded in a structured questionnaire).

2.5. Determination of Iodated Salt

To determine the availability of adequately iodized salt, the interviewer asked every sample household to provide a teaspoon of salt used for food preparation during previous night. Then the salt was filled on small cup and spread flat. Then two drop of test solution were added on surface of salt from white ampule and color were compare with color chart within one minute to determine the iodine concentration (intense color). If no color change appeared on the salt (after one minute) add test solution on a fresh sample up to 5 drop of recheck solution in red ampule and then 2 drops of test solution on same spot and compared the color with color chart. Finally, it was categorized as 0 ppm (no iodine content in the salt), <15 ppm (Light blue and have inadequate iodine), ≥ 15 ppm (Deep blue, have adequate iodine content) (WHO. 2011). This was determined by using Improved Iodized salt Field test kit Batch No. 016 MF JUN. 2016 EXP NOV.2017 for salt fortified with potassium iodate only. Unopened ampule was used and, the kit was accurate for visual detection of potassium iodate concentration at threshold of 15 ppm and result was valid. The test kit was obtained from UNICEF through Oromia Regional Health Bureau. During analysis households with iodine less than 15ppm and has no ioden at all were categorized as in adequate and household with iodine concentration greater than 15 PPM were categorized as adequate based on previous study (Roba *et al.* 2016).

2.6. Quality Control

The questionnaire was translated into Afan Oromo for data collection and then retranslated back into English by language experts to check for consistency. A two-day training was provided to the data collectors and supervisors on the data collection tool and the data collection procedure. The questionnaire was pretested on 5% of the sample size out of the study area to ensure its appropriate and modifications were made on questionnaire before final data collection. The principal investigator and the supervisors checked completeness of each questionnaire on a daily basis.

2.7. Data Processing and Analysis

The collected data were entered into Epi INFO version 7 statistical software and exported to SPSS statistical software version 21 for cleaning and analysis. Before the analysis, data were checked for completeness and then cleaned. Descriptive data will be described using frequencies, percentages and will be presented using tables and graphs. Logistic regression model was used to identify factors associated with adequacy of iodine in household's salts. P-value less than 0.05 were considered statistically significant. The degree of association between dependent and independent variables were reported using Adjusted Odds Ratio (AOR) and 95% CI.

2.8. Ethical Consideration

Ethical clearance was obtained from the Ethical Committee of Rift Valley University Ethical review committee. Letters of support was obtained from Oromia Regional Health Bureau, Arsi Zone Health department and Zuway Dugda district Health Office. Informed verbal consent was obtained from heads of household and study participants. The participants were allowed to consider their participation and given the opportunity to withdraw from the study at any point in the course of the study. Participants' name or personal identifier was not included in the written questionnaires to ensure participants' confidentiality. Health education on the importance and source of iodized salt and proper handling of it at household level was given to participants who has no iodine in their salt by the data collectors after data collection.

3. Results

3.1. Socio Demographic Ccharacteristics of the Respondents

A total of 402 households participated in the study with response rate of 100%. Among those, 384 (95.5%) were female, 334(83.1%) of whom were married, 322 (80.1%) were Muslim, 348 (86.6%) were from the Oromo ethnic group. From this group, le 256(63.7%) had formal education, 329 (81.1%) were housewives, 213 (53%) had family size more than five and 187 (45.8%) of the respondents' average monthly income was <500 Ethiopia Birr (Table 1).

3.2. Household Salt Iodization and Practice of Handling Salt

During data collection, we found all (402) of the households had salt in their homes. 337(83.8) of the households were using unpacked type of salt, 64.2% of the households got salt from the retail shop, 92.8% of the respondents stored the salt in a dry place and 82.3% stored the salt for less than two months after purchase. Only 25.6% of the households added salt to cooked food at the end of cooking (Table 2).

Around 54.6% of participants heard about iodized salt, for which only 34.4% respondents got information from health workers; only 26.5% of them mentioned iodized salt is important to prevent goiter. About 72.8% of the respondents responded that they knew the effects of iodine deficiency is goiter, 77.2% of the respondents thought that iodine deficiency did not cause still birth; 83.9% mentioned that iodine deficiency did not cause mental retardation, and 79.5% mentioned that every salt contains iodine (Table 3).

3.3. Iodine Content of Household Salt

Of the total respondents, (30.7% of the salt tested had adequate iodine (≥15 ppm) while 8.2% had no iodine in it at all (0 ppm) (Figure 3).

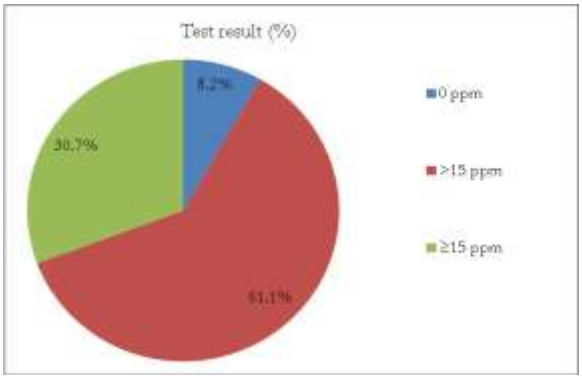

Figure 3: Iodine content test result at household level in communities of Zuway dugda DistricS

Table 1. Socio demographic characteristics of respondents in Zuway Dugda district South east Ethiopia, 2017.

Variable	Category	Frequency	Percent (%)
Sex	Female	384	95.5
	Male	18	4.5
Age group	18-31	81	20.1
	32-44	176	43.8
	>45	145	36.1
Marital status	Single	17	4.2
	Married	334	83.1
	Divorced	12	3.0
	Widowed	26	6.5
	Separated	13	3.2
Ethnicity	Oromo	348	86.6
	Zey	45	11.2
	Others*	9	2.2
Religion	Muslim	323	80.3
	Orthodox	64	16.0
	Protestant	7	1.7
	Catholic	8	2.0
Educational status	No formal education	146	36.3
	Formal education	256	63.7
Occupational status	House wife	329	81.8
	Government employer	34	8.5
	Private employer	39	9.7
Family size(Justify	<=5	189	47
	>5	213	53
Monthly household income(justify	<500 EBR	185	46.0
	501-1000	141	35.0
	>1000	76	19.0

Note: *Ahahra, Gurage

Table 2. Household salt utilizations in Zuway dugda District, south eastern Ethiopia, 2017.

Variable	Category	Frequency	Percent (%)
Type salt used	Packaged	65	16.2
	Not packaged	337	83.8
Place to buy salt	Open market	258	64.2
	Retail shop	144	35.8
Salt exposure to salt sunlight	Yes	7	1.7
	No	395	98.3
Washing the salt before use	Yes	1	0.2
	No	401	99.8
Salt storage place	dry area	373	92.8
	Not dry place	29	7.2
Salt container	With cover	354	88.1
	Without cover	48	11.9
Duration of salt storage at household level	<=2 months	331	82.3
	>2months	71	17.7
Time salt is added during food cooking	at early beginning of cooking	121	30.1
	At middle of cooking	178	44.3
	At the end of cooking	103	25.6

3.4. Factors Associated with Utilizations of Iodized Salt in the Households

The present study indicated that having formal education, using packed type of salt, buying salt from retail shop, having information about iodized salt and storing salt in dry place were significantly associated presence of adequate iodine in salt during bivariate analysis.

Table 3. Knowledge of respondents regarding the importance of iodized salt in communities of Zuway Dugda District, 2017.

Variable	Category	Frequency	Percent (%)
Have you heard about iodized salt	No	219	54.6
	Yes	182	45.4
Information source about iodized salt	From health worker	14	7.6
	From radio	145	79.7
	From their child	15	8.2
	From neighbors	8	4.4
Know importance of iodized salt , n=402	To keep healthy	123	30.6
	To prevent from goiter	90	22.4
	Better than other	77	19.2
	To grow well	29	7.2
	I don't know	83	20.6
Know cause of Goiter, n= 217	Yes	158	39.3
	No	244	60.7
Iodine deficiency cause still birth, n= 158	Yes	48	30.4
	No	110	69.6
Iodine deficiency cause mental retardation , n=158	Yes	35	22.1
	No	123	77.9

Using packed type of salt, buying salt from retail shop, storing salt in dry place and having information about iodized salt were significantly associated with household salt iodization. Participants who had packed type of salt were 2.89 times more likely to have adequate iodine in their salt than those who had not (AOR=2.89,95%CI (1.54,5.44)). Those participants who purchased salt from retail shop were 1.97 times more likely to have adequate iodine in their salt than those who had bought it from the open market (AOR= 1.97 95%CI (1.19,3.28). Households who had information about iodized salt were 4.11 times more likely to use adequately iodized salt than those whose had no information (AOR= 4.11 95% CI(2.42,7.01) and storing salt in dry place was 3.41 times more likely to lead to adequate iodine in their salt than those store it t in a damp place (AOR=3.41 95% I (1.01,11.51) (Table 4).

Table 4. Final model of predictors of adequately iodized salt availability in multivariable logistic regression in Zuway Dugda District, South East Ethiopia, 2017.

Variable		Iodine level in Freq (%)		COR	AOR
		>15PPM	<15PPM		
Educational status	No formal education	32(21.3)	114(78.1)	1	1
	Formal education	91(35.7)	165(64.3)	1.97(1.24,3.16)*	1.29(0.76,2.18)
Type of salt used	Packed	40(61.5)	25(38.5)	4.88(2.79,8.52)*	2.89(1.54,5.44)*
	Not packed	83(24.7)	251(75.3)	1	
Place to buy salt	Open market	56(21.70)	202(78.3)	1	1
	Retail shop	67(46.9)	77(53.1)	3.18(2.04,4.95)*	1.97(1.19,3.28)*
Place to store	Dry place	119(32)	253(68)	2.94(1.0,8.64)*	3.41(1.01,11.51)*
	Not dry place	4(13.8)	26(86.2)	1	1
Do heard about	No	24(13.2)	158(86.8)	1	1
iodized salt	Yes	99(45.4)	120(54.6)	5.48(3.3,9.10)*	4.11(2.42,7.01)*

Note: *Significantly associated in multivariate logistic regression at p≤0.05

4. Discussion

This study indicated that 30.7% of the households salt contained adequate iodine (>15ppm). Using packed type of salt, having information about iodized salt and storing salt in dry place were found to be positively and statistically significantly associated with utilization of adequate salts.

This study revealed that a small proportion of the households (30.7%) was using adequately iodized salt. This is very low compared to study conducted in India in which 51% of households had iodized salt (Government of India Office of Salt Commissionner 2010). Again, the households use of iodized salt in this study was lower than the findings of studies conducted in Southern Ethiopia, Sidama Zone, Bensa woreda, which found 45.2% of households used iodized salt (Masresha Tsegaye, Dejene Hailu et al. 2016) and Rural Communities in Laelay Maychew District, Northern Ethiopia which also found 33% of households used iodized salt (Gidey B, Alemu K et al. 2015). These differences might be due to differences in socio-demographic characters of the study areas as this study area is lowland and iodine concentration in salt is naturally low as a result of its volaitility. However, WHO recommends that more than 90% of the households should utilize adequately iodized salt to eliminate IDD (WHO, 2007). Therefore, the observed percentage was inadequate and require massive government intervention to reach universal salt iodization.

In this study, knowledge of respondents about the benefit of iodized salt and its effect on preventing IDDs was noted to be poor. Overall, only 5.9% of respondents know the important of iodine is to prevent iodine deficiency disorder and only 22.1% of respondents know iodine deficiency cause still birth. Similarly, low level of communities' knowledge was reported at another area in the country (Masresha et al. 2016). Unless households get access to information about how to store iodized salt, know the importance of it and the consequences of not using unionized salt to reduce IDD. Therefore, building the communities knowledge about the importance of salt iodization to containing IDD is an important intervention.

Using packed salt at the household level was significantly associated with availability of adequate iodine in the salt. A study in Sidama Zone, Bensa woreda showed households that were using packed type of salt containing adequate iodine compared to their counterparts. Households who store their salts dry preferably in a cool place and away from strong light had adequate iodine (Masresha T,, Dejene Het al. 2016). Another similar study in Laelay Maychew District in Northern Ethiopia showed that packed salt was mostly adequately iodized compared to non-packaged salt (Gidey B et al. 2015). It's clear that exposing iodized salt to households or using unpacked salt gradually reduces iodine concentration in salt due to its volatile nature. However, iodine content will remain relatively constant if the salt is packed dry with an impermeable lining such as polyethylene bags.

5. Strength and Limitations of the Study

First, the study provided insights into salt iodation adequacy and usage based on the households and determine that iodized salt use level is inadequate and fall below the WHO's recommendation. This can help nutritionists and public health experts to implement health promotion campaigns and awareness of using iodizes salt. Second, salt was tested immediately on field and families were informed about the status of their salt. This has the potential to increase the use of iodized salt among the households in the study area. This study used rapid field-testing kits to determine availability of adequately iodized salt from salt samples which did not include titration level of iodine AND urinary iodine.

Another limitation of this study is that most of the answers to the questionnaires that were collected through interview may lead to social desirability bias. To reduce this bias, data were collected in multiple pass to minimize this bias.

6. Conclusion and Recommendations

The availability of adequately iodized salt at the household level was very low compared to the WHO's recommendation. Awareness should be given to households on proper storage, handling, place to buy salt, and type of salt used and to be bought .

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